

## Generating possibilities

David Denby

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**Abstract** Our knowledge of the most basic alternative possibilities can be thought of as generated recursively from what we know about the actual world. But what are the generating principles? According to one view, they are recombinational: roughly, alternative possibilities are generated by “patching together” parts of distinct worlds or “blotting out” parts of worlds to yield new worlds. I argue that this view is inadequate. It is difficult to state in a way that is true and non-trivial, and anyway fails to account for our knowledge that there might have been other things, properties, relations, and combinations of these than there actually are. I sketch and defend an alternative view based on the distinction between determinable and determinate properties: roughly, alternative possibilities are generated by “intra-determinable” variation, variation from one determinate to another of the same determinable.

**Keywords** Possibilities · Knowledge · Metaphysics · Modality

### 1 The project

We all know a great deal about alternative possibilities. I know that my shoes might have been red or ten feet away. I know that there might have been more or fewer shoes and other concrete particulars than there actually are. I even know that my shoes might have instantiated properties and relations like Hume’s missing shade of blue that are not actually instantiated.

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D. Denby (✉)  
Department of Philosophy, Tufts University, Medford Campus, Medford, MA 02155, USA  
e-mail: david.denby@tufts.edu

How should we systematize such knowledge, summarize it in a few simple principles? Of course, a systematization of *all* our modal knowledge is a very tall order, so let us consider only our knowledge of which “basic” facts are possible. Basic facts are first-order, specific, contingent facts about the non-modal properties of and relations among concrete particulars. Some basic facts are actual, e.g. that my shoes are brown, that my shoes are six feet away. Others are merely possible, e.g. that my shoes instantiate Hume’s missing shade, that my dog is a million miles away.<sup>1</sup> The restriction to basic facts excludes: second-order facts about the features of and relations among properties and relations themselves; general (including negative existential) facts; necessary facts, e.g. mathematical facts; facts about non-concrete particulars like Cartesian egos, spaces and times, sets, numbers, and other abstract entities; and facts about the modal properties of or relations among concrete particulars, e.g. that my desk is essentially wooden. I will call knowledge of which basic facts are possible, “basic modal knowledge”.

We are finite beings in causal contact only with the actual world, yet our basic modal knowledge encompasses infinitely-many merely possible basic facts. To reflect this, I will assume that this knowledge is recursively generated from our knowledge of actuality. So systematizing it boils down to formulating conditional principles capable of generating all the possible basic facts from an initial input that consists only of the actual basic facts.<sup>2</sup> This would not have been a promising approach to systematizing our non-basic modal knowledge. Our knowledge of the modal status of second-order facts, general and necessary truths, and the generating principles themselves does not seem to be generated in this way. Nor is it obviously the only viable approach for systematizing our basic modal knowledge. But I hope it is an epistemologically illuminating one.

This project should be distinguished from the attempt to express the plenitude of possibilities, the fact that there are no “gaps” in logical space. That project is not epistemological and so needn’t be anchored in the actual world. It should also be distinguished from various metaphysical and analytic projects. I state the generating principles in terms of worlds and what they represent,<sup>3</sup> but I will not discuss the logical forms of modal sentences, the nature of the worlds or the representation relation (in particular whether they can be reductively analyzed), how properly to construct models of our modal discourse, etc. My aim is simply to systematize our pre-theoretic knowledge of what is and isn’t possible, not to analyze modality or investigate its metaphysics. (Nevertheless, my project should be a useful preliminary for these other, more familiar projects. After all, this knowledge constitutes the data against which to test proposed principles of plenitude and metaphysical theories of modality.)

<sup>1</sup> So my use of ‘fact’ will not be factive; I will call something a fact even if it does not actually obtain.

<sup>2</sup> For ease of exposition, I have suppressed a minor complication. If Descartes’ demon is fooling us all, actual experience mostly yields merely possible basic facts rather than actual basic facts. So strictly speaking, the initial input should be characterized as consisting of “basic facts provided by actual experience” rather than “actual basic facts”. But the key idea is unaffected: our basic modal knowledge is anchored in actual experience, even if this experience is delusional.

<sup>3</sup> Actually, I will talk indiscriminately of what worlds represent, what they contain, what exists at them, what goes on that them, etc.

## 2 Recombinationism<sup>4</sup>

Recombinationism conceives of the generating principles in terms of combining and separating things. A natural first attempt to capture this idea is:

- [R1] (a) If there is a world at which  $x$  and  $y$  exist and are distinct, then there is also a world at which  $x$  exists but  $y$  does not;<sup>5</sup> and  
 (b) If there is a world at which  $x$  exists but  $y$  does not and a world at which  $y$  exists but  $x$  does not, then there is also a world at which  $x$  and  $y$  coexist and are distinct.

In line with our official restriction, the variables here range over concrete particulars. Part (a) is intended to capture Hume's famous denial of "necessary connexions between distinct existences", and part (b) is intended to capture the complementary denial of necessary exclusions, the idea Lewis expresses when he says that "patching together parts of different possible worlds yields another possible world" (1986, pp. 87–88).

But [R1] is too liberal. Intuitively, there *are* sometimes necessary connections among distinct concrete particulars. Perhaps it is essential to me that I have the parents I actually have. Then, contrary to (a), there is no world at which I exist but my parents don't, even though I am distinct from them. Maybe there are also necessary exclusions. Perhaps it is of the essence of a god to be unique. Then, contrary to (b), there is no world at which two gods exist. (Indeed, whole worlds surely exclude each other; contrary to (b), there is no world at which distinct worlds coexist.)

