

MEREOLGY, MODALITY AND MAGIC¹

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Abstract

If the property *being a methane molecule* is a universal, then it is a structural universal: objects instantiate *being a methane molecule* just in case they have the right sorts of proper parts arranged in the right sort of way. Lewis argued that there can be no satisfactory account of structural universals; in this paper I provide a satisfactory account.

1. Introduction

If the property *being a methane molecule* is a universal, then it is a structural universal: objects instantiate *being a methane molecule* just in case they have the right sorts of proper parts arranged in the right sort of way. Structural universals contrast with simple universals like, perhaps, *being a charm quark*: an object's instantiating this property is apparently not a matter of its having suitably-arranged proper parts.

What reasons are there to believe in structural universals? Some reasons depend upon more general arguments in favour of universals [Armstrong 1997; Oliver 1996]: if you invoke universals to explain resemblance, causation or laws, or to provide

semantic values for predicates, then you may need structural as well as simple universals, especially if you are queasy about extreme reductionism.

Another reason to believe in structural universals concerns modal metaphysics: Peter Forrest, and, rather differently, John Bigelow and Robert Pargetter have developed accounts of possible worlds based on structural universals [Forrest 1986a; Bigelow and Pargetter 1989]. On such views possible worlds are world-properties – structural universals – and concrete actuality instantiates exactly one of these.

But David Lewis rejected structural universals, on the grounds that no satisfactory account could be given of the relationship between *being methane* and *being carbon*, for example [1986a]. What we require of such an account may vary as our purposes vary. Considered as part of a theory of properties, an account of structural universals needs to explain resemblance, for example, but there is no obvious advantage in doing so nonmodally (whatever that amounts to). But if we hope to account for modality in terms of structural universals, different sorts of noncircularity requirements may be imposed.

My goal in this paper is to rescue structural universals for those who want them as part of an account of properties: I will argue that we can make good sense of the relationship between *being methane* and *being carbon*. I will not address motives for accepting universals in the first place, nor for accepting structural as well as simple universals, though Lewis himself makes a strong case that advocates of universals will need structural universals. Finally, I will argue that, though we can successfully explain why every instance of *being methane* has an instance of *being carbon*

amongst its parts, we cannot expect structural universals to provide a reductive account of modality.

A note on terminology: ‘Methane is a kind of thing, a kind of substance, and so perhaps not really a property, but that complication seems not important here’ [Armstrong 1997: 34]. It is, however, important to distinguish the count noun ‘methane molecule’ from the mass term ‘methane’: we are concerned with a property of individual molecules, not a property of portions of stuff. Departing from Lewis’s practice, I will use ‘*being methane*’ rather than ‘methane’ to name the universal we are concerned with, or ‘*being a methane molecule*’ where clarity demands this.

A second note on terminology: I will use the noun ‘correlate’ such that, by definition, any structural universal has correlates. *Being carbon* and *being hydrogen* are correlates of *being methane*: every instance of *being methane* has suitably-arranged instances of *being carbon* and of *being hydrogen* amongst its proper parts. Stipulating this meaning for ‘correlate’ leaves it open whether the correlates of a structural universal are parts of that universal; different accounts of structural universals provide different accounts of the correlacy relation.

2. Lewis’s Challenge

According to Lewis, any satisfactory account of structural universals must explain why every instance of a given structural universal has suitably-arranged instances of its correlate universals amongst its proper parts. ‘Why *must* it be that if something instantiates methane, then part of it must instantiate carbon?’ [1986a: 101]

Exactly what needs explaining here? Lewis emphasises that, if the universals *being methane* and *being carbon* exist at all, then, in any metaphysically possible world, any thing which instantiates the former has a proper part which instantiates the latter. In contrast, merely contingent or nomologically necessary patterns of coinstantiation between universals are not mysterious: they occur by accident or design if purely contingent, and are explained by natural laws if nomologically necessary [1986a: 101].

It is easy to overlook the fact that two distinct claims are in play here. First, there is the claim that *being methane* has *being carbon* amongst its correlates at every world in which *being methane* exists. This posits a necessary connection between *being methane* and *being carbon*, and it exemplifies the general claim that, if one universal has another amongst its correlates in some world, then it does so in every possible world.

Second, there is the claim that, necessarily, if one universal is a correlate of another at a world, then at that very world every instance of the structural universal has a proper part which instantiates the correlate universal (call this the ‘coinstantiation principle’). This posits a necessary connection between the *being-a-correlate-of* relation amongst universals on the one hand, and a complex relation of partial coinstantiation on the other. Even if it is false that *being methane* has *being carbon* amongst its correlates at every world, it may yet be true that in every world where *being methane* does have *being carbon* as a correlate, every instance of the former has an instance of the latter amongst its parts. The two modal claims do not stand and fall together, and it is far from obvious that any explanation of one will explain the other.

