**Against Sider on Fundamentality**

**[Forthcoming in *Erkenntnis*: this the penultimate draft]**

**Abstract:** Sider’s *Writing the Book of the World* gives an account of fundamentality in terms of his central ideological notion ‘structure’. Here I first argue against Sider’s claim that to be fundamental *to a degree* is to be structural *to a degree*. I argue there’s a pair of properties, *P*1 and *P*2, such that *P1* is the more fundamental, but Sider is committed to counting *P2* as the more structural. I then argue that if *relative* structure and *relative* fundamentality can come apart in this way, then Sider is likely also wrong to identify being *absolutely* structural with being *absolutely* fundamental.

In *Writing the Book of the World*, Sider produces an elaborate metaphysical theory, based around a new ideological posit, ‘structure’. There, Sider also claims his theory of structure (hereafter SToS), enables him to provide an account of fundamentality, by identifying structuralness and fundamentality. This account, he claims, is superior to those given by Fine (2001) and Schaffer (2009). Here the idea of fundamentality is the familiar one that reality is somehow arranged into different ‘levels’ with those things which exist at ‘higher levels’ being ontologically dependent on those which exist at ‘lower’. Here I argue that, whatever its other merits, SToS cannot be regarded as an adequate account of fundamentality. Instead there’s a deep conflict between the other things which SToS says about structure, and Sider’s claim that the structural just is the fundamental.[[1]](#footnote-1) In particular, I show that for certain pairs of properties, *P*1 and *P*2, SToS commits Sider to holding that *P*1 is more structural than *P*2 and yet on any reasonable explication of the notion of fundamentality, *P*2 will count as more fundamental than *P*1.

I’m not going to take a stand here on whether we really need the notion of fundamentality in metaphysics at all. My claim is simply that SToS does not provide an adequate theory of fundamentality, should we desire one.

I also won’t try to give a detailed enough account of SToS for the reader to be able to pick up what Sider means by ‘structure’ from this paper alone. Sider is insistent that the meanings of ‘structure’ and ‘structural’ are supposed to be fixed by his entire theory, and that one comes to understand what he means by those terms by absorbing that theory. Given the sheer complexity of SToS, expounding the entire theory is not possible in a paper of the current length.[[2]](#footnote-2) Instead, I will restrict myself to discussing those things which Sider says about structure which commit him to, for certain pairs of properties, classifying the less fundamental of the pair as the more structural. For readers not familiar with *Writing the Book of the World* however, the *basic* idea is the following. Certain properties and relations and other items, those which are ‘structural’, are more ‘privileged’ than others, in that they play a variety of important metaphysical, epistemic and semantic roles. These roles include (though are not limited to) making for real similarity between things which instantiate them,[[3]](#footnote-3) being suited for being cited in explanations,[[4]](#footnote-4) being projectable,[[5]](#footnote-5)and being the referents of words, where usage alone fails to make reference precise.[[6]](#footnote-6) Crucially, by Sider’s lights, the degree to which a property, relation or other item is suited to play any one of these roles is supposed to correspond to the degree to which it is suited to play all of the others. This is why, on Sider’s view, there’s a unified phenomenon of being structural that’s worth theorizing about. And the account of the different roles which are all played by the structural properties, relations and other items, is also supposed to function as something like an implicit definition of ‘structural’.

The question of whether Sider can give an account of fundamentality in terms of this notion of structure is well worth asking. The notion of some items being fundamental, or of some items being more fundamental than others is ubiquitous in contemporary metaphysics.[[7]](#footnote-7) Yet there’s no single, theory of fundamentality that commands particularly wide acceptance. So if Sider’s account of fundamentality in terms of his notion of structure were tenable, it would fill an important gap in the literature.[[8]](#footnote-8)

Two quick further clarifications about SToS:

Firstly, Sider uses both an absolute notion of structure, on which something is either structural or it’s not, and a comparative notion on which one thing can be *more* structural than another.[[9]](#footnote-9) Below, I first directly argue that Sider’s account of what it is for something to be structural to a certain degree cannot also function as an adequate account of what it is for something to be fundamental to a certain degree. Then, I go on to argue that if the relatively structural can come apart from the relatively fundamental in this way, this also creates trouble for Sider’s claim that to be *absolutely* fundamental is just the same thing as being *absolutely* structural. I argue that if, in the actual world, ordering properties by how (relatively) structural and how (relatively) fundamental they are, produces different orderings, then we should expect there to be (metaphysically) possible worlds where the absolutely fundamental properties are not the absolutely structural properties. This shows that Sider is also wrong to identify the absolutely structural with the absolutely fundamental.

Secondly: I have assumed so far that Sider treats being absolutely structural, and being structural to a degree, as properties of properties, and that when he claims that the structural is the fundamental, he means to claim that *being absolutely structural* and *being structural to a degree* just are the same properties as *being absolutely fundamental* and *being fundamental to a degree*. In fact, however, whilst Sider mostly does formulate SToS by talking about properties (and other entities) being structural (absolutely or to a degree), officially, this is just an expository convenience. Canonically, SToS is to be formulated in a nominalist way that does not treat ‘absolutely structural’ and ‘more structural than’ as predicates of properties. Though he doesn’t try to show how this can be done in the case of comparative structure, in the case of absolutely structure he does introduce a special operator which is supposed to combine with any grammatical string of English to produce a true sentence iff (roughly speaking) the string has a sufficiently structural meaning.

In practice, however, this doesn’t make much difference with respect to the argument I make in this paper. For the special operator is supposed to combine with a predicate ‘*F*’ to make a true sentence iff ‘*F*’, on the assumption of platonism, stands for a property that counts as (absolutely) structural according to what Sider says when he speaks loosely and treats ‘(absolutely) structural’ as a predicate of properties. Now, as I’ve said, I’ll argue here that the predicate ‘absolutely structural’ which Sider uses cannot express (absolute) fundamentality because there are possible worlds where it fails to apply to all and only the absolutely fundamental properties. But suppose a predicate ‘*S*’ fails to express absolute fundamentality because it fails (at some worlds) to apply to all and only the absolutely fundamental properties. Then presumably an operator *o* which combines to form a true sentence with a predicate ‘*F*’ iff, on the assumption of platonism, *F* denotes a property to which ‘*S*’ applies, doesn’t deserve to be called an ‘absolute fundamentality’ operatoreither. The operator still combines with predicates that don’t have absolutely fundamental meanings to make true sentences (or fails to make a true sentence when combined with terms that are absolutely fundamental.) Similar remarks apply were Sider to try and formulate relative structure talk in terms of an operator rather than a predicate. So in practice, we can go on treating ‘(absolutely) structural’ and ‘more structural than’ as predicates of properties, as Sider does throughout (2011) when speaking loosely.