[R1] is also too conservative; it generates too few worlds. Clearly, every individual in every world that we can infer by applying (a) and (b) to actual basic facts must actually exist (or be the sum of individuals that do). So (ignoring the sums) none contains any "alien" concrete particulars, concrete particulars that don't actually exist. Yet, intuitively, there might have been other concrete particulars than those that actually exist (in addition to any sums).

Inspired by Lewis (1986, p. 89), we might try formulating the principles in terms of the recombination of *duplicates* of concrete particulars rather than the particulars themselves:

- [R2] (a\*) If there is a world at which  $x$  and  $y$  exist and are distinct, then there is a world at which a duplicate of  $x$  but no duplicate of  $y$  exists;<sup>6</sup> and

<sup>4</sup> I have avoided the more familiar 'recombinatorial' and its cognates because they are now associated with *metaphysical* theories of modality, e.g. Armstrong's (1989). To repeat: my concern is merely to systematize our modal knowledge not to advance metaphysical claims.

<sup>5</sup> Throughout 'distinct' means 'wholly distinct', that is, having no parts in common.

<sup>6</sup> For ease of exposition, I have suppressed another minor complication. If  $y$  is a duplicate of any part of  $x$ , then no duplicate of  $x$  can exist without a duplicate of  $y$  also existing. So (a\*) should read: If there is a world at which  $x$  and  $y$  both exist and are distinct *and  $y$  is not a duplicate of  $x$  or any of  $x$ 's parts*, then there is also a world at which a duplicate of  $x$  but no duplicate of  $y$  exists. (b\*) needs a similar amendment.

(b\*) If there is a world at which  $x$  exists but  $y$  does not and a world at which  $y$  exists but  $x$  does not, then there is a world at which a duplicate of  $x$  and a duplicate of  $y$  coexist and are distinct.

Roughly, (a\*) enables us to infer worlds by duplicating proper parts of worlds. For instance, given the actual world as input, it enables us to infer worlds containing duplicates of my left shoe but no duplicates of any other actual thing, worlds containing duplicates of my right shoe but no duplicates of any other actual thing, worlds containing duplicates of every actual thing except my left shoe, and so on. (b\*) enables us to infer worlds by duplicating parts of worlds and recombining these duplicates. From a world where just my left shoe exists and a world where just my right shoe exists, it enables us to infer worlds containing duplicates of both shoes.<sup>7</sup>

[R2] avoids [R1]’s excessive liberality. Even if I couldn’t exist without my parents, intuitively, something exactly like me could, which is all that (a\*) entails. And even if two gods or two worlds could not coexist, intuitively, things exactly like them could (even if these duplicates would not themselves qualify as gods or worlds), which is all that (b\*) entails.

However, [R2] is still too conservative. Clearly, every part of every world we can infer by applying (a\*) and (b\*) to actual basic facts must be a duplicate of some part of the actual world (or at least the sum of such duplicates). So (ignoring the sums) none contains any instances of alien, i.e. actually uninstantiated, properties or relations.<sup>8</sup> And (ignoring the sums) none even contains instances of alien *combinations* of non-alien properties and relations. Yet a complete systematization of our basic modal knowledge surely should generate both sorts of world. Intuitively, e.g., there might have been instances of Hume’s missing shade of blue or instances of the relation of being exactly  $n$  meters apart (where no actual things are exactly  $n$  meters apart). And even if actually nothing is both positively charged and 3 kg in mass or both blue and exactly three feet from me, surely something might have been.<sup>9</sup>

There is also a more fundamental problem. [R2] is plausible only if ‘duplication’ means *intrinsic* duplication, the sharing of intrinsic properties. Non-intrinsic properties “reach out” from their instances to interfere with the rest of the world, thwarting unfettered recombination. If ‘duplication’ meant, for instance, the sharing of all properties, non-intrinsic as well as intrinsic, both parts of [R2] would fail: (a) because if  $x$  has the property of coexisting with  $y$ , no duplicate of  $x$  could lack

<sup>7</sup> Throughout my world talk is a little informal. Here I talk of “applying” a principle to a world or of the world being “input” for the principle when that world makes true the antecedent of the principle. Elsewhere I talk of “inferring” and “generating” worlds, etc. This refers of course to the capacity of certain principles to tell us what worlds exist. I don’t mean to imply any ontological dependence of the worlds themselves on our principles.

<sup>8</sup> A minor terminological point. Perhaps there are properties (and relations) that, though not themselves actually instantiated, can be defined in terms of those that are. I would still count any such properties as alien; I use ‘alien’ for any property (or relation) that is not actually instantiated. But others would not (see, e.g. Lewis 1986, p. 91).