The distinction between two analogous necessity claims is much clearer for material particulars. Mereological essentialism is generally rejected in this realm: I could have existed without having these very parts, and the same goes for my house. There are, as a rule, no necessary connections between parts and wholes. Nevertheless, there is a necessary connection between the relation *being-a-part-of* as it applies to material particulars, and a certain partial colocation relation. Where *a* and *b* are material particulars, necessarily, if *a* is part of *b*, then *a* occupies a subregion of the region occupied by *b* (call this the ‘sub-region principle’). This posits a necessary connection between the *being-a-part-of* relation amongst material particulars, and the *occupying-a-sub-region-of-the-region-occupied-by* relation. It does not assert that the *being-a-part-of* relation holds of necessity where it holds at all.

Another pair of analogous necessity claims concern *N*, the second-order universal which, according to Armstrong, relates first-order universals to form laws of nature [Armstrong 1983]. On this view, if the universals *being F* and *being G* stand in the *N*(ecessitation) relation at a world then at that world all *F*s are *G*s. Armstrong argues that there is a necessary connection between the *N* relation and a certain coinstantiation relation, but denies that the *N* relation holds of necessity where it holds at all.

I have identified two distinct claims about structural universals: the claim that there is a necessary connection between structural universal and correlate, and the claim that the coinstantiation principle holds necessarily. The two are run together in Lewis’s characterisation of the challenge for any account of structural universals: ‘Why *must* it

be that if something instantiates methane, then part of it must instantiate carbon?’ As we will see, this elision has caused difficulties both for Lewis and for others in assessing whether rival accounts of structural universals can meet the explanatory challenge.

3. Three conceptions of structural universals

Lewis considers three possible conceptions of structural universals, dubbing them ‘linguistic’, ‘pictorial’ and ‘magical’. This three-way division matches his classification of ersatzist accounts of possible worlds in *On the Plurality of Worlds*, published the same year.

The ersatzers say that instead of an incredible plurality of concrete worlds, we can have one world only, and countless abstract entities representing ways that this world might have been. [1986c: 136]

One question seems to me crucial in dividing the versions [of ersatzism]: how is it that the ersatz worlds represent?...Different answers to that question lead to different views about the metaphysical nature of the ersatz worlds and individuals...I distinguish three principal versions: *linguistic*, on which ersatz worlds are like stories or theories, constructions out of words of some language, and represent in virtue of meanings given by stipulation; *pictorial*, on which they are like pictures, or scale models, and represent by isomorphism; and *magical*, on which they just represent, it is simply their nature to do so, and there’s nothing to be said about how they do it.” [1986c: 141]

What about structural universals?

Now I shall present three different conceptions of what a structural universal is...I call these conceptions (echoing my earlier classification of versions of ersatzism) linguistic, pictorial and magical. On the linguistic conception, a structural universal is a set-theoretic construction out of simple universals, in just the way that a parsed linguistic expression can be taken as a set-theoretic construction out of its words. [1986a: 87]

On the pictorial conception, a structural universal is isomorphic to its instances....a structural universal is an individual not a set. It is mereologically composite. [1986a: 90]

On the magical conception, a structural universal has no proper parts. [1986a: 101]

For Lewis, the key question about ersatz possible worlds is how the relation between such an entity and concrete reality can be a representation relation, and he taxonomises the different accounts by their answers to this question. The key question about structural universals does not concern representation (unless we take structural universals to be possible worlds – I will return to this issue below). Instead there are questions about the relation between the structural universal and its correlates, and about how this relation governs relations between the instances of these universals. In the previous section, I argued that we should distinguish two

questions: Why does a given structural universal have the same correlates in every world (if it does)? Why does the correlacy relation necessitate a distinctive pattern of partial coinstantiation? The rival accounts of structural universals may be assessed on their answers to each of these two questions.

3.1 The Linguistic Conception

On the linguistic (set-theoretic) conception of structural universals, Lewis sees no explanatory problem:

[Given the linguistic conception] We have the required necessary connections between the instantiating of a structural universal by the whole and the instantiating of simpler universals by its parts. And there is no mystery about how these connections can be necessary: they hold by definition. [1986a: 88]

Recall the two questions I distinguished above. First, the linguistic conception underpins the supposed necessary connection between structural universal and correlate by construing the former as simply defined in terms of the latter. This is acceptable if we can assume that such a definition provides modal identity conditions for the structural universal. Can the linguistic conception also underpin the coinstantiation principle? Yes, if we can assume that the set-theoretical relations amongst the universals are mirrored in their instances; this seems a safe assumption given that universals are wholly present in their instances, though Lewis refers us to a relevant wrinkle noticed by John Bigelow [Lewis 1986a: fn. 14].