**Section 1: A Counter-Example to the Identification of Relative Structure and Relative Fundamentality**

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Let Dbe the property *being a DNA molecule* and C be the property *containing at least three electrons as parts*. My claim is that relative structure comes apart from relative fundamentality in this case, as D is more structural, but less fundamental, than C. Here are the things Sider says about structure, which I think together show that D will come out as more structural than C:

1. **Objective Similarity** (pp.1-5): Here, Sider notes that we might think that how similar two objects are is a matter of how many properties they share in common, but that on certain views on properties, any pair of objects will both share infinitely many properties and be divided by infinitely many others. The suggested role of structure is that we should instead say that properties makes for similarity between the objects which instantiate them to the degree that those properties are structural.

Outside the obvious cases, such as properties that are highly disjunctive, it’s not immediately clear how we determine which of two properties makes for more similarity between its bearers. But insofar as C will group uranium atoms with DNA molecules, houses and galaxies, but not with helium atoms, whilst Dgroups together all and only DNA molecules, it seems clear that there is some intuitive sense in which D makes for greater similarity between its members than C.[[10]](#footnote-10)[[11]](#footnote-11)

1. **Explanations** (p.23) Here Sider’s idea is simply that explanations are better, insofar as they are stated in ‘joint-carving’, i.e. structural, terms:

The core insight of Lewis’s account of laws can be generalized beyond the case of laws: good scientific theories, whether or not they cite laws, must be cast in joint-carving terms. We may put this in terms of explanation: “theories” based on…non-joint-carving classifications are unexplanatory even when true. … We know on cardinality grounds that there are functions from the motions of the planets to past stock market performance under which the motions correspond to the fluctuations of the Dow Jones industrial average to date. But if someone were actually to produce such a function, no one would regard it as being explanatory (and no one would expect the correlation to continue). In contrast, explanations that cite facts about the geometry of spacetime or the initial singularity are genuine... (2011, p.23).

In order to explain why this leads to D counting as more structural than C, a little more needs to be said about the sense in which Sider thinks explanations are “better”, when couched in structural terms. Sider’s idea (as best as I can tell) is this. We often explain particular events by pointing out that they fall under certain general patterns which we have previously observed. For example, we say that the reason a particular event *e* of type *F* occurred, is because it was preceded by an event *e’* of type *G* and, as a general rule, events of type *G* bring about events of type *F*. However, provided that we countenance the existence of somewhat gerrymandered event types, there are observable patterns of this form which we would never cite in explanations in this way, because even had those patterns lasted for a long time, we would still not expect them to continue into the future. To use Sider’s own example, ‘we know on cardinality grounds that there are functions from the motions of the planets to past stock market performance under which the motions correspond to the fluctuations of the Dow Jones industrial average to date’ (2011, p.23). But if we found such a regularity, we would not expect it to continue, or think that changes in the motion of the planets *explained* changes in the value of the Dow Jones. Sider holds that what distinguishes such spurious regularities from the projectible regularities which *can* be cited in explanations, is that the latter, but not the former, can be described in relatively structural terms.

So in the end, the connection Sider draws between structure and explanation turns on the claim that properties are more projectable the more structural they are. Given this, I think a good case can be made that 2) counts D as more structural than C.

To see why, note that DNA molecules form a scientific kind, but things which have at least three electron parts do not.[[12]](#footnote-12) On a standard view, properties who’s extensions are scientific natural kinds are more projectable than other properties, even other properties which are not necessarily intuitively classed as ‘grue-like’ or gerrymandered’.[[13]](#footnote-13) Given this there is good prima facie reason to think D is more projectable than C. Furthermore, it’s hard to see what countervailing reasons there are for classifying C as the more projectable of the pair. So we seem

to have decent all things considered, as well as prima facie, reason to class D as the more projectable of the two. Hence we have decent reason to think 2) will count D as more structural than C, also.[[14]](#footnote-14)[[15]](#footnote-15)

So we’ve now shown that SToS will count D, *being a DNA molecule*,as more structural than C, *containing at least three electrons as parts*. In order to show that relative structure cannot just be relative fundamentality, we need to also show that reasonable notions of relative fundamentality will count Das *less* fundamental than C. Here I will show that, given the theoretical role that is generally assigned to relative fundamentality in contemporary metaphysics, a good case can be made for thinking that any notion which classifies D as more, rather than less, fundamental than C cannot play that theoretical role. Hence, a good case can be made for thinking that Sider’s notion of structure cannot play that role.

There are two main roles that (relative) fundamentality is usually assigned in the literature.

Firstly, whether something is fundamental is supposed to be partly a matter of whether something is ontologically or constitutively dependent on other things, or exists independently of them. Obviously, if we are looking for a constraint on *relative* rather than absolute fundamentality, we can’t simply say that all the items which do not depend for their existence on other things, are more fundamental than those which do. For this just divides items into two groups, one of which plausibly consists of all and only the *absolutely* fundamental items, rather than giving us a notion that comes in degrees as relative fundamentality is meant to. However, perhaps by comparing just what a property *F* depends ontologically on, to what another property *G* depends on, or comparing what *F*s depend on for their existence to what *G*s depend on for their existence, we might be able to use the idea that things are *more* fundamental the *less* they constitutively depend on other things, to produce an ordering on properties that is plausibly an ordering by relative fundamentality.

Secondly fundamentality is also usually connected to the notion that the sciences are arranged in a hierarchy of ‘levels of explanation’, with more fundamental sciences closer to the bottom.[[16]](#footnote-16) Indeed, Sider himself endorses such a connection:

... think of the traditional “levels” picture of the sciences, with physics at the bottom, chemistry next, and the other sciences arranged in some order or other on top. This ordering can be thought of as corresponding to the comparative fundamentality…of those sciences. (Sider, 2011, p.129).

We can imagine derivatively getting a notion of relative fundamentality for *properties* out of the notion of levels of explanation, by holding that particular properties somehow fall within the purview of particular sciences.