<sup>9</sup> Lewis of course was well aware that aliens generate problems: “We can’t get the alien possibilities just by rearranging non-alien ones. Thus our principle of recombination falls short of capturing all the plenitude of possibilities.” (1986, p. 92).

this property; and (b) because if  $x$  lacks this property, no duplicate of  $x$  could have it. However, if ‘duplication’ does mean intrinsic duplication, [R2] is trivial. For the following principle is constitutive of our pre-theoretic notion of intrinsicity:

[I] If properties  $F$  and  $F^*$  are intrinsic, then there are possible worlds representing each of the following: something is  $F$  and a distinct thing is  $F^*$ ; something is  $F$  and no distinct thing is  $F^*$ ; something is not  $F$  and a distinct thing is  $F^*$ ; something is not  $F$  and no distinct thing is  $F^*$ .<sup>10</sup>

That is, roughly, intrinsic properties are those properties that vary independently of one another between distinct things. That’s just what it is to be an intrinsic property (in part). And [R2] is simply a consequence of [I]: just let  $F$  and  $F^*$  be “complete intrinsic natures”.<sup>11</sup> So, in effect, [R2] says merely that if  $x$  and  $y$  are distinct concrete particulars, then among those of their properties that vary independently between distinct things (in the sense specified by [I]) are properties—complete natures—that vary independently between them. And that’s trivial. The only possibilities [R2] generates are those already implicit in which properties are classified as intrinsic, a classification presupposed in applying [R2] in the first place. That means that [R2] fails to generate new possibilities from the basic facts, as our project requires. Rather, they are all generated from non-basic (second-order) information about which properties are intrinsic; the basics turn out to play no role.

(At least, *prima facie*, [R2] is trivial. Of course, if the recombinationist can come up with an analysis of duplication (or intrinsicity) that doesn’t entail [I], she can resist the charge of triviality. However, the prospects don’t look good. The best bet would seem to be to take ‘duplication’ to mean the sharing of *natural* rather than intrinsic properties. But the problem then is that [R2] would no longer clearly even be true. Why shouldn’t some non-intrinsic properties—properties that would interfere with recombination—also be natural? Nothing in the analysis of naturalness suggests otherwise for the simple reason that no one has ever come up with an analysis (not an illuminating one at least: treating naturalness as a manifestation of universals or tropes or similarities clearly won’t help here). Nor is there anything in the original motivations for positing naturalness to suggest this.<sup>12</sup> One motivation is to account for our ability to refer, despite underdetermination by all the information available to us. But we refer to extrinsic as well as intrinsic properties. Another is to account for fundamental similarities in nature, as codified by science. But science is not yet done. Perhaps it will discover that some fundamental similarities are extrinsic. (Ted Sider (2001) has convincingly argued that properties like being a house, being a cat, and being a rock are extrinsic. If so, it is not too hard to imagine some fundamental physical properties turning out to be extrinsic too.)

<sup>10</sup> More generally, if  $C$  and  $C^*$  are any wholly distinct collections—none of their members overlap, even in part— $D$  is any possible distribution of  $F$  over  $C$ , and  $D^*$  is any possible distribution of  $F^*$  over  $C^*$ , then there is a single world at which  $D$  is the distribution of  $F$  over  $C$ , and  $D^*$  is the distribution of  $F^*$  over  $C^*$ . See Denby (2006).

<sup>11</sup> The complete intrinsic nature of something can be thought of as the conjunction of all its intrinsic properties. And a property is a complete intrinsic nature if it’s the complete intrinsic nature of some possible thing.

<sup>12</sup> For reasons to posit naturalness see Lewis 1983.

Both [R1] and [R2] are too conservative in two other ways. First, neither captures all the intuitively possible *extrinsic* variations in things. Intuitively, my left shoe could have been intrinsically just as it is, but all alone in the world, the only concrete particular. Now, [R1] applied to the actual world enables us to infer worlds where my left shoe is the only thing there that also *actually* exists, and [R2] enables us to infer worlds where a (n intrinsic) duplicate of my left shoe is the only thing there that is a duplicate of any *actual* thing, but neither enables us to infer a world where it or a (n intrinsic) duplicate of it exists all alone without anything else at all, not even alien things.

Second, neither [R1] nor [R2] captures all the possible variations in the properties of *collections* of things. Intuitively, e.g., concrete particulars could have been more or less numerous. Now, perhaps applications of (a) (or (a\*)) can mimic the effect of there being fewer of them. (Though not obviously: lacking (duplicates of) existing concrete particulars is not the same as having fewer of them—it doesn't rule out other things to take their place). But neither [R1] nor [R2] can provide worlds with more of them; recombining things or their duplicates will never produce anything extra.<sup>13</sup>

Of course, we could try harder at recombinationism. For instance, (a\*) and (b\*) could be amended to allow the worlds mentioned in their consequents to contain multiple duplicates of *x*, and of *x* and *y*, respectively. That will automatically generate worlds with more individuals than there actually are. But such an amendment is not purely recombinational in spirit; repeating or multiplying is not really quite the same thing as recombining. And it brings with it a new complication: Lewis points out that the number of duplicates cannot be unlimited if they are to fit into the relevant spacetime, so such an amendment would have to be accompanied by a “size and shape permitting” proviso. Moreover, it seems ad hoc; it doesn't throw any light on any of the other problems. Other amendments and responses to deal with this and the other difficulties are possible, but they too raise new difficulties and new complications. Enough has been said, I think, to motivate exploring a rival approach.

### 3 Determinablism

Determinablism is based on the distinction between determinable and determinate properties. I assume that this distinction is familiar, but roughly the idea is this. Properties can be categorized into families (the masses, the shapes, the charges, the colors, etc.). The properties corresponding to these families (having a mass, being shaped, etc.) are determinables, and their members (being 1 kg, being round, etc.) are their determinates.<sup>14</sup> Again roughly, the key facts are: (1) no property belongs to more than one family (a shape is not also a color, or a charge, or...); (2) something

<sup>13</sup> Ignoring the possibility of analyzing things into their parts before recombining. After all, the intuition seems just as compelling restricted to the metaphysical atoms of the actual world: surely there could have been more or fewer of them, however many there are.