The problem with the linguistic conception lies elsewhere: given this conception, structural universals are merely sets of simple universals, requiring the existence of simple universals, and adding almost nothing to the resources available to those who believe only in simple universals. ‘What we have are make-believe structural universals for those who do not accept the real thing.’ [1986a: 89] Like Lewis, I will focus on the pictorial and magical conceptions of structural universals.

3.2 The Pictorial Conception

According to the pictorial conception, the relation between correlates and structural universal is that of mereological composition. Though he rejects the pictorial conception on other grounds (which I will discuss below), Lewis is satisfied with its explanation of the relevant necessities:

Why *must* it be that if something instantiates methane, then part of it must instantiate carbon?...According to the pictorial conception, that is because carbon is a part of methane, and the whole cannot be wholly present without its part. Fair enough. [1986a: 101]

Here, I think Lewis has been misled by running the two necessities together. The pictorial conception is well-placed to explain the necessity of the coinstantiation principle: necessarily, the parts are present wherever the whole is. But what about the supposed necessary connection between structural and correlate universals, between *being methane* and *being carbon*, for example? Relations between whole and parts are typically contingent, not necessary.

Are there special reasons to think that mereological relationships amongst universals hold of necessity if they hold at all? Consider conjunctive universals. These are universals like *being round and red*, which supposedly has *being round* and *being red* as proper parts. Lewis takes the existence of such universals to be uncontroversial (granted the existence of the simpler universals): they enjoy a 'mereological' mode of composition, which is to say that different conjunctive universals cannot share all their conjuncts. Indeed, given the existence of simpler universals, the existence of

conjunctive universals is entailed by principles of classical extensional mereology, though this is an embarrassment for those who accept instantiated universals whilst rejecting uninstantiated ones.

Do conjunctive universals have their conjuncts essentially? Of course, if we label the conjunctive property ' $F \& G$ ' [Lewis 1986a: fn.21] it is hard to conceive of it as possibly being simple, or possibly having conjuncts other than F and G . Moreover, even calling these universals 'conjunctive' rather than 'composite' suggests that the relationship between parts and whole is quasi-logical. But this is the sort of error which Lewis warns against in another context:

...you can make any problem look easy if you state it so as to presuppose that it is already solved...how can two universals, which we might at first call by the neutral names 'Matthew' and 'Carl', possibly enter into the necessary connection which would entitle us to call them 'methane' and 'carbon' instead? It only conceals our problem if we call them that from the start.
[1986a: 102]

Similarly, Lewis reminds us that we cannot explain how $N(F, G)$ ensures that every F is G simply by calling N 'necessitation', any more than we can explain how someone has mighty biceps simply by calling him 'Armstrong' [1983: 40]. And we cannot settle whether conjunctive universals have their components necessarily by giving them conjunctive names from the start. Consideration of conjunctive universals does not help ground mereological essentialism for universals.

Perhaps it's the 'wholly present' aspect of universals which means that they satisfy mereological essentialism, even though material particulars do not. Following Lewis, we might understand transworld 'identity' for particulars in terms of counterpart theory: no wonder particulars don't satisfy mereological essentialism, since they don't really exist in more than one world. But universals really do enjoy transworld identity: it's the very same entity which exists in each of many worlds. So (?) that entity must have the same parts in each world in which it exists.

If this argument were successful it could be adapted to show that enduring entities, wholly present whenever they exist, cannot change their parts over time. An enduring object really does enjoy transtemporal identity: it's the very same entity which exists at each of many times. Perdurantists would be delighted if enduring objects had to have the very same parts at every time at which they exist, but sadly this is not the case: endurantists have stories to tell about time-relative parthood relations (e.g. [McDaniel 2004]). Similarly, the multiply-locatable nature of universals does not entail mereological essentialism for universals.

A final shot: as J. Robert G. Williams stresses [2007], Lewis takes metaphysically necessary connections between the instantiation of a structural universal and the instantiation of its correlates (i.e. the combination of the coinstantiation principle plus necessity of correlates) to be definitional of 'structural universal'; weaker patterns of coinstantiation can be explained by lawlike or accidental connections between distinct universals. Williams contrasts structural universals with 'emergent' universals like (perhaps) *being alive* or *being conscious*: the instantiation of an emergent universal at most nomologically necessitates the instantiation of other universals.

Suppose that it is indeed a necessary truth that every instance of *being methane* has an instance of *being carbon* amongst its parts. And suppose that it is true, but only contingently true, that every instance of *being alive* has proper parts which instantiate certain properties. If there is such a difference between *being methane* and *being alive*, this neither entails nor is explained by the claim that the former has parts, whilst the latter does not. Rather, it is because the former has its correlates necessarily, whereas the latter does not. In each case, there is a pattern of coinstantiation between the complex universal and its actual correlates, a pattern which holds necessarily in the former, and contingently in the latter case. Whether or not a relation amongst universals is one of parthood is orthogonal to whether that relation holds necessarily.

