Structural Parsimony

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Contemporary Humean philosophers often resist commitments to necessary connections between distinct entities by appealing to Hume's *dictum* (HD), according to which there are no necessary connections between distinct entities.[1] Some have recently argued that HD is endorsed in the absence of good grounds.[2] But Humeans can also resist commitments to necessary connections between distinct entities by invoking the following normative twist on HD:

> *The Humean Solvent:* do not necessarily connect distinct entities beyond necessity.

Whenever necessarily connecting distinct entities can be shown dispensable, the Humean Solvent invites us to avoid such a commitment in our theory.

The Humean Solvent (or for short, "the Solvent") is a principle of parsimony. Just as Ockham's razor is a principle of ontological parsimony, the Solvent is a principle of *structural parsimony* as we can say that a theory is structurally more parsimonious than another when the latter is committed to a more necessarily connected ontology than the former is. Just as Ockham's 'razor' encourages us to cut down superfluous ontological commitments, the Humean 'Solvent' encourages us to dissolve dispensable metaphysical glue: we should not glue pieces of our ontology beyond necessity. Just as Ockham's razor is dear to the heart of those with a taste for desert landscapes, the Humean Solvent should be dear to the heart of those with a distaste for rigid structures. But while most of us would agree that ontological parsimony is a theoretical virtue,[3] whether structural parsimony is a theoretical virtue is an open question. This is the question that I will address in this article.

But first, some clarifications.

What I mean by saying that some things are necessarily connected is that their separability, or that of their states, is in a certain measure constrained. At the ironmonger's shop, I can find glues that vary in strength – glue vs. superglue – and glues that vary in the range of items that they can glue – *i.e.* universal glues vs. special-purpose glues for paper, wood, or plastic. Likewise, the Solvent has both a *qualitative* and a *quantitative* dimension. Qualitatively, it encourages us not to glue

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[1] See e. g. Armstrong 1983, Bennett 2004, Lewis 1992, Moyer 2008, Paull & Sider 1992.

[2] MacBride 2005, Maudlin, 2007, Wilson 2010 and 2015.

[3] See e.g. Lewis 1986a: 2, Nolan 1997, Quine 1951, Smart, 1984, Sober 1975. For a rejoinder, see Parsons 1979: 660.

pieces of our ontology with an unnecessarily strong glue. *Metaphysically* necessary connections are the strongest possible superglue: no force is powerful enough to separate what they connect. Quantitatively, the Solvent encourages us not to glue pieces of our ontology that need no gluing. Hence combining the qualitative and quantitative dimensions of the Solvent, other things being equal, the worst possible worldview is such that every entity is metaphysically necessarily connected to every other entity. Spinoza is sometimes interpreted as having defended such a universally superglued metaphysics.[4] If structural parsimony is a theoretical virtue, then the Solvent provides us with a methodological reason to reject this form of necessitarianism. On the other hand, the Solvent can also be used to resist commitments to special-purpose metaphysically necessary connections. Most of the time, this is what Humeans do: they resist alleged causal necessary connections, truth-making necessary connections, necessary connections between entities and their origins, or necessary connections between states of distant particles, etc. Finally, one may also wish to use the Solvent to resist commitments to necessary connections that are weaker than metaphysical. But, in this article, I will focus on metaphysically necessary connections, reserve the phrase "necessary connections" for them, and reserve the phrase "structural commitments" for commitments to metaphysically necessary connections between distinct existents.

As I conceive of it, the main role of the Solvent – if structural parsimony is a virtue – would be to help us along with other theoretical constraints to decide between rival hypotheses, accounts, or theories. If so, the standard of comparison for what is "beyond necessity" must be meta-theoretic. Suppose that a candidate account α^1 of some phenomenon ϕ – where a phenomenon can be a mere belief – commits us to a necessary connection between distinct entities, say a and b. Then the Solvent encourages us to explore alternative accounts $\alpha^2 \ldots \alpha^n$ of ϕ that vindicate one or the other of the following hypotheses:

H_1: despite appearances to the contrary, a and b are not distinct;

H_2: a and b are distinct, but the appearance of necessary connection between them is a mere feature of our representation of them, not a feature of the external world.

The claim that the Solvent is a theoretical virtue implies that, if some satisfactory account of ϕ vindicates H_1 or H_2, then *ceteris paribus* this account is better than α^1. Which of H_1 and H_2 is better should depend on our evidence for the distinct existence of a and b.

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[4] See e.g. Della Rocca 2002 and 2008.

It should be clear that the Solvent and HD are distinct claims since one can reject HD while agreeing with the Solvent. Indeed, even an advocate of causal necessary connections could endorse the Solvent but disagree with Hume because she takes these structural connections as indispensable. I take this to be a virtue of my Solvent: while HD is divisive in contemporary metaphysics, the Solvent seems to provide us with a less controversial starting point to express and evaluate our structural disagreements. Moreover, while HD has some basis in Hume's writings,[5] the Solvent doesn't. Hume did not regard inference to the best explanation as a reliable form of reasoning. Yet structural parsimony, if it is a theoretical virtue, is best conceived as playing a role in such inferences: other things being equal, between candidate hypotheses or theories we should prefer those that keep things as separable and loose as possible. Nevertheless, the Solvent could play a role in an original defence of HD: if it can be shown that no structural commitment is indispensable, then the Solvent justifies endorsing HD.[6] It is for this reason, and because I think that contemporary Humeans are more receptive to the virtuousness of structural parsimony than their opponents, that I use the qualifier "Humean" for the Solvent, although talking of "Hume's Solvent" would be utterly misguided.