<sup>14</sup> I will often just use ‘determinable’ for ‘property family’ and I will talk of determinates “belonging to” a determinable or being “from” a determinable, etc.

can instantiate two determinates only if these determinates belong to distinct families (if it is square, then it cannot be round, or triangular, or...); and (3) necessarily, something instantiates a determinable iff it also instantiates one or other of that family's determinates (if it is square, it must be shaped, and if it is shaped, it must instantiate some determinate shape or other). Lots of properties are not clearly either determinables or determinates. Candidates include: haecceitistic properties, like being identical to Socrates; logically (and perhaps mereologically) complex properties, like being either colored or 3 kg in mass; and "intermediate" properties, like redness or triangularity, that seem to be determinates relative to some properties (e.g. being colored, being shaped) but determinables relative to others (e.g. being scarlet, being equilateral). I will simply ignore such properties; I will pretend that the determinable-determinate distinction really is exhaustive. (Though for vividness I will continue to use redness and other colors as examples, treating them as determinates of the determinable being colored.) I will also simply assume (1), (2) and (3) and ignore any other complications. My project is a modest one. I aim merely to sketch an alternative to recombinationism, not to formulate a full account of determinables and determinates sensitive to all possible complications. That is a project for another day.<sup>15</sup>

Determinablism conceives of the generating principles in terms of "intra-determinable" variation, variation from one determinate to another of the same determinable. A natural first attempt to capture this idea is:

[D1] For any properties  $F_i$  and  $F_j$  that are determinates of the same determinable, and any concrete particular  $x$ , if there is a world at which  $x$  instantiates  $F_i$ , then there is a world at which  $x$  instantiates  $F_j$ .<sup>16</sup>

[D1] allows us to infer, e.g., that my shoe, which is actually brown, might have been yellow and that my dog, who is now actually about three feet away, might have been about four feet away. For brownness is one determinate of the color determinable whose other determinates include yellowness, and being about three feet away is one determinate of the determinable whose other determinates include being about four feet away.

[D1] has several advantages over [R2]. First, since [D1] is not recombinational, since it simply makes no mention at all of combining or separating things, there is no need for it to exclude properties that might "reach out" from their instances and interfere with recombination. Its quantifiers can be taken to range over all properties, intrinsic and non-intrinsic alike. Thus [D1] sidesteps problems generated

<sup>15</sup> Moreover, I argue below that determinablism should apply only at the level of natural properties and the haecceities, compounds and intermediates probably don't qualify. So investigating them further would not be worthwhile anyway. I discuss determinables and determinates further in Denby (2001).

<sup>16</sup> For ease of exposition, when I'm discussing determinablism, I concentrate on properties, ignoring relations. But the generalization to relations seems straightforward, at least if they too are categorizable into determinables and determinates governed by analogues of (1), (2) and (3) and they can be thought of as properties of pairs, triples, etc. For then we need only let the individual variables in [D1] range over pairs, triples, etc., for [D1] (and its subsequent modifications) to cover possibilities involving relations too.

by attempts to exclude non-intrinsic properties. In particular, unlike [R2], it does generate possibilities involving non-intrinsic variation and it is not trivial.<sup>17</sup>

Second, recall that [R2] is formulated in terms of the recombination of *duplicates* of concrete particulars. This is tantamount to taking complete (intrinsic) natures as the fundamental units of modal variation. Intuitively, however, that is the wrong choice: complete natures are special, maximal properties, whereas most modal variation involves ordinary, less-than-maximal properties. [D1], by contrast, is formulated in terms of these ordinary, less-than-maximal properties rather than duplicates. So, unlike [R2], it can permit variation, e.g. from brownness to yellowness, or from being about three feet away to being about four feet away.

Third, for [D1], the variation takes place *within a structure*—from one determinate to another of the same determinable. This allows [D1] to generate possibilities involving alien properties, e.g. the possibility that my brown shoe instantiate Hume’s missing shade of blue. For despite being alien, Hume’s shade is still a determinate of the same family, color, to which the determinate brownness also belongs. Indeed, because property families typically have an internal structure on which alien determinates have *specific* locations, determinabilism manages to generate possibilities involving *specific* alien properties. Notice that this is true not only of the colors but also of the more fundamental property families. Because the masses and lengths have the structure of the positive reals, for instance, [D1] can generate possibilities involving specific “missing” masses and lengths. By contrast, for [R2], the variation involves entities—complete intrinsic natures—that are not identified as elements of any broader structure that might provide access to aliens. And [R2] conspicuously fails to generate possibilities involving alien properties.

However, [D1] needs refinement. As yet it does not allow joint variation in multiple concrete particulars, only in one at a time. The remedy is to generalize its singular quantifiers over concrete particulars to plural quantifiers:<sup>18</sup>

[D2] For any properties  $F_i$  and  $F_j$  that are determinates of the same determinable, and any concrete particulars  $X$ , if there is a world at which the  $X$ s instantiate  $F_i$ , then there is a world at which the  $X$ s instantiate  $F_j$ .