Advocates of the pictorial conception should accept that, whilst they can explain the necessity of the coinstantiation principle, they cannot explain why structural universals have their correlates necessarily. They should then attempt to argue that this is not their job. It may well be that every possible methane molecule has the structure CH₄, and that every possible water molecule has the structure H₂O. But that this is so does not seem to flow from what it is to be a structural universal, but rather from consideration case-by-case of the modal identity conditions of such properties.

I have argued that if universals like *being methane*, or indeed *being round and red*, do have their correlates (*being carbon*, *being round*) essentially, this is a modal fact about them which is not explained by taking the correlacy relation to be one of parthood. So the pictorial conception does not explain all that Lewis thinks it does. This point is significant for two reasons. First, Lewis's case against the third,

‘magical’ conception of structural universals turns on the fact that it does not attribute (supposedly explanatory) part-whole relations to universals. Second, Bigelow and Pargetter’s alternative account of structural universals is built on the assumption that the pictorial account, whatever its other failings, succeeds in explaining the relevant necessities because it invokes mereology.

3.3 The Magical Conception

Although Lewis thinks that the pictorial conception of structural universals meets his explanatory challenge, he rejects it on other grounds. He takes it that the composition relation posited by the pictorial conception is unique, i.e. extensional: any two distinct wholes must differ in their proper parts. But this is hopeless, since we know that, if they exist at all, *being methane*, *being butane*, *being isobutane* and many other structural universals all have the same correlates. Rejecting the pictorial conception, Lewis turns directly to the ‘magical’ conception, according to which structural universals do not have their correlates as parts.

What it is for a conception to be ‘magical’? Lewis attacks the magical ersatzist view of possible worlds by posing a dilemma: either the representation relation between possible worlds and concrete reality is internal or else it is external. There are problems either way:

In short: if the concrete world selects elements by an internal relation, we have no conception whatever of the differences among elements in virtue of which some are selected rather than others; and it is only by magic that ‘selects’ could be our word for any such relation. If, on the other hand, the concrete

world selects elements by an external relation, it is the relation itself that is magical: what spell constrains it to correspond rigidly to goings-on in the concrete world? Either way, ersatzism that relies on such a relation is justly called ‘magical’; and is to be rejected. [1986c: 182]

On the first horn, we cannot grasp which of the many internal relations between concreta and abstracta is the one which matters. On the second horn, we have an additional difficulty: how can an external relation between concrete actuality and a possible world constrain the intrinsic nature of concrete actuality?

There are responses to these arguments. For example, Michael Jubien [1991] argues that Lewis’s standards would make it difficult for us to grasp many internal relations which, evidently, we do grasp, whilst David Denby [2006] treats this as a special case of semantic underdetermination. For present purposes, however, I am concerned only to distinguish the two senses of ‘magical’: a theory involves magic if it imputes to us a mystery ability to grasp one relation out of many apparently indiscernible ones, *or* if it involves unacceptable brute modalities. The magical conception of structural universals invokes a *sui generis* relation amongst universals – a nonmereological relation – and thus risks both kinds of magic: how can we grasp this *sui generis* relation, and how can it ground either the necessity of the coinstantiation principle or the necessity of the correlacy relation? These are uncomfortable questions for advocates of the magical conception.

4. A fourth conception of structural universals

Why does Lewis move straight from the pictorial conception, which involves a unique composition relation, to the magical conception, which does not involve parthood at all? Why couldn't correlates be parts governed by a nonunique composition relation? In one sense, the term 'mereological' is analytically tied to the principles of classical extensional mereology, making space for a substantive question about whether all composition relations are mereological and thus unique. In a different sense, a relation is 'mereological' iff it involves the ordinary parthood relation; in this sense, the principles of classical extensional mereology, including uniqueness, are substantive hypotheses about the real nature of mereological relations. Either way, there is space for a substantive question about whether there could be a nonunique composition relation, an intermediate option between taking the relation between correlates and structural universal to be that of unique mereological composition, and taking it to be *sui generis* and thus magical.

Lewis argues that there is no such intermediate option. One argument is this: the paradigm part-whole relation is the one which holds amongst material particulars, and composition in that realm is unique (says Lewis). Moreover there is no alternative paradigm to be found amongst sets: the subset relation is compositional, but unique, whilst the relation between an element and its unit set is noncompositional. So any nonunique relation is unlike the paradigmatic part-whole relations; we do not have a general notion of composition of which unique composition is merely a special case. Thoughts like this emerge clearly both from Lewis's [1986a], and from his *Parts of Classes* [1991].