However, my aim in this article is not to defend HD but to investigate whether structural parsimony is a theoretical virtue in order to determine whether it could provide an alternative motivation to resist structural commitments. Section 1 motivates this issue further by offering evidence that the Solvent plays a methodological role in the argumentative practice of contemporary Humean philosophers. In Section 2, I wonder if structural parsimony is a species of either ontological or ideological parsimony – if so, the virtuousness of structural parsimony could be explained in terms of the virtuousness of ontological or ideological parsimony. However, I will dismiss this thought. In Section 3, I argue that we should not restrict the range of possibilities at a world beyond necessity and use this as a justification for the claim that structural parsimony is a theoretical virtue.

1. Structural Parsimony at Work

David K. Lewis is arguably the most vehement and convinced denier of necessary connections between distinct entities in the recent history of philosophy. He is also the main target of those

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[5] Hume says, for example, that 'there is no object, which implies the existence of any other if we consider these objects in themselves,' (*T* 86) and that 'Necessity … is nothing but an internal impression of the mind' (*T* 165).

[6] To my knowledge this strategy of defence of HD has never been explored in the literature. At least, it is not discussed in Wilson 2010, which reviews motivations for HD.

philosophers who argue that HD is ill-motivated.[7] I have no doubt that Lewis, my paradigm example of a contemporary Humean philosopher, would have liked HD to be true. But I think that there is textual evidence that, according to him, a structural commitment – *i.e.* a commitment to some necessary connection between distinct entities – is justified if, and only if, there are compelling reasons to think that it is indispensable. If my reading of Lewis is correct, then it provides evidence that the Solvent plays a methodological role in the actual argumentative practice of Humean philosophers.

Evidence that Lewis admits that if a structural commitment is indispensable, then such a commitment is justified can be found in his endorsement of set theory. Evidence that he also takes the indispensability of such a commitment as a necessary condition for its justification can be found in his defence of Humean Supervenience.

First, Lewis accepts set theory and he takes it to be necessarily true.[8] In set theory, singleton sets are set containing exactly one member. Thus {Socrates} is the singleton of Socrates and {Sappho} is the singleton of Sappho. Lewis (1991: 15) maintains that "every singleton is a mereological atom – it has no subclasses except itself – and that "every individual and every set has a singleton" (1991: 15). He (1999) also claims that mereological composition is the only mode of composition and defines distinctness as absence of overlap.[9] From these commitments, it follows that, necessarily, for every x, if x exists, then another entity y – namely, $\{x\}$ – exists.[10] So Lewis commits himself to a form of necessary connection between singletons and their members despite their distinctness. Some have argued that this conflicts with his alleged commitment to HD.[11] The charitable conclusion is that Lewis does not dogmatically endorse HD. He allows for violations of HD in certain specific circumstances. What is the characteristic of set theory that justifies relaxing HD to accommodate it?

The answer is that Lewis regards set theory as indispensable for mathematics:

(…) but most of mathematics is into set theory up to its ears. If there are no classes, then there are no Dedekind cuts, there are no homeomorphisms, there are no complemented lattices, there are no

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[7] See e.g. MacBride 2005, Maudlin 2007: chapter 1, and Wilson 2010 and 2015.

[8] That Lewis takes set-theory to be necessarily true can be derived from his account of propositions as sets of possible world and his account of properties as sets of *n*-tuples of *possibilia*.

[9] Thus, for Lewis, non-identical entities x and y are distinct if and only if they do not overlap – *i.e.* have no proper part in common.

[10] Notice that this is a *de dicto* necessity. Lewis (1991: 37) himself suggests to appeal to his counterpart theory in order to analyse the *de re* claim that every thing is such that it could not exist without its singleton existing.

[11] See Armstrong 1991 and Oliver 1992.

probability distributions, …. For all these things are standardly defined as one or another sort of class. If there are no classes, then our mathematics textbooks are works of fiction, full of false 'theorems'. Renouncing classes means rejecting mathematics. That will not do. (Lewis 1991: 58)[12]

Moreover, set theory is also indispensable to his (1983) account of properties and propositions, which play ancillary roles in his (1986a) analysis of modality, his account of language and the mind. Thus, for Lewis, a structural commitment, such as the connection between a singleton and its member, is warranted *if* it is indispensable.

But, more importantly for my argument, Lewis also assumes that a commitment to necessary connections between distinct entities is warranted *only if* it is indispensable. Evidence for this can be found in his discussion of Humean Supervenience, a thesis he (1986b: ix) introduces as follows:

> Humean supervenience is named in honor of the greater denier of necessary connections. It is the doctrine that all there is to the world is a vast mosaic of local matters of particular facts, just one little thing and then another …. We have geometry: a system of external relations of spatiotemporal distances between points …. And at those points we have local qualities: perfectly natural intrinsic properties which need nothing bigger than a point at which to be instantiated. For short: we have an arrangement of qualities. And that is all. There is no difference without difference in the arrangement of qualities. All else supervenes on that.