Here, I will argue that any notion of relative fundamentality which can play either the level of explanation role, or the ontological dependency role, will classify C as more fundamental than D. If I’m right about this, then Sider’s notion of structure can play neither of these two important parts of the relative fundamentality role, and so is not a suitable notion for identifying with relative fundamentality.

Firstly, on levels of explanation:

It’s obvious that D is a property at the biochemical level, so if C is a property at a level lower than the biochemical, then the ‘levels part’ of the relative fundamentality role mandates treating C as more fundamental than D. Furthermore, the ‘levels of explanation’ at which C is most plausibly located are obviously ‘lower’ than the biochemical level. In particular, plausibly the level of explanation at which C is found is that of fundamental physics. After all, aren’t facts about how many electrons a thing has as parts in some sense fundamental physical facts about it? In general facts about electrons are fundamental physical facts. And unlike say, Sider’s example of *cow-or-electron* which, despite concerning electrons, is plausibly not located at the fundamental physical level, facts about how many electrons something has as parts seem to in some sense involve *only* electronhood plus the highly abstract and general notion of parthood which is plausibly not tied to any particular level. Note also that C can be located at the fundamental physical level in the relevant sense, even though it can be instantiated by marco level objects, as well as micro level ones. To see this, note that *having mass* is plausible a property located at the fundamental physical level in the sense at stake here, and yet is instantiated by objects of all sizes.[[17]](#footnote-17)

 At this point, some might object that it’s only properties which are scientific natural kinds that can be assigned to any particular ‘level’ of explanation. If so, C might not get assigned any particular ‘level’ and so count as neither higher nor lower level than D. But this seems wrong. Suppose, as is highly likely, that there’s nothing particularly distinctive about ecosystems containing 10 765 893 mosquitoes. Ecosystems containing 10 765 892 or 10 765 894 mosquitoes are, ecologically speaking, pretty much the same. In no sense do the ecosystems containing exactly 10 765 893 mosquitoes form a natural kind amongst ecosystems. Still, doesn’t it make sense to say that the property *being an ecosystem that contains 10 765 893 mosquitoes* is a property that exists at the ecological level, rather than at the level of individual organisms, or the level of biochemistry? I think it’s fairly obvious that it does. So the objection to locating C at the fundamental physical level fails.

Secondly, on ontological dependency:

 It’s a bad idea to try to produce a ranking of properties in terms of relative fundamentality, by looking at what those properties themselves ontologically depend on for their existence. For on some reasonable views on the nature of properties, no such ranking can be produced. For example, on some platonist views all properties exist primitively as absolutely fundamental abstract objects not constitutively dependent for their existence on anything else. Clearly on such views, we can’t order properties by what they depend on. Regardless of what we think of such forms of platonism, we presumably don’t want a definition of relative fundamentality where all properties count as equally fundamental if such a form of platonism is true. Intuitively, the question of whether properties themselves exist primitively or are ontological dependent on the things which instantiate them is irrelevant to the question of which properties count as more relatively fundamental than others.[[18]](#footnote-18)

However, as I noted above, we might try and rank properties in terms of their relative fundamentality not by looking at what the properties themselves depend on, but rather by looking at what objects which instantiate those properties ontologically depend on. In particular, suppose we had an ordering of properties in terms of how easy it is to build something which instantiates the property in question out of perfectly fundamental constituents. Perhaps we could take this ordering to be an ordering of properties in terms of their relative fundamentality. The idea would be that the more complicated an arrangement of fundamental things you need to cook up, in order for it to be the case that something instantiates *F*ness, the further from being a basic and fundamental part of reality something’s doing so is, and hence, derivatively, the less fundamental *F*ness itself is. Indeed, Sider himself attempts to define relative fundamentality in this way, suggesting that we take a property to be more fundamental the shorter a definition it can be given in a language where all terms have meanings which are *perfectly* fundamental.

However, workings out of the idea that properties are more fundamental, insofar as it’s easier to build something that instantiates them out of perfectly fundamental parts, seem likely to rank *C* as more fundamental than *D*. Presumably, the perfectly fundamental entities will be the smallest and most basic physical objects, as well as certain properties of those objects, and maybe some highly abstract and relatively topic neutral properties, such as logical, mereological, and mathematical properties. It’s clear, however, that it takes a far more complicated arrangement of far more of the smallest physical objects, to build a thing with at least three electron parts than to build a DNA molecule, at least if we stick to the *simplest* possible arrangement needed to build the former. After all, even some quite simple atoms have three electron parts, whilst DNA-molecules are very large molecules themselves built out of *very* many atoms. It takes far less of the most fundamental entities we know about, various particles mentioned by the standard model of quantum physics, to build a single atom with three electron parts, than to build a very complex molecule. Perhaps there is some relevant notions of ease of building that doesn’t just depend on the number of fundamental objects needed to construct a DNA molecule or other non-fundamental object, but rather includes some notion of how complexly those constituents need to be put together. But if so, I think the burden of proof is on anyone who claims this. Further, insofar as we bake in some kind of metric for complexity of arrangement of fundamental particles, rather than just number of such particles, it seems we are no more likely to end up classing D as more fundamental than C. DNA molecules are made up of subatomic items arranged into a rich structure after all, rather than being unstructured in the manner of, for example, a mere mereological sum of 1,000 electrons.

At this point, some may suggest that rather than measuring the relative fundamentality of a property *F* by asking how complex the simplest method for constructing an *F* out of perfectly fundamental materials is, we should instead measure it by how complex the *most complex* way of constructing an *F* out of fundamental materials is. I suspect this would lead to counting D as more fundamental than C (since, after all, objects much larger and more complex than DNA molecules can have three electron parts). But it’s not a plausible proposal for ranking properties in terms of their relative fundamentality. To see this, note that it likely counts any property *F* which can be instantiated by large and complex composite objects as being not especially structural, even if *F* is also a property instantiated by some perfectly fundamental things, and figures in laws governing the behaviour of those perfectly fundamental things. And it’s implausible that such an *F* would be not-especially fundamental. Consider, for example *having mass*. As I’ve already noted, this is a property which is plausibly highly fundamental, and yet can be instantiated by very large and complex and not at all fundamental objects. However, because *having mass* has the latter feature, the proposed measure will likely rank it is as not very fundamental at all.

What about Sider’s own way of working out the idea that a property *F* is less fundamental, the more complex an arrangement of basic things is needed to make an *o* that is *F*?[[19]](#footnote-19) Here, I think, things get a little complicated.