This argument provides some support for the conditional claim that, if ordinary composition is unique, then all composition is unique. But it is unsatisfactory in two respects. First, it suggests that we should settle disputes about the uniqueness of composition realm by realm, beginning with material particulars, then assessing case-by-case whether other entities differ in this respect from the paradigm. Forrest [1986b] and Armstrong [1986] both point out that states of affairs involve nonunique composition, if they exist at all. Lewis [1986b] responds *so much the worse for states of affairs* (I paraphrase). Stalemate looms.

Second, and more importantly, the argument fails to capture the depth of Lewis's opposition to nonunique composition: the notion is not just *prima facie* mysterious since unparadigmatic but 'unintelligible' [1986a: 94]. Moreover, the claim that ordinary composition is unique is not merely plausible-all-things-considered: it is central to Lewis's notion of composition. It's not that nonunique composition is rejected because it happens not to be the mode of composition enjoyed by ordinary things. Rather, it cannot be the mode of composition enjoyed by ordinary material things, because it is inherently problematic.

Why is the notion of nonunique composition inherently problematic? As Sider [2007] makes clear, Lewis later takes the relation between parts and whole to be a weak form or analogue of the identity relation. The parts just are the whole, in some loose sense. Identity, of course, is unique, in that an object cannot be identical to two distinct objects. So composition, being analogous to identity, must also be unique.

Why accept the constraints of this analogy between composition and identity? The analogy can explain central features of the composition relation. If *a* and *b* are material particulars then, necessarily, if *a* is a part of *b*, then *a* occupies a sub-region of the region occupied by *b*. This subregion principle expresses a necessary connection between the parthood relation and another relation. Compare this to Leibniz's Law: necessarily, if *a* is identical to *b*, then *a* instantiates all and only the properties that *b* instantiates. Leibniz's Law expresses a necessary connection between the identity relation and the indiscernibility relation. Moreover it is an acceptably brute necessity, if anything is, and so taking composition to be analogous to identity helps render the necessity of the subregion principle acceptable (either brute but acceptably so, or else reducible to the acceptably brute necessity of Leibniz's Law).

Likewise, of course, taking the relation between correlates and structural universal to be analogous to identity would render the necessity of the coinstantiation principle respectable. 'Why *must* it be that if something instantiates methane, then part of it must instantiate carbon?' [1986a: 101] Mystery! But compare the following: why *must* it be that if something instantiates *being carbon*, then it must (sic) instantiate *being carbon*? No mystery here: *being carbon* is identical with *being carbon*, so of course the former is instantiated whenever the latter is. Similarly, if *being carbon* is a part of *being methane*, and parthood is analogous to identity then the fact that *being carbon* is instantiated wherever *being methane* is no longer looks like an unacceptable brute modality.

Lewis regards the pictorial conception as explanatory (though false), because it can draw upon an explanatory analogy between unique composition and identity. But why can't a conception of structural universals founded upon a nonunique relation between correlates and structural universal also draw upon the composition-identity analogy, and thus account for the relevant necessities? Is magic the only alternative to extensional mereology? In the next section I will argue that the composition-identity analogy does not require us to think of composition as unique.

5. Uniqueness and the Composition-Identity Analogy

The uniqueness of composition does not *directly* account for the necessity of either the subregion principle or the coinstantiation principle. It's not that a material particular's parts must be located where it is because distinct objects cannot share all their parts. Rather, uniqueness is supposedly a prerequisite for drawing a close analogy between composition and identity, and it is this analogy which allows us to account for the necessary connections, by drawing upon the self-evidence and acceptable bruteness of Leibniz's Law.

Whilst I accept the power of the composition-identity analogy, I will argue that this power is available even to those who deny the uniqueness of composition. In particular I will argue that whether the necessity of the subregion principle for material particulars is unacceptably brute does not turn on whether composition in that realm is unique. My argument does not depend upon establishing that composition is in fact nonunique in any realm; I attempt only to establish that the thesis of nonunique composition does not turn the subregion principle into an unacceptably brute necessity.

Consider the following paradigmatic view: statue and lump of clay are distinct objects which share all their simple parts (at a time, perhaps at every time). Moreover *being a statue* and *being a lump of clay* are sortal properties which are irreducible to microfeatures of the objects which instantiate them (e.g. [Baker 2000]). Standard objections to this view target the alleged irreducibility of the sortal properties, the conflict with ideas about the dependence of the macroscopic on the microscopic, or some related failure of supervenience. I am sympathetic to these objection, but let us set them aside.

Is there a hitherto-unnoticed further problem for this sort of view? Following Lewis's arguments about structural universals, we might expect advocates of nonunique composition amongst material particulars to have trouble explaining the necessity of the subregion principle. Why must the statue's parts must be where the statue is, given that having parts arranged like that does not suffice for being a statue? Frankly, it's hard to hear this as unacceptable brute modality. But perhaps this is bad faith; perhaps we find the necessity of the subregion principle acceptable only because we're tacitly relying on the identity-composition analogy, an analogy which crucially depends upon the assumption that composition is unique.