The connection with Hume is that Humean Supervenience entails that there are no necessary connections between local *goings-on* – which Lewis assumes to be both distinct and fundamental. Although Lewis defended Humean Supervenience, he admitted that it may turn out false:

> Really, what I uphold is not so much the truth of Humean supervenience as the *tenability* of it. If physics itself were to teach me that it is false, I wouldn't grieve.
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> That might happen: maybe the lesson of Bell's theorem is exactly that there are *physical* entities which are unlocalized, and which might therefore make a difference between worlds – worlds in the inner sphere – that match perfectly in their arrangements of local qualities. Maybe so. I'm ready to believe it. But I am not ready to take lessons in ontology from quantum mechanics as it now is. (…) If, after all that, it still teaches nonlocality, I shall submit willingly to the best authority.
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> What I want to fight are *philosophical* arguments against Humean supervenience. When philosophers claim that one or another commonplace feature of the world cannot supervene on the

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[12] See also Lewis 1986: 2-5.

> arrangement of qualities, I make it my business to resist. Being a commonsensical fellow (except where unactualized possible worlds are concerned) I will seldom deny that the features in question exist. I grant their existence, and do my best to show how they can, after all, supervene on the arrangement of qualities. (Lewis 1986b: x-xi)

Assuming that Humean Supervenience implies the denial of necessary connections between local goings-on (for short, NCLG), which we assume to be distinct for the sake of the argument, Lewis's reasoning in this passage can be reconstructed as follows:

(1) Philosophical arguments do not show the indispensability of a commitment to NCLG, or so we can show by offering a philosophical account of nomic features that incurs no such commitment.

(2) If physics were to show the indispensability of NCLG, then we should "submit willingly".

(3) But physics, in its current state, does not show the indispensability of NCLG.[13]

(4) Therefore, opposing a commitment to NCLG – *i.e.* defending Humean Supervenience – is warranted.

As such premises (1)-(3) do not suffice to justify conclusion (4). One can agree with these premises but still think that a structural commitment to NCLG is more warranted than its rejection or think that one should be agnostic about such a structural. But Lewis thinks that, given (1)-(3), opposing a structural commitment to NCLG is warranted. I take this as evidence that, in this argument, Lewis endorses the following methodological assumption: a structural commitment, such as a commitment to NCLG, is warranted only if such a commitment is indispensable. Arguably, Lewis agrees that philosophical arguments show that there are adequate accounts of nomic features of the world that commit us to NCLG. Plausibly, he also agrees that the quantum physics of his time, with its flaws, provides a *prima facie* good case for a commitment to NCLG. But, for a Humean like Lewis, when it comes to commitments to necessary connections, mere adequacy and "a *prima facie* good case" are not enough. Unless a demonstration of the indispensability of such a commitment can be offered, the denial of such a structural commitment is the best hypothesis *by default*. Why? The answer must be: because a commitment to necessary connections between distinct entities has a cost that is better avoided.

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[13] This is the assumption that Maudlin (2007: chapter 1) famously objects to. But whether this assumption is true or not is irrelevant to my purpose.

Therefore, there are good reasons to think that Lewis endorses the methodological assumption that a commitment to necessary connections between distinct entities is justified if and only if such a commitment is indispensable. Our paradigmatic Humean thinks that a commitment to necessary connections has a theoretical price: a price in structural economy. Sometimes, the price is right, as in the case of set theory. But sometimes there is not enough evidence that it is right, as in the case of necessary connections between local physical goings-on. In this case, our paradigmatic Humean assumes that we should stand for the view that avoids further structural commitments. This form of reasoning relies on the assumption that structural parsimony is some sort of theoretical virtue. But what, if anything, justifies this assumption?

2. Derived virtue

Why believe that it is a theoretical virtue not to necessarily connect entities beyond necessity? Some maintain that there are just two kinds of theoretical commitments: ontological and ideological.[14] Ontological commitments concern the number of entities a theory is committed to, whereas ideological commitments concern the primitive concepts to which a theory is committed. If this view is correct, then, if structural commitments are theoretical commitments, they must be either ontological or ideological commitments.

This suggests two arguments for the claim that structural parsimony is a theoretical virtue. The first one relies on the premise that structural parsimony is a variety of ontological parsimony:

(*SO-Reducibility*): Structural parsimony is a variety of ontological parsimony.

(*O-Virtuousness*): Ontological parsimony is a theoretical virtue.

Therefore, structural parsimony is a theoretical virtue.

The second one relies on the premise that structural parsimony is a variety of ideological parsimony:

(*SI-Reducibility*): Structural parsimony is a variety of ideological parsimony.

(*I-Virtuousness*): Ideological parsimony is a theoretical virtue.

Therefore, structural parsimony is a theoretical virtue.

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[14] E.g. Cowling 2013.

In this section, my goal is to undermine these two arguments. More precisely, I will argue that neither (SO-Reducibility) nor (SI-Reducibility) is justified.[15]

2.1.   Is structural parsimony a variety of ontological parsimony?

If structural parsimony is a variety of ontological parsimony, and (SO-Reducibility) is true, there can be no difference in structural parsimony without a difference in ontological parsimony. Why think that this is correct? Consider two theories T and T* that are both committed to the existence of three individuals: *a, b,* and *c.* T and T* differ in one respect only: according to T*, *a, b,* and *c* are necessarily connected to each other, whereas, according to T, *a, b,* and *c* are loose and separable. Hence, T is structurally more parsimonious than T*. But, if *a, b,* and *c* are necessarily connected to each other according to T* but not according to T, then there is *something* T*, but not T, is committed to, namely a necessary connection. So, although T commits us to exactly three entities – *a, b,* and *c* – T* commits us to four entities – *a, b, c,* and a necessary connection. If so, T is *ontologically* more parsimonious than T*.[16] Therefore, it seems that there is no difference in structural parsimony without a difference in ontological parsimony, which vindicates (SO-Reducibility).[17]