Sider’s idea, recall, is that we take a property to be more fundamental the shorter a definition it can be given in a language where all terms have meanings which are *perfectly* fundamental. On many reasonable accounts of what is perfectly fundamental, including Sider’s own, the shortest possible complex predicate expressing C in a language containing only terms with fundamental meanings (from now on ‘the fundamental language’), will obviously be much shorter than the shortest possible complex predicate expressing D. Hence, on many reasonable accounts of what goes into the fundamental language, Sider’s proposal will count C as more fundamental than D. On other reasonable views about what is fundamental, it’s simply very hard to tell whether it’s D or C that can be expressed more concisely in the fundamental language. For, one these views, the fundamental language will be so austere that it’s hard to see how to go about constructing predicates that express either D or C using only it’s resources. In sum, there’s a small glimmer of hope that Sider’s method for ranking properties by relative fundamentality will rank D as more fundamental than C, as the identification of relative structure with relative fundamentality requires. But this hope only exists on certain controversial views about what is (perfectly) fundamental, views that Sider himself does not share. And even on those views about what is fundamental, there is no *positive* reason to think D will be ranked as more fundamental than C by Sider’s method; the ranking the method produces on such views is simply unclear.

The only candidates for being expressions in a perfectly fundamental language are either those which stand for properties distinctive of the smallest physical entities out of which everything else is built up, or highly, highly abstract expression associated with entities at all scales, like logical, mereological and mathematical expressions. Clearly the only way to define Dwith such meagre resources is to say that it consists of many of the very smallest things arranged into a much larger structure which has them as parts. Meanwhile, an adequate definition of C simply has to say that it’s a property had by anything which has at least three subatomic particles of a particular type as parts, no mention of a more complex arrangement of entities necessary. The latter definition will be shorter on many reasonable views of what terms get into the fundamental language.

For example, suppose that parthood is fundamental, and so are electrons. Then, since the fundamental language will very likely also contain logical vocabulary,[[20]](#footnote-20) we can use it to form the following complex predicate expressing, *L*, C:

$$λx(∃y∃z∃b(Ey and Ez and Eb and y is a part of x and z is a part of x and b is a part of x and $$

$¬(y=z) and ¬(z=b$))) (Here *E* is a primitive predicate of electronhood).

In comparison any attempt to specify how the subatomic, plausibly (absolutely) fundamental, particles can be combined to form a DNA molecule in such a language will be unimaginably more complicated, since any DNA molecule will be made up of *very* many atoms, themselves constructed out of subatomic entities.

Of course, perhaps parthood is not (perfectly) fundamental, and perhaps none of the entities described be current physics, including electrons are in fact fundamental either. If so, the fundamental language won’t contain ‘*E*’ or ‘is a part of’, and so *L* will not be constructable using its resources. Still, it’s hard to see why either of these changes would lead to it being easier to express D than C within the fundamental language.

Suppose firstly that it turns out that none of the entities currently known to physicists are in fact perfectly fundamental, and that even things like electrons which have no known constituents, are in fact constructed out of other entities. In that case, *L* will not be formable in the fundamental language. Instead, to express *C* we would need to first specify the arrangement of the actually fundamental entities which leads to them composing electrons, and then define up a predicate which says that an object contains as parts three distinct groups of fundamental entities, arranged in the specified, electron-composing way. This predicate would indeed be a lot lengthier than *L*. But nonetheless, it would still be shorter than any predicate we could use to express D in such a language. For DNA molecules contain a *very* large number of electrons as parts. Hence any predicate used to express D in such a language would have to specify that far more distinct fundamental entities were arranged in such a way as to compose electrons. It would therefore be far longer than C.

Secondly, suppose that we think mereological relations like parthood aren’t perfectly fundamental. How might we then define up complex predicates that express D and C in a language without mereological terms? The answer is that this depends on just what other vocabulary remains in the fundamental language, but that on no reasonable view is there any reason to think D can be more concisely expressed than C. On Sider’s own way of managing without talk of parthood in the fundamental language, C will still get a shorter definition than D, whilst on other parthood free accounts of what the fundamental language is, defining relative fundamentality in terms of length of definition in a perfectly fundamental language no longer looks plausible. According to Sider (2011, ch.13), the language containing only perfectly fundamental terms does not need to contain mereological terms, for the following reason. Provided that it contains set-theoretic and spatio-temporal vocabulary, we can define objects as space-time points, and then simply let *is a member of* do any of the work that *is a part of* was meant to do. On this particular mereology-free view of what the fundamental language is like, C can be defined more easily than D. After all, (assuming electrons are fundamental, and so the fundamental language contains predicates of electronhood)[[21]](#footnote-21) to define up C, we just need to say that something exists and has three distinct electrons as members, and then lambda abstract on this sentence to get a parthood free equivalent for *L*. (Both the thing that’s said to exist and the electron themselves are sets of space-time points on Sider’s view, but the variables in Sider’s fundamental language range over sets as well as ur-elements, so this is not a problem).

Perhaps, however, there might be other reasonable ways of doing without mereological vocabulary in the fundamental language, which do not involve letting set membership do the work of parthood. On such views, it’s simply very hard to say whether D can be expressed more succinctly using the fundamental language than C can. Since parthood talk is not allowed, and we can’t use set membership talk to substitute for it, to define C, *presumably* we would have instead to specify in fundamental terms, a relation such that, necessarily, it’s borne by all and only things with (at least) three electron parts to the (perfectly) fundamental items which are their constituents, and then express C as the property of bearing that relation to some object or other. At least, it’s hard to see how else we could form a complex predicate expressing C in such an austere language. And something parallel will have to be done in the case of D; we would have to express some disjunction of all the ways that fundamental constituents could be arranged in order to compose a DNA molecule, and then somehow define up a relation that holds between all and only DNA molecules and constituents arranged in one or other of these ways. At this point, we are so far away from being able to give either such predicate, assuming it is even possible to do so,[[22]](#footnote-22) that it’s very hard to say which would be more syntactically complex. (In contrast, we can at least see that if the fundamental language includes parthood, or set-memberships substitutes for parthood in the manner suggested by Sider, that a) C can be expressed reasonably simply[[23]](#footnote-23) and b) D would be very much more cumbersome to express, even if we don’t have much idea exactly how to write down a predicate that express D.) So perhaps there is a small glimmer of hope here for SToS as a theory of fundamentality. *If* we are persuaded that parthood isn’t fundamental, *and* we reject Sider’s own strategy of using set membership to do the work of parthood, then it *might* be the case that Sider’s account of relative fundamentality in terms of ease of expression in a fundamental language, will count D as more fundamental than C. But even if all these assumptions are met, it also might not be the case that D will get a shorter definition. At the very least, then, we should be less than convinced that on Sider’s own account of relative fundamentality, D will come out as more fundamental than C.[[24]](#footnote-24) Further, insofar as SToS is only acceptable if we take a particular austere view of what is perfectly fundamental, rejecting fundamental parthood (and Sider’s set-theoretic substitute for it), it’s clear that at the very least those metaphysicians who reject this austere view must look elsewhere for a theory of fundamentality.