[D2] subsumes [D1] as the special case where the  $X$ s consist of just a single concrete particular. But it also generates possibilities involving alternative ways for multiple concrete particulars to be, many of which do not reduce to ways for those concrete particulars to be severally. This allows it to capture modal intuitions about concrete particulars collectively—about their arrangements, their cardinality,

<sup>17</sup> Notice that (1), (2) and (3) are negative; they tell us only about what is not possible, not about what is possible. So they do not allow us to infer any worlds at all, even in combination with all the actual basic facts and all the information about which properties are determinates of which determinables. That’s why they do not imply [D1]. And that’s why, even if (1), (2) and (3) are constitutive of the notions a determinable and its determinates, [D1] is not trivial. By contrast, [I] is positive; it tells us which worlds there are. And [I] plus the actual basic facts plus information about which properties are intrinsic does generate all the worlds generated by [R2]. That’s why [R2] is trivial.

<sup>18</sup> While extending the range of the property-quantifiers to cover plural properties, including non-distributive ones, and extending the determinable-determinate distinction to cover them. I assume that this raises no new difficulties.

their collective composition, and so on—that elude [D1]. Consider, e.g., the fundamental particles in the universe. Collectively, they have various properties: a particular spatiotemporal arrangement; a particular cardinality; a particular composition (say 10% electrons); and so on. Now, each of these properties is a determinate of some determinable: the arrangement determinable; the cardinality determinable; the percentage-of-electrons determinable; etc. So [D2] allows us to infer alternative possibilities for the particles involving their instantiation of other determinates belonging to the same determinables. Thus, we know that they might have been arranged in a circle; that they might have been twice as numerous; that they might have consisted of 90% electrons; and so on.<sup>19</sup>

However, [D2] also needs refinement. As yet it does not allow for the joint variation of multiple properties, just of one at a time. The remedy is to replace its singular quantifiers over properties with plural quantifiers. This is more fiddly, but one way is:

[D3] For any *eligible* collections of determinate properties, the Ps and the P\*s, if the Ps and P\*s are *variants* and there is a world at which the Xs instantiate the Ps, then there is a world at which the Xs instantiate the P\*s,<sup>20</sup>

where a collection of determinate properties is *eligible* iff it contains only determinates drawn from distinct families; and two such collections, the Ps and the P\*s, are *variants* iff the P\*s result from the Ps when one or more of the Ps is replaced by another determinate from its family. Eligible collections contain at most one member per family; variants contain different members of the same families.

[D3] subsumes [D2] as the special case where the Ps and the P\*s consist of just a single determinate each. But unlike [D2], it also generates alternative possibilities involving alien combinations of properties. Suppose that nothing is actually yellow and two feet long. Let the Xs consist of just my shoe; let the Ps consist of just brownness and being one foot long; and let the P\*s consist of just yellowness and being two feet long. Clearly, the Ps and the P\*s are variant eligible collections of determinate properties. Now, my shoe is actually brown and one foot long. So the Xs instantiate the Ps. From this, [D3] allows us to infer a world at which the Xs instantiate the P\*s, i.e. a world at which my shoe is both yellow and two feet long. And that, we're supposing, is an alien combination of properties. ([D2] allows us to infer a world where my shoe is yellow and a world where it is two feet long, but not one where it, or anything else, is both.)

A third refinement is needed to keep determinablism neutral on vexed issues concerning essences. [D3] entails that if concrete particulars can instantiate one

<sup>19</sup> Notice that by exploiting the cardinality determinable, we can conclude that there might have been zero particles—in effect, that there might have been nothing at all. Many would object. Lewis, e.g., denies that this is a possibility (1983, pp. 73–74), as does Armstrong (1989, pp. 24–25 and pp. 63–64). On the other hand, many would not. And it perhaps has pre-theoretic intuitions on its side (as Lewis and Armstrong both concede). I tend to agree with Lewis and Armstrong that whether there could have been nothing is a case of “spoils to the victor”. Moreover, since it is clearly a special case, it would not really be ad hoc to modify [D2] in such a way as to exclude it (and there are several straightforward ways to do this).

<sup>20</sup> Talk of “collections of properties” makes the exposition smoother, but note that it is intended as an idiom of plural quantification, not as set talk.

determinate of a given family, they can instantiate any other. But perhaps this is not really possible. Perhaps some concrete particulars have some determinates essentially, or some limited range of determinates essentially (perhaps, for instance, they could have been bigger or smaller, but not much). One remedy is to replace [D3] with:

[D4] For any eligible variant collections of determinate properties, the Ps and the P\*s, if there is a world at which some concrete particulars instantiate the Ps, then there is a world at which some concrete particulars instantiate the P\*s.

Unlike [D3], [D4] is de dicto; it has no implications for what is and isn't essential. And although it is formally weaker than [D3]—[D3] entails [D4] but not vice versa—it may still generate all the worlds that need to be recognized. Perhaps, as Lewis has convincingly argued, the metaphysics of modality is at bottom purely qualitative (1986, chapter 4). Anyway, I will stick with de dicto principles. It is enough for now to sketch determinablism as an alternative to recombinationism. It would take us too far afield to decide whether Lewis really is right. (And I see no way to stay neutral.)

There is also a second problem that [D4] does not address. It entails, as does [D3], that if any determinates from distinct determinables are compatible, they all are. Now, that seems right for some determinables: intuitively, shapes, charges, and masses can all vary independently. But it is not right for others: volume and surface area cannot vary independently—some volumes are too big for some surface areas; the pictures on a TV screen cannot vary independently of the pattern of illumination of its pixels; a red thing could be blue and could exist in an all-red world, but nothing could be both blue and exist in an all-red world. In still other cases, it is just unclear. Being a donkey is compatible with some shapes, but is it compatible with all shapes—could there be circular donkeys?