But the previous argument for (SO-Reducibility) is flawed for familiar reasons. From the claim that, according to T*, *a, b,* and *c* are necessarily connected to each other, it does not follow that T* is committed to a necessary connection. The validity of this inference depends on the assumed account of properties and relations. First, it depends on whether proponents of T* are Quinean nominalists (Quine 1963, Melia 2008, 2015). According to the Quinean nominalist, there are charged things, but something's being charged does not involve any relation between this thing and a property. Likewise, Quinean proponents of T* would contend that there being some necessarily connected things does not involve any relation between these things and a connection. If proponents of T* are not Quinean nominalists, whether their ontology is less parsimonious than that of proponents of T still depends on whether we assume an abundant view of properties (Lewis 1983). If we do, then there is no ontological difference between T and T* since T and T* commit

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[15] Some readers may also wish to reject (O-Virtuousness) and (I-Virtuousness). I don't. But I do not assume that these premises are true in the following argument.

[16] Notice that this alleged difference in ontological parsimony is a *qualitative* one since individuals and connections arguably belong to different kinds of entities.

[17] Notice that whether the connection between *a, b,* and *c* T* is committed to is *necessary* or not does not seem relevant in this argument. What seems relevant is that things are connected according to T* but not connected according to T. This is a further reason to think that this argument for the view that a difference in structural parsimony entails a difference in structural parsimony is flawed, but this is not the flaw I want to focus on.

us to the same number of classes of *n*-tuples of individuals.[18] If a sparse view of properties is assumed, then whether there is an ontological disagreement between proponents of T and T* still depends on whether the connection between *a, b,* and *c* has to be a sparse relation. Otherwise, proponents of T* can claim that it is an *ontological free lunch*. Therefore, there are many moves in the philosophical game that allow us to block the inference from the claim that T* is structurally less parsimonious than T to the conclusion that T* is ontologically less parsimonious than T. This suffices to undermine (SO-Reducibility).

But, before I move on, notice that Lewis's own defence of Humean Supervenience may suggest an ontological interpretation of structural parsimony. He (1994: 474) writes that he defends Humean Supervenience in order "to resist philosophical arguments that there are *more things* in heaven and earth than physics has dreamt of" (my emphasis). This suggests that his disagreement with opponents to Humean supervenience is motivated by ontological considerations. But this reading of Lewis is misguided. Lewis (1986b: x) admits that Humean Supervenience is at best a contingent truth. Given his (1986a) commitment to genuine modal realism, this entails that there are, in his ontology, possible worlds in which those entities dreamt of by opponents to Humean Supervenience *exist*. When Lewis talks about "more things in heaven and earth" his quantifier is restricted to "our inner sphere": he means *our* heaven and *our* earth. Talking unrestrictedly, there is no ontological dispute between him and opponents to Humean Supervenience.

A further remark. In the introduction, I claimed that if an account α^1 of a phenomenon ϕ commits to a necessary connection between distinct entities, then the Solvent encourages us to explore alternative accounts of ϕ according to which the relevant entities are not distinct. Suppose that, driven by the desire to maximize structural parsimony, I look for such an alternative account of ϕ and find satisfactory one such account, say α^2, according to which the relevant entities are not distinct. By endorsing α^2 rather than α^1, I also maximize ontological parsimony since α^2 commits us to a single entity where α^1 commits us to two entities.[19] This situation shows that the pursuit of structural parsimony can yield ontological parsimony. But even so, in this situation, the *intended* effect of my investigation is structural parsimony, whereas ontological parsimony is a mere *welcome* but *unintended* effect of it. If structural parsimony were a variety of ontological parsimony, this contrast would be empty, which it isn't. I conclude that structural parsimony is not a variety of ontological parsimony.

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[18] Following Lewis (1983), I assume here that there is a one-one relation between the domain of abundant properties and the domain of classes of *n*-tuples of individuals.

[19] Here, the ontological economy seems merely *quantitative*; see e.g. Lewis 1973: 87, Nolan 1997.

2.2.   *Is structural parsimony a variety of ideological parsimony?*

It seems more natural to think that differences in structural commitments are differences in ideological commitments. For instance, T and T* (see Section 2.1 above) seem to differ with respect to what they *say* about the entities they are committed to. But does it follow from this that structural parsimony is a variety of ideological parsimony?

The notion of "ideology of a theory" we are interested in when evaluating the ideological parsimony of a theory concerns only the number of its ideological primitives – that is to say, the concepts that are taken as unanalysed or undefined within a theory (Quine 1951, Cowling 2013). Thus, the issue is: can there be a difference in structural parsimony without a difference in number of primitive concepts? Here is, I think, a plausible scenario that shows that the answer to this question must be negative. Consider a Humean who thinks that the fundamental features of reality are all categorical and a dispositional essentialist who thinks that they are all essentially dispositional.[20] Should we believe that the theory of the Humean is ideologically more parsimonious than that of the dispositional essentialist? Some philosophers have argued for the identity of the categorical and the dispositional.[21] If they are right, there is a one-one correspondence between the domains of categorical and dispositional properties. But there could also be a bijection between the domains of categorical and dispositional *concepts* without identity of categorical and dispositional properties. Suppose that this is the case. Then, it is plausible to think that the primitive ideology of the Humean and that of the dispositional essentialist will, or at least could, contain the very same number of primitive predicates. Yet the dispositional essentialist is typically committed to a more connected ontology than the Humean is since laws of nature are metaphysically necessary according to the former but not the latter. So, even though the theory of the Humean is structural more parsimonious than that of the dispositional essentialist, this difference need not reflect any difference in ideological parsimony. If so, (SI-Reducibility) fails.