To sum up the discussion of attempts to rank properties in terms of fundamentality via looking at how difficult is to build objects with the property in question out of perfectly fundamental constituents: There are good general reasons to think most attempts to do this will rank C as more fundamental than D. Meanwhile, when we look at Sider’s specific version of the idea that properties are less fundamental, the easier it is to construct things which instantiate them out of (perfectly) fundamental objects and properties, there are good reasons to think that on some sensible views on what is perfectly fundamental, it will rank C as the more fundamental of the pair. And there are no obvious positive reason to think that it will rank D as the more fundamental, whatever our view on what is perfectly fundamental.

To conclude this whole Section, there’s a good, even if perhaps not *completely* decisive case for thinking that any reasonable explication of the notion of relative fundamentality will count D as less fundamental than C, despite the fact that D is the more structural of the pair. Given this, Sider is wrong to identify relative structuralness with relative fundamentality.

**Section 2-The Absolutely Structural May Well Also Come Apart from the Absolutely Fundamental**

Some might think the result of the last Section is not such bad news for SToS, even though the idea that there is some connection between the structural and the fundamental is one of the main claims of *Writing the Book of the World*. For even if SToS does not give an adequate account of *relative* fundamentality, it might still give us a good account of *absolute* fundamentality. After all, there’s nothing contradictory about the idea that even though relative structuring and relative fundamentality produces different orderings on properties, the absolutely fundamental properties are all and only the absolutely structural properties. So perhaps, even if we grant the argument of the previous Section, SToS might still do some work in giving us an account of *absolute* fundamentality.

Here, however, I will argue that if relative structure comes apart from any reasonable notion of relative fundamentality, then it’s also wrong to identify absolutely fundamentality with absolute structuralness. My argument is the following:

1. To be structural to a degree is not the same thing as being fundamental to a degree.
2. IF, to be structural to a degree is not the same thing as being fundamental to a degree;

THEN,

possibly: there is either a property *F* which is absolutely structural but not absolutely fundamental or a property *G* which is absolutely fundamental but not absolutely structural.

Conclusion: Possibly: there is either a property, *F* which is absolutely structural but not absolutely fundamental or a property, *G* which is absolutely fundamental but not absolutely structural.

I take it that it follows from the conclusion that being absolutely structural is not simply the same thing as being absolutely fundamental.

1) I’ve already argued for in the previous Section, so 2) is the key premise. Here’s the basic reason for endorsing 2). Given the way Sider introduces the notion of structure, it’s clear that being absolutely structural is the same thing as being maximally relatively structural. Further, presumably being absolutely fundamental is the same thing as being maximally relatively fundamental. Now saying that being absolutely fundamental and being absolutely structural are the same thing, presumably carries modal commitments,[[25]](#footnote-25) and in particular, entails that there are no worlds where the absolutely structural properties form a different class from the absolutely fundamental properties. But saying that there’re no worlds where the absolutely structural properties form a different class from the absolutely fundamental properties is equivalent to saying that there are no worlds where the maximally relatively fundamental properties at the world form a different class from the maximally relatively structural properties. And this looks, absent further explanation, like an implausible modal coincidence, given that we know that relative structure and relative fundamentality are *not* the same thing, and do not impose the same ordering on properties.

Why think that being maximally relatively structural just is being absolutely structural? Firstly, it’s hard to see in what sense both absolute and relative structure talk deploy a single, unequivocal notion of structure, if this’s not the case. Secondly, as Sider himself admits (2011, p.129) he introduces even his absolute notion of structure largely through claims about various properties being more structural, the more they have some other feature, such as being suited to figure in explanations. It’s hard to see however, how someone could fix a meaning for an all or nothing predicate, ‘*F*’ by talking about what it is for things to be *F* to a certain degree, unless we take it that the property ‘*F*’ denotes is being maximally *F*. As for the claim that being maximally relatively fundamental is just the same thing as being absolutely fundamental, the first of the two reasons given still applies.

And why think that, given that it’s not the case that relative structure and relative fundamentality are the same thing, there will be some possible world where the maximally relatively structural properties differ from the maximally relatively fundamental properties? Well*,* firstly, we know from the previous Section that *more structural than* and *more fundamental than* are not the same relation. Given this, it would be odd if, at worlds where there were things as (relatively) structural or (relatively) fundamental as it is possible to be, the topmost end of the orderings imposed by these two relations always coincided. This would be a strange modal coincidence, unless some explanation of it could be given.

The basis for being unhappy with such modal coincidences is that, all things being equal, there is a presupposition in favour of logically consistent claims being possibly true.[[26]](#footnote-26) If we have some consistent claim *P* about the world, we seem to need a reason to deny that possibly: *P*. But we seem not to need any further support to conclude that (probably) possibly *P*, absent some reason to think *P* impossible.[[27]](#footnote-27) Of course, this presupposition in favour of possibility can be defeated, and presumably is when we have good reason to consider something to be analytically false or in conflict with a necessary *a posteriori* truth. But the argument here isn’t supposed to be any kind of conclusive proof of 2), but just reasonably strong evidence in its favour which puts the burden of proof on Sider if he wishes to deny it.