To reject the uniqueness of composition is to accept that sortal properties of composite objects cannot be reduced to the intrinsic properties of and spatio-temporal relations between their parts. But if such features of the parts do not suffice to determine the sortal property of the whole, why think that they suffice to determine the location, shape, or other features of the whole? Perhaps any step away from

complete reductionism creates a requirement to explain why certain features of the whole are reducible whilst others are not. Perhaps nonunique composition requires a brute distinction between those features of the whole which are determined by the parts, and those which are not.

This argument fails. It presupposes as default that the reductionist project succeeds or fails in its entirety, so that theories which reject total reductionism whilst still maintaining some micro-macro connections require special pleading. But this is an unreasonable presupposition. We might more reasonably assume as default that particular features of composite objects can be reduced, and accept that features are irreducible only when there is good reason to do so. Advocates of nonunique composition think they have good reason to take sortal properties to be irreducible; they are not thereby committed to thinking that all other properties of complex objects are irreducible. Likewise, the apparent irreducibility of certain quantum states does not commit us to thinking that *no* aspect of big things is reducible to those of little things.

Moreover, those who deny the uniqueness of composition do not have to abandon the composition-identity analogy, merely weaken it a little. Even those who think that composition is unique rarely think that composition just is identity. Sider [2007] points out various problems with ‘strong’ or ‘superstrong’ composition-as-identity, mostly arising from the consequent dissolution of the plural/single distinction. Yet the retreat from ‘composition is identity’ to ‘composition is analogous to identity’ doesn’t give rise to new brute necessities, or to difficulties in grasping what composition is; quite the opposite. So it’s not clear why the composition-identity

analogy cannot be loosened just a little more, if there is good reason to do so, without rendering composition magical.

Lewis argues that if the relation between correlates and structural universals is not that of unique composition, then it is not analogous to identity, and thus cannot explain the necessity of the coinstantiation principle. I have argued that this is false: if *being carbon* is a part of *being methane*, this explains why the former is instantiated whenever the latter is, even if composition in this domain is not unique, just as a molecule's being a part of a statue explains why the molecule is where the statue is, even if the statue shares all its parts with a distinct lump of clay. And we can accept this point even if we reject the claim that statue and lump are distinct.

6: Residual Magic?

So far, I hope, so good, but there's still work to do. There are several aspects of structural universals which need explaining. One is this: why, whenever *being methane* is instantiated, is *being carbon* instantiated too, by a proper part of that instance? I have argued, first, that what needs explaining here is not just a necessary connection between *being carbon* and *being methane*, but also a necessary connection between the correlacy relation and a certain pattern of coinstantiation. I have argued that the second necessity is satisfactorily explained if *being carbon* is a part of *being methane*, even given nonuniqueness. The first necessity neither entails nor follows from the claim that correlacy is any kind of parthood, but establishing modal identity conditions for universals like *being methane* is not part of the job-description for a general account of structural universals.

Lewis discusses further problems for any account of correlacy as parthood, however. If both *being methane* and *being butane* have *being carbon* as a part, why is it that whenever the former is instantiated, *being carbon* is instantiated just once, whilst when the latter is instantiated, *being carbon* is instantiated four times over? If *being methane* has both *being hydrogen* and *being carbon* as parts, why do its instances have four distinct proper parts which each instantiate *being hydrogen*, and just one further proper part which instantiates *being carbon*? Finally, even if the distinction between *being methane* (CH₄) and *being butane* (C₄H₁₀) can be explained satisfactorily, it remains puzzling why the instantiation of *being butane* imposes a certain structure upon the proper parts of the instance, a structure which is different from that imposed by the instantiation of *being isobutane* (also C₄H₁₀).

Lewis explores but ultimately dismisses various attempts to spell out a way in which *being carbon* might be a part of *being methane* ‘once’, but a part of *being butane* ‘four times over’. This formulation is inherently problematic, given that we are dealing with universals; moreover it cannot explain the differences between *being butane* and *being isobutane*. I agree with Lewis that this strategy fails.

But this doesn’t mean we must abandon the idea that *being carbon* is a part of *being methane*, of *being butane* and of the rest. Instead, advocates of structural universals should question Lewis’s assumption that the differences between *being methane*, *being butane* and the rest must somehow be explained by differences in their parts.