But I think that there is a more direct reason why structural parsimony is not a species of ideological parsimony. This reason is that structural and ideological parsimony principles do not target the simplicity of the same thing. Ideological parsimony targets the relative simplicity of *theories*: "the more *conceptual* primitives of a theory, the greater the *theory's* complexity" (Melia 2015: 185). By contrast, ontological parsimony does not target the relative simplicity of *theories* but that of the *world* that theories depict (*ibid.*). It targets the simplicity of the world our theories depict in this respect that it concerns the number of (kinds of) elements of beings out of which the world is

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[20] E.g. Ellis 2001.

[21] See in particular Strawson 2008. See also Oderberg 2009 for a reply.

made. Does structural parsimony target the simplicity of theories, like ideological parsimony, or does it target the simplicity of the world depicted by theories, like ontological parsimony? The latter seems to be correct. It targets the simplicity of the world in so far as structural parsimony concerns the simplicity with which the same elements of beings can be recombined to make another world. Since ideological and structural parsimony target the simplicity of different kinds of thing – theory vs. the world depicted by theory – it is misguided to regard structural parsimony as a variety of ideological parsimony.[22]

I conclude that (SI-Reducibility) is no more justified than (SO-Reducibility). Structural parsimony does not derive its alleged virtuousness from that of ontological or ideological parsimony. If so, why believe that it is a theoretical virtue?

3. Why not necessarily connect our ontology beyond necessity?

In this section, I argue that structural parsimony is a theoretical virtue. First, I argue that necessarily connecting elements of a world's ontology entails reducing the range of possibilities at that world. Then I argue that we should not restrict the range of possibilities at a world beyond necessity.[23]

Consider two logically consistent and coherent theories T and T* that do not differ with respect to their ontology. T and T* only differ in the following respect: two, and only two, distinct elements of the ontology of T*, say *a* and *b*, are metaphysically necessarily connected, whereas no two distinct elements of the ontology of T are metaphysically necessarily connected – where *a* and *b* are contingent beings. More precisely, suppose that, in T*, the existence of *a* necessarily implies the existence of *b* but not *vice versa*. This structural difference between T and T* entails a difference regarding the range of metaphysical possibilities. According to T*, it is metaphysically possible that

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[22] Note that Sider (2011) has argued for an objective comparison of ideologies of theories such that the primitive ideology of a theory A is better than that of a theory B if the former is better at *carving reality at its natural joints* than the latter is. One may think that if the ideological commitments of a theory A are such that A does not connect elements of its ontology more than necessary whereas the ideological commitments of a theory B are such that B does connect elements of its ontology beyond necessity, then the ideology of A is, in this respect, better than that of B. Perhaps; arguably, this generalises to anything we should not do *beyond necessity*. In any case, Sider's way of comparing ideologies is about maximizing the structural isomorphism between our map of reality – the theory – and the alleged structure of reality. Yet two maps of the same portion of reality can be equally good with respect to structural isomorphism although one gives more information about this portion of reality than the other one does. Sider's way of comparing ideologies is orthogonal to the question of their parsimony.

[23] The argument of this section assumes that metaphysical possibility is absolute and that S5 is the right logic for metaphysical possibility. Although rejecting these assumptions would have interesting consequences on my argument, I think that, ultimately, it would just make it much more complex without impacting its overall plausibility. Therefore, I hope that readers will indulge me for making these assumptions here for reasons of space.

neither *a* nor *b* exists, that both *a* and *b* exist, and that *b* exists without *a*, but it is not metaphysically possible that *a* exists without *b*. On the other hand, according to T, that neither *a* nor *b* exists, that both exist, that *b* exists without *a*, and that *a* exists without *b* are each metaphysical possibilities. Since T is coherent and logically consistent, T* rules out as impossible coherent scenarios about elements of our ontology that violate no logical law. This shows that metaphysically necessarily connecting elements of our ontology entails restricting the range of metaphysical possibilities relative to what is coherent and logically consistent. So, if it is wrong to restrict the range of possibilities in this way beyond necessity, it is wrong to necessarily connect distinct entities beyond necessity. I think that it is intuitively wrong to restrict the range of possibilities beyond necessity, and this is why I think that structural parsimony is a theoretical virtue.[24] But this intuition needs elaboration.

Before I elaborate, notice that necessary connections can also restrict the range of restricted possibilities. Consider a two-dimensional world w made up of 16 pixels, arranged in a 4 X 4 grid, each of which can be either 'on' or 'off'. Hold fixed this description of w in order to define a restricted sphere S of possibilities centred around w – so, every world in S is made up of 16 pixels, arranged in a 4 X 4 grid, each of which can be either 'on' or 'off'. Let us say that members of S represent *physical* possibilities at w, whereas worlds that do not belong to S represent physical impossibilities at w. So we obtain a restricted notion of physical possibility at w. Let, following Sider (2007), a 'statespace' of a world be the set of all physical possibilities, in the intended sense, at that world. We are interested in knowing the statespace of w. Let H_3 be the hypothesis that there are no necessary connections between distinct pixels on the grid. According to H_3, the statespace of w has 2^{16} members, as illustrated in fig. 1, because the number of physical possibilities at w is 2^{16}.