There is, however, one final possible response to the argument just sketched which I will briefly deal with here. In ch.12 of (2011), Sider defends his own ‘Humean’ account of (metaphysical) modality. On Sider’s view ‘possibly’ and ‘necessarily’ are not especially structural. Rather what it is for something to be necessarily the case is simply for it to be true and be a proposition of one or more of several types which we have somewhat arbitrarily grouped together by deciding to call all true such propositions necessarily true: mathematical truths, analytic truths, identity statements, and ‘claims in fundamental metaphysics.’ According to Sider it follows from the Humean account of modality that it’s always dialectically inappropriate to argue against a view in ‘fundamental metaphysics’ by arguing that a) the view is necessarily true if true at all, and b) that it’s not a necessary truth, because there are possible circumstances in which it does not hold. If Sider’s Humean account of modality is correct, and he is right about its consequences for arguments from possibility against ‘fundamental metaphysical claims’, then this spells trouble for my argument in this Section. Presumably the claim that to be absolutely structural is the same thing as being absolutely fundamental is a ‘fundamental metaphysical claim’ if anything is. And I have argued against it by taking it to be necessary if true, and then arguing that there are probably possible worlds where it is false. This is exactly the kind of ‘argument from possibility’ which Sider says is in some sense always dialectically illegitimate if the Humean view is true. Here I want to say three things to explain why I don’t think the response to my argument just suggested is particularly promising.

Firstly, it would already represent something of a defeat for Sider if a key plank in SToS, such as the claim that the structural is the fundamental, were defensible only on the assumption of his particular account of modality. SToS is supposed to give us a general framework for doing metaphysics in which is *reasonably* neutral on first-order metaphysical disputes.

Secondly, Sider’s argument for the Humean account of metaphysical necessity does not strike me as all that strong. It runs as follows. Firstly he says there are reasons not to treat metaphysical modality as *absolutely* structural/fundamental. And then he says that no reductive account of metaphysical modality, other than his deflationary one, on which we arbitrarily group together certain disparate types of proposition as necessarily true if true at all, is adequate. This argument, of course, is only as strong as our reasons for thinking that, if current reductive accounts of metaphysical modality fail, no less-deflationary-than-the-Humean reductive account, on which there’s some underlying commonality to the class of metaphysically necessary propositions which explains why we have a concept grouping them together, is likely to turn up. And that assumption seems to me to be a dangerous one for the following reason. Arguably, no especially convincing reductive account of *any* sort of modality is currently available. But whether or not reference to *metaphysical* modality ever shows up in everyday or scientific contexts, modal thought and talk more generally is ubiquitous. This suggests that there’s some underlying reason for its existence, and therefore some underlying reason why we group together just those types of claims that we do as being possible/necessary. Perhaps, however, if there’s some account of this available for the sorts of modal claims made in ordinary life, it will be extensible in some way to the case of metaphysical modality. At the very least, it seems overconfident to bet against this, as the Humean does.

Thirdly, and finally, Sider presents his argument from the Humean view against ‘arguments from possibility’ as depending on ‘claims of fundamental metaphysics’ getting onto the arbitrary list of claims which are metaphysically necessary if true at all. And the reason they’re supposed to get on this list, is simply because they are amongst the claims which speakers of philosophical English typically count as necessarily-true-if-true-at-all. The trouble with this though, is that if Sider is right that putting such claims on the list causes trouble for arguments from possibility, then putting them on the list runs counter to other features of how ‘metaphysically necessary’ is used by speakers of philosophical English. As Sider himself points out, the sort of arguments from possibility which he criticizes are fairly common in the literature, and therefore presumably exert some semantic pull on metaphysical necessity talk in the direction of interpretations of ‘metaphysically necessary’ on which such arguments are not inevitably dialectically inappropriate. For another thing, Sider himself admits that many philosophers have been attracted to views on which there are no ‘brute’ necessities, and these views are inconsistent with the claim that all ‘claims of fundamental metaphysics’ are necessarily true if true at all (see 2011, pp.275-6). It’s therefore not clear why we should prioritize those elements of metaphysical necessity talk which favour putting all (true) ‘claims of fundamental metaphysics’ on the list, over those which are in tension with doing this. So even if we accept Sider’s claim that all there is to being metaphysically necessary is to be counted as being so by our practice in philosophy in using the term ‘metaphysically necessary’, it’s unclear that ‘arguments from possibility’ will come out as illegitimate. For part of how ‘metaphysically necessary’ is commonly used is by figuring in premises of arguments from possibility.[[28]](#footnote-28)

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1. For evidence that Sider identifies the structural with the fundamental (or at least believes that things are structural to the degree they are fundamental), see the following passage: Structure is particularly central to metaphysics. The heart of metaphysics is the question: what is the world ultimately, or fundamentally, like? And fundamentality is a matter of structure: the fundamental facts are those cast in terms that carve at the joints.

The truly central question of metaphysics is that of what is *most* fundamental. So in my terms, we must ask which notions carve *perfectly* at the joints. By using ‘red’ and ‘blue’, we carve more closely to reality’s joints than do the speakers of the ‘bred’/‘rue’ language. But we do not thereby carve perfectly at the joints; colors are presumably not perfectly fundamental. To carve perfectly, one must use the most fundamental concepts, expressing the facets of reality that underly the colors. (2011, p.5). For evidence that Sider identifies *relative* structuralness with *relative* fundamentality, see the following passage:

Relatedly, think of the traditional “levels” picture of the sciences, with physics at the bottom, chemistry next, and the other sciences arranged in some order or other on top. This ordering can be thought of as corresponding to the comparative fundamentality of the notions of those sciences. (Sider, 2011, p.129).

Sider gives this example of ordering of notions in terms of relative fundamentality, as an example of an ordering of notions in terms of their relative structuralness. This suggests that he thinks that the former and the latter are the same thing, or at least produce the same ordering. [↑](#footnote-ref-1)
2. Those who are familiar with Lewis’ (1983) account of ‘natural’ properties, can get a reasonable grip on what being structural is supposed to be, by understanding it as a generalization of Lewis’ notion of ‘natural property’ to include entities other than properties, and also to the meanings of terms which do not stand for entities at all. [↑](#footnote-ref-2)
3. (2011, ch.1) [↑](#footnote-ref-3)
4. (2011, ch.3.1) [↑](#footnote-ref-4)
5. (2011, ch.3.3) [↑](#footnote-ref-5)
6. (2011, ch3.2).I’m somewhat simplifying the account of ‘reference magnetism’ which is given there. [↑](#footnote-ref-6)
7. See Bennett (2017, p.102) for the claim that fundamentality-talk is so ubiquitous. [↑](#footnote-ref-7)
8. Note also that insofar as Sider’s notion of structure is, in effect, a generalisation of Lewis’ notion of ‘natural’ properties, the argument here may also show that we cannot identify being a fundamental property with being a natural property in Lewis’ sense, as Lewis arguably does in (1983). So the argument of this paper may also be of interest to Lewis scholars. [↑](#footnote-ref-8)
9. (2011, pp.128-30). [↑](#footnote-ref-9)
10. Or at least, it’s hard to reject this claim whilst maintaining, as Sider does, that we have a robust grip on ‘makes for more/less similarity between it’s bearers’. [↑](#footnote-ref-10)
11. An anonymous reviewer at *Erkenntnis* made the following objection to the claim that *being a DNA molecule* makes for greater similarity among objects which instantiate it than does *being a thing with at least three electron parts*. Because ‘a DNA molecule is, by definition, made up of molecules (nucleotides), each of which contains a phosphate group, a sugar group and a nitrogen base’ and ‘the content of these [bases] can slightly vary’ there’s more than one way to construct a DNA molecule out of more fundamental constituents. But surely, if a property *F* is multiply realisable in this way, it makes for less similarity between the things that instantiate it, than a property *G* such that there is only one underlying microphysical state which things can instantiate *G* in virtue of being in. And surely *having at least three electron parts* is a property of the latter, non-multiply realisable, sort, and so must make for more similarity amongst things which instantiate than does *being a DNA molecule*.