So [D4] needs qualifying. I suggest restricting the properties to those that are natural<sup>21</sup> and adding a proviso:

[D5] For any eligible variant collections of *natural* determinate properties, the Ps and the P\*s, if there is a world at which some concrete particulars instantiate the Ps, then there is a world at which some concrete particulars instantiate the P\*s, *unless that would violate any mathematical or mereological relations among the P\*s.*

The restriction is intended to exclude properties like existing in an all-blue world and having such and such a TV picture from the scope of [D5]. For, intuitively, such properties are not natural; they correspond to no *fundamental* similarities in nature. The proviso is intended to filter out any impossible combinations even among determinates that are natural, e.g. volumes and surface areas. The hope is that this is enough to prevent [D5] from generating incompatible combinations of determinates.

Note several points about these qualifications. First, the haecceities, compounds, and intermediates mentioned earlier seem not to be natural either. None corresponds

<sup>21</sup> Perhaps naturalness is a matter of degree—properties are more or less natural. If so, just read 'perfectly natural' for 'natural' throughout.

to a fundamental similarity in nature and none figures in at least our current physical laws. So it would not have been worth discussing them further earlier on.

Second, restricting [D5] to natural properties does not mean missing any genuine possibilities. For, intuitively, all properties supervene on the natural properties anyway. So any genuine possibility generated by [D4] is still generated by [D5]. Nor does it mean denying the intuitive appeal of [D4]. Reasoning with non-natural properties remains an indirect, though fallible way to reason modally. For, given the supervenience, any variation among non-natural properties is guaranteed to correspond to some variation among the natural properties too. What is not guaranteed of course is that this variation will generate genuine possibilities.

Third, neither qualification is ad hoc. The restriction to natural properties anchors the alternative possibilities in how things fundamentally are. It means ignoring only that which is superficial or mind- or language-dependent (and supervenient anyway).<sup>22</sup> And the proviso constrains variation among properties only to the degree that their families are mathematically or mereologically entangled, and that is merely to generalize the idea, common to all approaches, that independent variation requires distinctness. It is just that distinctness among property-families is more complicated than distinctness among particulars. Since many families, e.g. the volumes and the surfaces areas, have internal mathematical structure, they can be linked in non-mereological ways via these internal structures.

Fourth, since which properties are natural is a posteriori and what the mathematical and mereological facts are is unobvious, these qualifications account for our frequent uncertainty about whether some combination of properties is really possible. Is donkeyhood really a natural property? Does it perhaps involve some hidden geometrical constraints or some parts that preclude donkeys from being circular?

[D5] captures even those intuitions that seem most recombinational. Consider, e.g., the intuition that there might have been unicorns. This, the recombinationist will say, results from recombining horses and horns. Now, not only does [D5] also generate “unicorn worlds”, it provides multiple routes to doing so. Here are four. (1) Each actual pair of a horn and a horse is a certain determinate distance apart. By exploiting the distance determinable, [D5] allows us to infer worlds where pairs of horses and horns are zero distance apart—touching—throughout their careers. These are worlds containing unicorns-qua-horses-with-horns. (2) Unicornhood is an actually uninstantiated determinate of a determinable, the species determinable, many of whose other determinates are actually instantiated. By exploiting this determinable, [D5] allows us to infer worlds where there are instances of unicornhood. These are worlds containing unicorns-qua-instances-of-an-alien-species. (3) The fundamental particles of the actual world are actually arranged in a determinate way. In virtue of this arrangement, there actually are horses, cows, horns, etc., but no unicorns. By exploiting the arrangement determinable, [D5] allows us to infer worlds whose particles are arranged quite differently. Some of these are worlds containing unicorns-qua-alien-arrangements-of-particles. (4) All

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<sup>22</sup> And this is a more appropriate role for naturalness than precluding extrinsic properties from the scope of the generating principles (see above p. 7). For it corresponds to one of the original motivations for positing naturalness in the first place, viz. accounting for fundamental similarities in nature.

the fundamental particles of the world are composed of a certain determinate kind of matter. By exploiting the kind-of-matter determinable, [D5] allows us to infer worlds whose particles are made of an alien, perhaps magical, kind of matter. And by exploiting the arrangement and the kind-of-matter determinables simultaneously, [D5] allows us to infer worlds containing unicorns-qua-alien-arrangements-of-alien-kinds-of-matter. (By contrast, neither [R1] nor [R2] really does capture this intuition, even if unicorns are thought of simply as horses with horns. They allow us to infer worlds where (duplicates of) horses and horns coexist, but not worlds where they are *joined* to make unicorns because, roughly, their consequents talk only about *what* exists at a world, not *how* things exist there.)<sup>23</sup>

[D5] also suggests a diagnosis of recombinationism. By exploiting the cardinality determinable, [D5] entails that if it is possible that there be a collection consisting of two concrete particulars, *x* and *y*, then it is possible that there be a collection consisting of just one concrete particular, *z*, and vice versa. Both [R1] and [R2] also entail this. What they add, making them distinctively recombinational, are constraints on the individual members of the collections: [R1] adds that *z* is identical to *x* and that none of its worldmates is identical to *y*; [R2] adds that *z* is a duplicate of *x* and that none of its worldmates is a duplicate of *y*. But these additional constraints are precisely what generate the problems that make [R1] and [R2] unacceptable even as partial systematizations of our basic modal knowledge. (Roughly, [R1] is false because its constraint is incompatible with possibility of extrinsic essences, and [R2] is trivial because its constraint implicitly makes use of the notion of intrinsicity.) And if the intuitions are really about cardinalities of collections, these constraints are unnecessary anyway. For intuitions about the relative sizes of two collections imply nothing about relations of identity or duplication between the members of the one collection and the members of the other; they concern the members collectively, not individually. Perhaps then recombinationism results simply from misinterpreting intuitions about the cardinalities of collections as intuitions about their members, prompting troublesome and unnecessary additional constraints.