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[24] Notice that Humeans often object to commitments to metaphysically necessary connections between distinct entities on the grounds that it restricts the range of metaphysical possibilities in the absence of good grounds. Thus Lewis (2001) rejects Armstrong's (2004) truthmaker principle – according to which, for every true proposition, there is an entity that necessitates the truth of that proposition – on the grounds that it entails a difference-maker principle such that every difference between worlds requires two difference-makers, one in each world. Lewis (2001: 609) objects to this difference-maker principle as follows: "The idea that we should set some sort of limits on the ways that possible worlds can differ looks clearly right. (…) But I doubt that our two-way principle of difference-making is the right limit to set. Why two-way? Certainly, one good way for two worlds to differ is for one of them to have something that the other lacks. But why must it be reciprocal? If we pass from world W to world V by removing something, why must we add something else to take its place?".
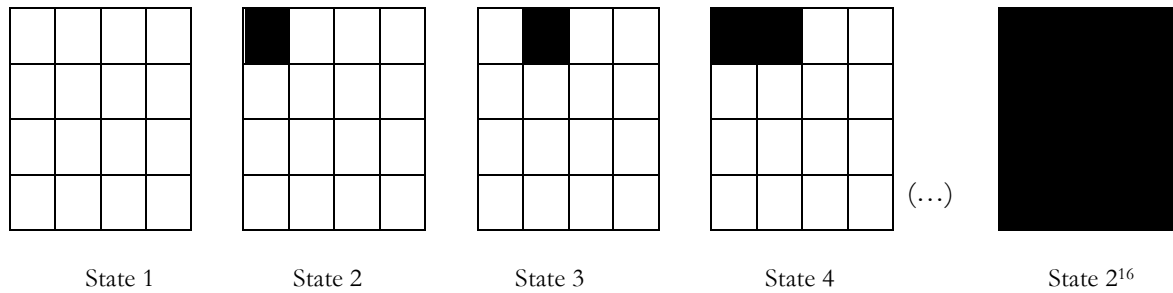
| State 1 | State 2 | State 3 | State 4 | State 2^{16} |

Fig. 1

Now let H_4 be the hypothesis that there is a necessary connection between pixels (1,1) and (4,4) – and only between them – such that these two pixels must have distinct values: if either of (1,1) and (4,4) is on, the other is off; if either of them is off, the other is on. Since pixels (1,1) and (4,4) are not adjacent, this necessary connection is some sort of *action at distance*. But what matters for my purpose is that H_4 limits the number of physical possibilities *at w*. According to H_4, the statespace of w has 2^{15} members – for instance, States 1, 3, and 2^{16} of fig. 1 above turn out physically impossible. Hence, because H_3 is structurally more parsimonious than H_4, the number of physical possibilities at w according to H_3 is greater than the number of physical possibilities at w according to H_4. Necessary connections between distinct entities do not merely limit the size of the absolute modal space, they can also restrict the range of restricted possibilities at a world. This point is important in order to understand why I conceive of the debate about Humean Supervenience as a debate about structural parsimony.[25] If there are good reasons to think that we should not restrict the range of possibilities at a world beyond necessity, then these are further reasons to think that structural parsimony is a theoretical virtue. Are there such reasons?

First, there is a wide agreement in the literature that accounts of modality can be compared with respect to their completeness – where completeness is intended as the requirement that no possibility is left unrepresented and where which possibilities there are is, by and large, based on our prior modal beliefs.[26] Thus Lewis (1986a) contends that, given his principle of recombination, his genuine modal realism allows him to represent every modal fact, so that it is complete. He (1986a) argues for the superiority of genuine modal realism over linguistic ersatzism mainly on this basis: there are possibilities, of causal role-switching, that can be represented in genuine modal realism but not in linguistic ersatzism. But Divers and Melia (2002) and Wilson (2015) have argued that Lewis's own version of the principle of recombination fails to generate a complete space of

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[25] Remember that, in the second quote from Lewis 1986b about Humean Supervenience in Section 1, Lewis explicitly talks of "worlds in the inner sphere".

[26] See e.g. Divers & Melia 2002 : 18, Divers 2004 : 662.

possibilities.[27] In the same vein, Melia (2003) objects to modalism – the theory that takes modal operators as primitive – that it cannot represent possibilities that possible world analyses of modality allow us to represent. Likewise, haecceitists object to antihaecceitism that it fails to represent pairs of possible worlds that do not differ qualitatively but merely haecceitically (e.g. Kment 2012). So it is widely agreed in the literature that the adequacy of an account of modality partly depends on whether it delivers a complete or incomplete account of the range of possibilities, and that *ceteris paribus* the more it is complete the better it is. There is an obvious *rationale* for this agreement: saving the modal phenomena. It is the task of accounts of modality to account for what seems possible – our prior beliefs about what is possible – and it is better if such an account delivers the verdict that the modal facts correspond as much as possible to what they seem to be.[28] But there is no reason to think that the recommendation to save the phenomena about the extent of possibilities must be limited to theories whose primary task it is to account for modality. Suppose, for instance, that an account of causation does very well at saving the *causal* phenomena but very poorly at saving the *modal* phenomena. Then this can rightly be taken as an important theoretical cost of this account of causation. The reason for this is that many think that accounts of causation are not supposed to have this sort of ramifications for the analysis of modality. Hence, it is better for any theory not to restrict the range of possibilities – compared to our prior beliefs about what is possible – beyond necessity.