However, this objection fails for two reasons. Firstly, it’s not clear that there is only one underlying microphysical state such that objects can instantiate *having at least three electron parts* by virtue of being in it. Suppose we set aside the question of whether we should individuate underlying microphysical states so that there is only one such state for the property *having exactly three electrons as parts*. Even so, things, with for example, five or 100 electron parts instantiate *having at least three electron* parts just as well as things with three electron parts do. And arguably at least, they instantiate it in virtue of being in some underlying state involving 5 and 100 electrons respectively, rather than three.

Secondly, in any case it’s difficult for Sider to endorse the view that whether or not a property makes for similarity between its instances is fixed by whether or not there are multiple ways in which an object can come to instantiate the property. To see this, consider a view on which objects instantiate generic quantitative properties like *having mass* in virtue of instantiating properties of having precise amounts of the quantity, like *having a mass of 23.347kg*. This is the sort of reasonable, even if not mandatory, first-order metaphysical view that Sider would presumably want SToS to be compatible with. However, SToS cannot be combined with this view if we hold that whether or not a property *F* makes for similarity between its instantiators is fixed by whether or not there are multiple ways in which an object can come to instantiate *F*. For then, any generic quantitative property like *having mass* will come out as very unstructural, given that there will be very many distinct underlying precise properties in virtue of which it can be instantiated. But the other things Sider says about structure fit badly with the claim that all generic quantitative properties are not very structural. For example, there doesn’t seem to be any reason why such properties could not be highly projectable, which as I discuss under 2) is what Sider means by ‘suited to be cited in explanations’. Nor does it seem that such properties couldn’t be relatively easy to refer to (2011, ch.3.2). And it seems like questions involving such terms can be ones to which the answers are epistemically valuable to know (ch.4.5); for example, questions about the nature of mass itself seem well worth asking. [↑](#footnote-ref-11)
12. Some colleagues in philosophy of physics have brought to my attention that there *are* some cases where physicists might cite the fact that a particular system has at least three electrons as parts, in explaining certain features of it. For some known principles in fundamental physics apply to things which have at least a certain number of particles as parts. I doubt this is enough to make things with three electron parts count as a scientific kind. But perhaps some will argue that it’s enough to make C a property which we should think is likely highly projectable because it is cited in good scientific explanations and theorizing. But even if this is true, I doubt that there are *no* properties which both count as somewhat more fundamental than *being a DNA molecule*, and yet are not properties which would be cited in scientific explanations or theorizing. For example, for each type of atom, there is a property of the form bei*ng a thing that contains at least seven G atoms as parts*. It seems unlikely all of these properties are apt for citing in scientific explanations. And I think that the reasons I give below for considering C to be more fundamental than D, are equally reasons for thinking all properties of this form are more fundamental than D. After all, they are still ‘lower-level’ than D. And they, like C, will be easier to define in a language containing only fundamental physical, mathematical and logical vocabulary, than D. But I have stuck with using C as an example of a pretty fundamental, but not especially structural property, simply because it’s especially easy to show how it can get a short definition in some plausible candidates for being the fundamental language.

Note also, that even if we do think that *having at least three electron parts* is a scientific kind, this would not help Sider all that much. For even given this, it’s not clear that 2) would class C as more, rather than merely equally structural as D. And if I’m right that C is more fundamental than D, then Sider needs it to also come out as more structural, in order to avoid a counterexample to the identification of relative fundamentality with relative structuralness. [↑](#footnote-ref-12)
13. For example, in a survey article on the literature on natural kinds, Koslicki says the following:

‘First, natural kinds are often said to be particularly well-suited, in comparison to other sorts of taxonomic classifications, to the task of grounding legitimate inductive inferences concerning the members of the kind in question. Thus, from the premise that all observed samples of copper in the past have been found to conduct electricity we can legitimately infer that the next observed sample of copper will conduct electricity, presumably at least in part because samples of copper form a genuine natural kind and their capacity to conduct electricity is uniformly associated with samples of this kind of metal…’ (2008, p.790).

In the context of her survey article, it’s clear that she means to be summarizing an orthodox view here, rather than merely recording her own. A similar view is approvingly attributed to Mill by Hawley and Bird (2011, p.216). Others state more vaguely that there is some sort of connection between natural kinds and induction (i.e. Chakravarttay (2007, p.152), Tahko (2015, pp.797-8)); it’s not clear to me whether this absolutely commits them to holding that natural kinds are generally especially projectable, but it certainly suggests such a view. [↑](#footnote-ref-13)
14. Could Sider appeal to a view on which all not obviously grue-like properties were equally projectable, as a plausible alternative to views on which properties that pick out scientific kinds are more projectable than those that do not? No, because then all non-grue like or gerrymandered properties will be classed by 2) as equivalently structural, regardless of how fundamental those properties are. [↑](#footnote-ref-14)
15. The following reason for doubting that *being a DNA molecule* is well suited to being cited in explanations has been suggested to me by an anonymous reviewer at *Erkenntnis.* Suppose Sider holds that what matters for being suited to being cited in explanations is not that, in our current state of knowledge, there are things we can only give good explanations of by citing the property, but rather that in some sort of idealised epistemic state where we had completed physics and the other sciences, we would still have to cite that property in explanations. He could then (so goes the objection) argue that, in such an idealised epistemic state, we could replace reference to Din explanations with reference to the property of consisting in some underlying arrangement of microphysical parts, where it was (at least) nomologically necessary that anything which was composed of such an arrangement of microphysical parts was a DNA molecule. Sider could then argue that this shows that, given the relevant idealisation, Dis not well suited to appear in explanations, because it can be easily replaced in this way.