## 4 Some objections to determinablism

### 4.1 *Unacceptable primitives?*

To apply [D5] at all means knowing which properties are determinates of which determinables. Call this information, *D*. Now, I myself think that it is possible to analyze the notions of a determinable and its determinates in non-modal terms,

<sup>23</sup> Again this is not to deny the possibility of fixes to recombinationism to enable it to specify the manner of coexistence. For instance, part (b\*) of [R2] could be modified to allow the duplicates to exist in any spatiotemporal arrangement, perhaps as follows: If there is a world at which *x* exists but *y* does not and a world at which *y* exists but *x* does not, then for any possible spatiotemporal arrangement *A*, there is a world containing distinct duplicates of *x* and *y* coexisting in arrangement *A*. Thus modified, [R2] would generate the first sort of unicorn-world, those containing unicorns-qua-horses-with-horns. But this amendment brings its own difficulties—for one thing, it introduces an extra modal element, the notion of a *possible* arrangement, into [R2]—and it wouldn't capture unicorn worlds in the other senses anyway.

though explaining how is beyond the scope of this paper (Denby 2001). But suppose that I am wrong; suppose these notions are really ineliminably modal. Then D is modal information.

Does that mean that determinablism is objectionably circular? No. Circularity is objectionable only in a theory intended as a reductive analysis. But determinablism aims only to systematize modality, to articulate general principles that capture our basic modal knowledge, not to analyze it reductively. So its use of modal primitives is unobjectionable.

Determinablism cannot account for our knowledge of D itself: contact with the actual world tells us only which concrete particulars instantiate which properties, not which properties belong to which families; and D is presupposed rather than generated by [D5]. Does that mean that determinablism is objectionably incomplete? No. Determinablism aims to account for our knowledge only of *basic* (first-order) possibilities. And D doesn't qualify; it is second-order information about the features of and relations among properties. (Nor should determinablism be faulted for its limited scope. The class of basic facts is a natural and interesting one. There is nothing ad hoc about leaving the non-basics to another day.)<sup>24</sup>

Does it mean that determinablism fails to anchor our modal knowledge in the actual world? Again, not objectionably so. The application of [D5] does not require as input any *basic* facts other than actual basic facts, even if it also requires some non-actual, but non-basic facts drawn from D. And that is all the anchoring needed given our modest aim of formulating principles to generate the merely possible basic facts from actual basic facts. To require that [D5]'s input make use of none of our modal knowledge at all, basic or non-basic, would amount to requiring that determinablism provide a reductive analysis of modality, at least as far as the basics are concerned. (Moreover, unlike [R2], it really does require some of these basic facts as input—D plus [D5] alone do not entail any worlds.)

In sum, even if the notions of a determinable and its determinates are ineliminably modal, there is nothing obviously objectionable about determinablism taking them as primitives or presupposing information about the classification of properties into determinates and determinables.

#### 4.2 *Too conservative?*

[D5] permits the variation only of natural properties, those that correspond to fundamental similarities in nature. So if there are non-natural properties that can vary independently of the natural properties, [D5] fails to generate all possibilities; it is too conservative.

I have already indicated my response: I just do not think there are any such properties. The non-natural properties all supervene on the natural properties; they cannot vary independently. This is widely accepted (see, e.g. Lewis 1986, p. 60). However, I do not know how to show it. So it remains a possible weakness in [D5].

<sup>24</sup> Parallel remarks apply to information about which properties are natural and which are mathematically or mereologically linked. It is not objectionable that such information is presupposed in applications of [D5] rather than explained by them because this information does not consist of basic facts.

[D5] mentions only properties that are determinates or determinables. So if there are others and they are capable of varying independently, [D5] fails to generate all possibilities.

Again, I simply deny that there are. Some candidates are mereological or logical compounds of others, or are analytically linked to others. None of these is capable of independent variation. Others, e.g. haecceities, are just not capable of varying at all. Moreover, none of the candidates seems to be natural. At least none figures in our current physical laws alongside the masses, charges, lengths, etc. At the level of the natural properties, the determinable-determinate distinction really does seem to be exhaustive. But again I do not know how to show this and it remains a possible weakness in [D5].

[D5] permits the variation of determinate properties, but not the variation of determinable properties. So it generates no alternative possibilities involving alien determinables, or even alien combinations of non-alien determinables. So if these are genuine possibilities, [D5] is too conservative.