Of course, the requirement of saving the phenomena about the extent of possibilities supports the injunction of not multiplying possibilities beyond necessity as much as it supports the injunction of not restricting the range of possibilities beyond necessities. There is a trade-off between completeness and consistency – the requirement that no impossibility is represented as possible. With respect to consistency, there is an upper limit to the range of possibilities we can all agree about: we should not represent as possible these scenarios that are logically inconsistent or incoherent. The question is whether there are further scenarios, especially scenarios about the separability of distinct entities, that should not be represented as possible or whether denying their

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[27] More precisely, what Divers and Melia argue for is that Lewis's genuine modal realism fails to be both complete and *non-modal* in the sense that it reduces modal facts to non-modal facts. Cf. also Gibilisco 2016 for a reply to Wilson.

[28] Nota Bene: the rational of saving the phenomena about what is possible also supports the injunction that we should not multiply possibilities beyond necessity in the sense that accounts of modality should avoid to represent as possibilities what seems impossible – where what seems impossible is also, by and large, based on our prior beliefs about what is possible. But there is no conflict between this injunction and the injunction that we should not restrict possibilities beyond necessity. The latter injunction is the injunction that we should maximise completeness, whereas the former is the injunction that we should maximise consistency; cf. Divers & Melia 2002: 18-19.

possibility would amount to restricting the range of possibilities beyond necessity. In order to address this issue we need to wonder about how we can know whether something is possible.

Historically, the standard view of how we can gain knowledge of what is metaphysically possible is based on Hume's Conceivability Principle that:

Whatever we conceive is possible, at least in a metaphysical sense …. (*A* 11)[29]

The view is that some sort of mental activity (conceiving or imagining) is our epistemic access to the modal facts. More precisely, the view is the following:

(CP) If it is conceivable that p, then it is possible that p;

where, following Yablo (1993), p is conceivable only if one can imagine a world that one takes to verify p.

(CP) has famously been used to defend HD: Since, for any distinct *x* and *y*, it is conceivable that *x* exists without *y*, then it is metaphysically possible that *x* exists without *y*.[30] However, there is a wide agreement that *a posteriori* necessary truths undermine (CP). Thus it is conceivable that water is not H2O although it is metaphysically necessary that water is H2O.[31] Such counterexamples to (CP) undermine defences of HD that directly rely on it. But they do not justify the belief that conceivability does not teach us anything about the range of possibilities and necessary connections.

Yablo argues that, even though (CP) can fail, we are justified in maintaining that conceivability is a defeasible guide to metaphysical possibilities, where by *conceivability* he means the appearance of metaphysical possibility. It is correct to assume that modal appearance is a *prima facie* reliable guide to modal knowledge just as sensory appearance is a *prima facie* reliable guide to perceptual knowledge. Of course, *a posteriori* necessary truths show that we are not immune to modal illusions: modal appearances that are not conducive of modal knowledge. But just as it would be an overreaction to deny that visual experience is a reliable guide to perceptual knowledge on the basis of visual illusions, it is an overreaction to deny that conceivability is a reliable (though defeasible) guide to modal knowledge on the basis of modal illusions.

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[29] Or "Tis an establish'd maxim in metaphysics, that whatever the mind clearly conceives includes the idea of possible existence." *T* I, ii, 2.

[30] See Wilson 2010: § 3 for criticisms to this line of argument for HD.

[31] See Kripke 1972.

If conceivability is a reliable guide to knowledge of the modal facts, then there is an excellent epistemic justification for the claim that we should not restrict the range of possibilities, compared to what is conceivable, beyond necessity. If conceivability is a reliable guide to knowledge of the modal facts, then it is rational to trust modal appearances in the absence of compelling reasons to believe that they are deceptive. If so, for any coherent and logically consistent conceivable scenario, the burden of the proof is on the shoulders of those who want to deny that this scenario represents a genuine possibility. Focusing on separability scenarios, one can agree with Hume that, for any distinct x and y, the existence of x without y is always conceivable.[32] If so and if conceivability is a reliable guide to possibility, then the burden of the proof is always on the shoulders of those who deny that such scenarios represent genuine possibilities.

Perhaps some will want to dispute Yablo's claim that conceivability enjoys the same epistemic status as sensory appearance. Some would prefer an account of our knowledge of possibilities that does not rely on (CP) such as the counterfactual account recently defended by Williamson (2007a 2007b). But whether we should account for our knowledge of possibilities in terms of conceivability or counterfactual reasoning is beside the point. Each of these accounts of modal epistemology aim at capturing something that is true about our common sense theory of the range of possibilities, namely that it is *very* liberal. It is this feature of our common sense theory of the range of possibilities that explains the resilience of Hume's conceivability principle in the history of philosophy. As Dominic Gregory (2017: 834) recently put it:

> We seem standardly to have a fairly liberal attitude towards possibility: we ascribe possibility to a proposition unless we can see compelling reasons for denying that it is possible. One might therefore mention A's lack of contradictory consequences [where A is arbitrary] simply to raise the question why anyone would *deny* that A is possible, rather than as providing substantial support for the conclusion that $\neg(A \square \rightarrow \bot)$.