However, this objection does not look very worrying, for two reasons. Firstly, I think when read carefully, it’s clear that what Sider means when he says that a property is well-suited to figuring in explanations, is just that it’s projectable. And it’s completely unobvious why being dispensable with in explanations given idealised scientific knowledge, should make a property any less projectable. Secondly, it’s dubious that there is *any* notion of ‘better suited to figure in explanations’, under which, given idealised scientific knowledge, we could give better explanations by appealing to the relevant underlying microphysical property here, than we could by citing D. The reason for this is that Dis somewhat multiply realisable, in that DNA molecules are made up of nucleotides that can themselves vary slightly in just what still more basic constituents they have. Given this, any underlying microphysical property had by all and only DNA molecules will be somewhat disjunctive, in the sense that it will be a property of being in one of several different underlying microphysical states. And it’s a standard ((though of course not universally accepted) claim of the literature on multiple realisation that explanations involving disjunctive microphysical properties are worse than those which involve the higher-level properties which the disjunctive properties form the realisation base for. Furthermore, Sider endorses the claim that being too disjunctive rules a property out from being able to figure in good explanations (2013, p.763) (Though in fairness, it’s possible that he only means to concede this for properties much more disjunctive than that which forms the realisation base for D). [↑](#footnote-ref-15)
16. I’m not claiming here that the relevant notion of levels of explanation is not itself conceptually tied to some notion of ontological dependence. But we do have an independent grip on it through examples. [↑](#footnote-ref-16)
17. (See also Bennett (2017, pp.132-3)). [↑](#footnote-ref-17)
18. The argument in this paragraph is adapted from an argument given by Bennett (2017, pp.187-9) [↑](#footnote-ref-18)
19. Note that I am not introducing Sider’s own account of how to rank properties by relative fundamentality in order to demonstrate that Sider’s is guilty of internal inconsistency, because his account of relative fundamentality is incompatible with the claim that the structural is the fundamental. My purpose in this paper is rather to show that the claim that the structural is the fundamental is inconsistent with the theoretical role that fundamentality is typically thought to play in the wider literature in metaphysics, beyond Sider’s own work. I mention Sider’s account only because it’s one possible way of working out the more generally accepted claim that things are less fundamental the more they depend ontologically on other things, in a way that allows us to rank properties in terms of their relative fundamentality. Any such account is relevant to the question of whether the ontological dependence part of the (shared, public) relative fundamentality role can be worked out in a way which ranks D as more fundamental than C. [↑](#footnote-ref-19)
20. Certainly this is Sider’s own view (2011, ch.13). Further, since without logical vocabulary it’s hard to define much of anything using only terms for fundamental physical entities, Sider’s idea that we can define relative fundamentality in terms of length of definition in a perfectly fundamental language is likely a non-starter if we don’t let logical vocabulary in. [↑](#footnote-ref-20)
21. For the reasons given in the previous paragraph, I think dropping this assumption wouldn’t really help. [↑](#footnote-ref-21)
22. It’s not clear to me that this is a safe assumption. If it’s not, so much the better for my argument that C is more fundamental than D, given that on the other conceptions of the fundamental language we’ve looked at, and the accounts of fundamentality other than Sider’s own, C comes out as more fundamental. [↑](#footnote-ref-22)
23. At least if electrons are fundamental. [↑](#footnote-ref-23)
24. To be fair Sider himself suggests modifying the definition of relative fundamentality in terms of definability in a perfectly fundamental language in several ways, to cope with some well-known counter-examples. However it’s not clear that any of his proposed amendments both help to make D come out as more fundamental than C, and are independently plausible as part of an explication of the notion of (relative) fundamentality.

Firstly he suggests that if a complex predicate is disjunctive, that, as well as length, should count against the property it is used to express being fundamental. But there’s nothing disjunctive about the definition of tri-electronhood given above for a language containing mereological vocabulary, and nor would it need to be defined disjunctively if we followed Sider’s preferred scheme of using set membership as a substitute for parthood. On the last suggestion meanwhile, I suspect that both D and C will gain disjunctive definitions, given that there are multiple ways fundamental things can be related to compose either a thing with at least three electron parts, or a DNA molecule.

Secondly, Sider suggests counting how well suited a predicate is to appear in simple and strong generalizations. But consider the generalizations that everything which falls under C obeys the conjunction of the laws of fundamental physics. This generalization is true of course, but it’s also exceedingly powerful, given the sheer number of different objects which have at least three electrons as parts. The generalization that those things which are DNA molecules obey the laws of fundamental physics, meanwhile, seems much weaker, since far less things are DNA molecules.

Thirdly, Sider appeals to ‘the degree to which a notion plays a role in causal statements’ (2011, p.131). But this notion seems clearly to come apart from any notion of fundamentality which we might possess before encountering SToS. Fundamentality is supposed to be connected to notions like ontological dependence and the picture of reality as consisting of a series of levels. But even very high-level predicates seem to be able to play a role in causal explanation. Think, for example, of ‘smoking causes cancer’. So it’s not clear why we should expect there to be a connection between fundamentality and causal explanation. [↑](#footnote-ref-24)
25. Though as we’ll see below Sider in effect denies this, though as we’ll also see below, I do not think his grounds for doing so are convincing. [↑](#footnote-ref-25)
26. I’m aware this claim is far from universally accepted, but won’t defend it further here. [↑](#footnote-ref-26)
27. This point is nicely made by Chalmers’ (1996, p.96). [↑](#footnote-ref-27)
28. Merrick’s (2013) similarly argues that, if Sider’s account of modality really is incompatible with arguments from possibility, then, given the pervasiveness of such arguments in current philosophy, so much the worse for Sider’s account of modality. Sider responds in (2013), but his response largely takes the form of claiming that it is only argument from possibility against claims in fundamental metaphysics that his account of modality rules out, and not all arguments from possibility whatsoever. So his response is not relevant here, given that the claim that structure and fundamentality are the same thing is clearly a claim in fundamental metaphysics. [↑](#footnote-ref-28)