Compare the situation for material particulars, as described by those who reject the uniqueness of composition. The statue differs from the lump of clay in various

respects – sortally, modally, perhaps historically, perhaps aesthetically. And these differences cannot be explained by differences in their parts since by assumption the objects share their simple parts. There are objections to this view, objections with which I sympathise. But if composition is indeed nonunique, then of course the differences between composite entities are not exhausted by differences between their parts: this is the centrepiece of the view, not an unwelcome consequence.

Similarly, if we take the thesis of structural universals seriously, and understand correlacy as nonunique composition, then we should expect that *being methane*, *being butane* and the rest should differ without differing in their parts. What distinguishes *being butane* from *being methane*, for example, despite their being made of the same simpler universals? We don't know much about the intrinsic natures of these universals themselves, but we know that they differ in how they characterise their instances: we can explain constitutive and consequent physical/chemical differences between methane molecules and butane molecules. Why suppose that these all of differences must be explained by differences in the *composition* of the two universals?

Objection: unlike the statue and the lump, methane and butane molecules don't just differ, they differ in what parts they have. Even butane and isobutane molecules differ in how their parts are arranged. We might not expect every difference between the instances of two universals to be explained by reference to the composition of those universals, but aren't we entitled to expect such an explanation of differences in the *composition* of the instances?

Reply: first, recall that statue and lump are supposed analogous to *being methane* and *being butane*, which share all their parts, not to individual methane or butane molecules, which do not. Second, however, there is a sense in which statue and lump ‘differ in respect of their composition’, and this may help us understand both the differences between *being methane* and *being butane*, and the consequent differences between their instances. Statue and lump share all their basic parts, but there is a sense in which each stands in a different relation to those parts (on this view). For example, the statue imposes a certain spatial arrangement upon the parts, in the sense that that very statue could not have had an entirely different shape, whilst the lump is more tolerant.

Perhaps there is a similar sense in which *being methane*, *being butane* and *being isobutane* stand in different relations to the same parts (*being carbon*, *being hydrogen*, and a bonding relation). What relations? Well, those relations which underpin the relevant patterns of coinstantiation. Of course this isn’t terribly illuminating. My point is just that advocates of structural universals may not need to take the differences between *being methane*, *being butane* and *being isobutane* as entirely brute facts, but can instead see these differences as grounded in the different relations each universal bears to its parts.

Once we adopt the more relaxed attitude I’m recommending, we can fit conjunctive universals like *being round and red* into the larger picture. One difference between a structural and a conjunctive universal is that the proper parts of the former are instantiated by proper parts of its instances, whereas the proper parts of the latter are instantiated by its instances themselves. A methane molecule has carbon atoms as

proper parts, whereas a round and red thing is itself round. But this distinction is not as significant as it might appear. Both patterns are captured by the coinstantiation principle, so long as we read ‘parts’ as ‘proper or improper parts’: if *A* and *B* are universals, then necessarily if *A* is a part of *B*, then every instance of *B* has an instance of *A* amongst its parts. Indeed, Armstrong makes the contrast thus: ‘Leaving conjunctive properties, we pass to structural properties, which involve both properties and relations’ [1997: 32]. We might think of conjunctive universals as a special case of structural universals: they involve no relation other than the identity relation, which ensures that the conjuncts are instantiated by the same entity.

So we can take the coinstantiation principle – amongst universals, necessarily, if *A* is a part of *B*, then every instance of *B* has an instance of *A* amongst its parts – as characteristic of parthood amongst universals. But if there really are complex universals like *being methane*, *being butane* and *being isobutane* which share the same parts, then we should expect them to differ without differing in what parts they have, and for one aspect of this difference to emerge as a difference in detailed patterns of coinstantiation. Moreover it may be that these differences between the complex universals can be explained by differences in their relations to those shared parts, although I do not take myself to have established this final point here. (I explore related ideas in [Hawley 2006].)

7. Modal Reductionism

I have now shown that an account of structural universals which understands correlacy in terms of nonunique composition can explain why, if a universal is a correlate of another in a world, then every instance of the second in that world has an

instance of the first amongst its parts. I have distinguished this task from that of explaining why structural universals have their correlates (i.e. parts, in my view) essentially. Those who want structural universals to ground resemblance and the like are not obliged to complete this second task.

However those who want to identify possible worlds with structural universals need to establish both the necessity of the coinstantiation principle and that structural universals have their correlates essentially. Failure to distinguish these tasks undermines Bigelow and Pargetter's 'nonmereological' theory of structural universals, which is intended to provide the basis of a modal reductionism about possible worlds. As reductionists, Bigelow and Pargetter strive to eliminate modal primitives, but concede that 'everyone needs a little magic in their life' [1989: 8]: the question is whether their theory contains unacceptable modal magic. Fraser MacBride in his [1999] details a number of problems for any attempt to use universals as a basis for modal reductionism, but here I will focus on issues specific to structural universals.