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[32] Perhaps some will wish to dispute the claim that separability scenarios are always conceivable in the correct sense of *conceivability*. Rosen (2006) distinguishes between conceivability – where p is conceivable if and only if one can see no absurdity or incoherence in the supposition of a world in which p is true – and correct conceivability – where, roughly, p is correctly conceivable just in case p does not entail a logical inconsistence when combined with a full specification of the natures of the things p is about. The objection is that it is not the case that, for every distinct x and y, the separability of x and y is always *correctly* conceivable. My response is that my possible objector misunderstands the meaning of "distinct". The only reading of the phrase "the nature of a thing" that I find unproblematic is such that the nature of a thing is wholly intrinsic to it. If so, what it means that x and y are distinct is that a full specification of the nature of x does not involve any reference to the nature of y and *vice versa*.

If this is our standard attitude towards the modal facts, then our standard attitude towards the modal facts vindicates the maxim that we should not restrict the range of possibilities in the absence of compelling reasons to do so. The thought is that it is part of our common sense theory about the range of possibilities that scenarios that are coherent and logically consistent represent possibilities. Yet common sense is, as far as possible, not to be violated. If so, when a logically consistent scenario is conceivable, it is a virtue of a theory if it does not deliver the verdict that this scenario is impossible. The methodological virtue I am appealing to here is *conservatism*: our common sense theory of the range of possibilities is to be respected as far as possible simply because theory construction cannot start from scratch.[33] The claim that we should save the modal phenomena can be grounded in this conservatism as much as in the alleged reliability of conceivability as a guide to possibility. It warrants the claim that we should not restrict the range of possibilities beyond necessity. *A fortiori* it warrants the conclusion that structural parsimony is a theoretical virtue.[34,35]

So far my argument mainly concerned absolute, *i.e.* metaphysical, possibility. Can the link between conceivability and possibility, or simply our common sense liberal attitude towards the range of possibilities, justify that we should not restrict the range of restricted possibilities at a world beyond necessity? Consider again our two-dimensional world *w* made up of 16 pixels that

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[33] On this line of thought, cf. Lewis (Lewis 1986a: 134): "… a theory cannot earn credence just by its unity and economy. What credence it cannot earn, it must inherit. It is far beyond our power to weave a brand new fabric of adequate theory *ex nihilo*, so we must perforce the one we've got. A worthwile theory must be credible, and a credible theory must be conservative. It cannot gain, and it cannot deserve, credence if it disagrees with too much of common sense. Common sense is a settled body of theory – unsystematic folk theory – which at any rate we *do* believe; and I presume that we are reasonable to believe it. (*Most* of it.). See also Beebee & MacBride 2015: 230-2. Of course, that we should respect common sense beliefs as much as possible does not imply that we shouldn't also respect scientific *data* as much as possible. We should respect both as much as possible.

[34] Notice that this way of arguing for the Solvent is in line with Brian Weatherson's account of why Lewis defended Humean Supervenience. According to him (2015: 108), the point of defending Humean Supervenience is "to save various features of our commonsensical picture of the world."

[35] Some may object that common sense also has *essentialist* intuitions, such as the essentiality of origins. If so, conservatism does not favour a freely recombinatorial account of the modal space over a more restricted account of the modal space. My view on this matter is that the strength of this objection depends on whether common sense essentialist intuitions genuinely conflict with the liberal intuitions about possibilities that vindicate free recombination or whether this conflict is merely superficial. My view is that it is merely superficial. For instance, counterpart theory provides an account of essentialist intuitions that does not conflict with a combinatorial account of the modal space. Given the availability of counterpart theory, restricting the range of possibilities in order to account for essentialist intuitions is *not necessary*. So the burden of the proof is on the shoulders of those who want to defend that the conflict between essentialist and combinatorial intuitions is irreducible.

can be either 'on' or 'off', arranged in a 4 X 4 grid. Hold this description fixed, and imagine how the story of w could develop from *there*. Against the backdrop of this physical description of w, we can assess what *seems* possible at w: 2^{16} physical recombinations of elements of w are conceivable. Yet, following H_4 – according to which there is a necessary connection between two of the pixels – what we can conceive about w is mistaken: some coherent scenarios that do not violate anything we know about the physics of w are ruled out as physically impossible. Thus H_4 entails that modal appearances about w are deceptive, it does not save the modal phenomena. Therefore, if conceivability is a reliable though defeasible guide to possibility, or if we simply agree that it is better to save the modal phenomena as far as possible, then it is rational not to endorse H_4 in the absence of compelling reasons to do so.

We should not restrict the range of possibilities at a world beyond necessity because we should not undermine our best epistemic access to the modal facts, whether we take our best epistemic access to the modal facts to be our *inner sense* of imagining or our collective common sense theory of the range of possibilities. Since necessary connections between distinct entities do restrict the range of possibilities, we should not necessarily connect distinct entities beyond necessity.

Therefore, philosophers do not need to dogmatically assume HD in order to resist commitments to necessary connections between distinct entities. Arguably, it is better if they don't. What they can do instead is to assume that it is better to avoid dispensable commitments to such connections, and then do their homework to show that they are dispensable. For, indeed, it is a good theoretical maxim that we should not necessarily connect distinct entities beyond necessity.

This maxim, the Humean Solvent, is a maxim of structural parsimony, but it is neither a variety of ontological nor ideological parsimony. This does not imply, however, that structural parsimony is a *sui generis* and *ad hoc* theoretical virtue. For, if my reasoning is sound, the justification for structural parsimony derives from well-entrenched methodological constraints: saving the phenomena and conservatism. These constraints play crucial roles at the core of Hume's philosophy – much more so than considerations of ontological or ideological parsimony. Humeans need not follow Hume's word, his *dictum*, so long as they respect his spirit.

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