Bigelow and Pargetter are guided by Lewis in two respects. First, they are persuaded that mereological accounts of structural universals fail: the relation between *being carbon* and *being methane* is not one of parthood. Second, they take the modal primitives associated with mereological relations to be paradigmatically acceptable, and so they aim to show that the primitive modalities involved in their own theory are no more mysterious than those arising from part-whole relations.

What is their theory of structural universals?

‘Being methane’ then is to be identified with a highly conjunctive *second order* relational property of an individual (molecule): the property of having a part which has the property of being hydrogen, and having a part which is distinct from the first part which has the property of being hydrogen, and...

[*Being carbon* etc] are not ‘constitutive’ [of *being methane*] in the mereological sense, however it is constitutive of the nature of methane that it stands in these relations to these properties. Standing in these relations is an *essential* characteristic of methane. [1989: 6]

There are two kinds of relation here: the relations amongst an individual methane molecule and its parts which are the basis for any instantiation of the property *being methane*, and (nonmereological correlacy) relations between the universal *being carbon* and the universal *being methane*.

And where might the primitive modalities be?

For instance, we argue that there is an essential relation between being methane and being carbon:

Necessarily, (being methane) R (being carbon).

And it is because they stand in that relation that there is an entailment between something’s being methane and that thing’s containing a part which is carbon:

Necessarily, for any F and G, if (F) R (G), then any instance of F has a part which is an instance of G.

This necessity is to be grounded in the essences of the universals, avoiding unexplained modal primitives. And yet isn't this appeal to essences an appeal to a kind of modal magic? [1989: 8]

Recall the difference between mereological essentialism and the necessity of the link between parthood and coinstantiation. Bigelow and Pargetter here skate over an analogous difference between, on the one hand, its being essential to *being methane* that it be R-related to *being carbon* (that it have *being carbon* as a correlate, in my terms) and, on the other, the necessity of the link between the R-relation and coinstantiation. Neither of these necessities is reducible to the other, and if structural universals are to provide the basis for an account of possible worlds then we will need to postulate both necessities separately.

Bigelow and Pargetter argue that their primitives are no worse than the apparently uncontroversial modal primitives arising out of part-whole relations.

[Armstrong and Lewis] have suggested, for instance, that 'being F and G' entails 'being F' because being F is part of what it is for a thing to be F and G. And it is suggested that this is to be explained simply by the fact that the conjunctive universal 'being F and G' is the mereological sum of 'being F' and 'being G'. This kind of theory may or may not be viable. Yet if it were possible to use the part-whole relation in this way, to give a theory of structural universals, then most of us (including Lewis) would not object to the use of that relation as 'magical'. Yet in a sense it is. It generates modalities such as:

Necessarily, for any universals F and G, if being F is part of what it is to be G, then any instances of [G] will be instances of [F].

This principle has exactly the same form as the one enunciated [in the quotation immediately above] concerning the relations between being methane and being carbon. [1989: 8-9]

Like Lewis, Bigelow and Pargetter do not clearly differentiate the assumption that conjunctive universals have their conjuncts essentially from the assumption that parthood amongst universals entails a certain pattern of coinstantiation. But I have argued that, if parthood is modally demystifying, it is because the analogy with identity demystifies the necessary connection between parthood and coinstantiation. It is not because mereological essentialism about universals is somehow obviously true.

Bigelow and Pargetter attempt to defend their theory by comparing their modal primitives to those involved in mereological accounts of conjunctive universals. Unfortunately, this strategy fails in two ways. First, if correlacy is parthood, we have an explanation of *why* the coinstantiation principle is necessary, an explanation which goes via the analogy between parthood and identity to the necessity of Leibniz's Law. But nothing similar can be offered if correlacy is the R relation; this necessary connection must be taken as primitive (that's just what it *is* for two universals to be R-related). Second, any account of modality in terms of structural universals must rely on further modal primitives associated with the brute fact of 'correlate essentialism': the fact that *being methane* essentially has *being carbon* as a part, or the fact that

being methane essentially stands in the R-relation to *being carbon*. The analogy between R and parthood does nothing to establish this.

8. Conclusion

I have not argued that universals exist. There are a number of theoretical roles which could be filled by universals, but there are rival candidates for those positions. Nor have I argued that, if there are universals, then there are structural universals: Lewis provided some arguments for this conditional claim, though the strongest has recently been under attack [Williams 2007]. Nevertheless I have tried to clarify the structure of Lewis's argument against structural universals, highlighting its dependence both upon Leibniz's Law as the ultimate brute necessity, and upon the claim that composition must be unique if it is to avoid unacceptable brute necessities. I have undermined this second claim, I have shown what can reasonably be expected of a theory of structural universals, and, finally, I have shown that any theory with the resources to provide an account of possible worlds will have to take mereological essentialism (or its equivalent) for universals as brute.

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