Again, I deny that they are genuine possibilities. This time, however, the denial is less plausible, at least *prima facie*. Nevertheless, there are several things to say in its defense. First, the putative possibilities are very *outré* and any alleged intuitions in their favor fairly weak. It is certainly not a Moorean fact that there could have been other determinables or combinations of determinables than those that there actually are. Nor does it seem to be the consequence of any deeply-entrenched principle of modal reasoning. (After all, it is not entailed by determinablism or even recombinationism!) And the alleged intuitions are clearly not as strong as those supporting the possibility of alien determinates or alien combinations of determinates. Second, the most likely source of these alleged intuitions is simply analogy with determinates: alien determinates and combinations are possible, why not alien determinables and their combinations? But if so, then they are weak indeed. For determinables and determinates are quite different kinds of property: (1), (2) and (3) encode quite different logical relations for them; and it seems to be part of the essence of a determinable, but not a determinate, to have an internal structure, e.g. the structure of the positive reals in the case of the lengths.<sup>25</sup> Moreover, we just don't seem to be able to conceive of *specific* alien determinables or alien combinations of determinables as we can with alien determinates and combinations of determinates.<sup>26</sup> Third, a final verdict on this matter will have to wait on a full understanding of determinable and determinate properties anyway. And perhaps if this shows that an amendment to [D5] really is needed, it will also reveal just how to make it. (Perhaps, for instance, the lesson of intermediate properties like redness is that property-families have greater internal structure. Perhaps they have tree-like internal structures with "absolute determinates" occupying the topmost nodes,

<sup>25</sup> This is one reason why it won't do to think of determinables as mere disjunctions of determinates: their internal structures typically exceed what can be encoded by Boolean operations on their determinates.

<sup>26</sup> What about shapes in higher dimensions or curved spaces? Aren't these specific alien determinables? I don't think so. They are still shapes, after all, and the shape determinable is not alien. What these examples show is that the shape determinable has a complicated internal structure—perhaps it is multidimensional or tree-structured (see the following remarks).

“absolute determinables” occupying the bottom node, and “relative determinable/determinates” like redness occupying the intermediate nodes. Sufficiently generalized, this might justify extrapolation to alien determinables and combinations for all but the bottom-level absolute determinables. And perhaps there really are no possible alternatives to these most general determinables.) Finally, it is hard to see how to accommodate possibilities involving alien properties without finding some unvarying framework which provides the dimensions along which to extrapolate to them. At some point, something must be taken to be invariable. Determinables seem as good a candidate as any. And any rival theory that manages to accommodate the possibility of aliens will presumably face a similar problem. I conclude, hesitantly, that the alleged possibilities of alien determinables or combinations of determinables are insufficient reason to reject determinablism. The charge that it is too conservative remains unproven.

#### 4.3 *Too liberal?*

Electrons are negatively-charged. By exploiting the particle and charge determinables simultaneously, [D5] enables us to infer worlds where electrons are positively-charged. However, intuitively electrons couldn't be positively-charged. So it seems that [D5] is still too liberal.

But why couldn't electrons be positively-charged?

Perhaps it is just analytic (“those are called *positrons*”). If so, [D5] is off the hook. What it denies is that the *property* of being an electron precludes being positively-charged. But analytic truths merely reflect linguistic conventions. And a linguistic convention not to call something by the term ‘electron’ when it is positively-charged doesn't mean that it no longer has the property of being an electron.

Perhaps instead it is because the property of being an electron is a logical compound of properties that include being negatively-charged. Again, if so, [D5] is off the hook. For presumably then electronhood would not be a natural property after all, and so would fall outside the scope of [D5].

Perhaps it is because, like volume and surface area, the particle determinable and the charge determinable are mathematically linked in a way that precludes positively-charged electrons. (Implausible maybe, but who knows what science will reveal?) Again that would let [D5] off the hook. The proviso will filter out worlds containing positively-charged electrons.

Perhaps, finally, it is because electronhood is a complex property of which the property of being negatively-charged is literally a part. Then the proviso will prevent the generation of worlds containing electrons that are not negatively-charged (assuming that instantiating a property means instantiating its parts). And since being negatively-charged and being positively-charged are determinates of the same determinable, [D5] will not permit us to infer worlds where anything negatively-charged is also positively-charged. So once again it is off the hook. (And again such a connection might be revealed only after scientific investigation.)

Suppose however that there really are no analytic, logical, mathematical, or mereological links between electronhood and charge, and suppose that these

properties really are natural. Then the determinabilist just has to maintain that there really could be electrons that are positively-charged. But in that case, she seems to be on firm ground. Doesn't it then just seem possible? Where could alleged intuitions to the contrary have come from? How trustworthy are they? Of course, the compatibility of electronhood and being positively charged is not the only case. The determinabilist has to hold that natural determinates drawn from mathematically and mereologically independent determinables are always be capable of coinstantiation. And I know of no independent reason why this should be so. But nor can I think of any clear-cut counterexamples. The charge that [D5] is too liberal remains unproven.

## 5 Concluding remarks

According to determinablism, the division of properties into determinables and their determinates is central to our knowledge of basic possibilities. To instantiate a determinate is to occupy a particular "location" in the property space defined by the internal structure of its determinable. To be square, for instance, is to occupy a particular location in the "shape space"; to be red is to occupy a particular location in the "color space"; etc. According to determinablism, alternative possibilities correspond simply to the other locations in these determinables, the other determinates. The alternatives to being square are being round, being hexagonal,...; the alternatives to being red are being blue, being green,...; etc. Determinablism, I have argued, is a better approach to systematizing our basic modal knowledge than recombinationalism. [D5] generates all our basic modal knowledge, even knowledge that seems most recombinational and knowledge that recombinationalism fails to capture. And it does so on the basis of actual basic facts alone, anchoring it in actual experience.

Determinablism also provides a perspective from which to diagnose the errors in [R1] and [R2]. [R1] suggests that modal variation is rooted ultimately in the distinctness of things. What is right about this is that one dimension of variation is cardinality: there could have more or fewer things. But from the perspective of determinablism, [R1] fumbles this insight by treating it as a matter of the recombination of things rather than as matter of the cardinality of collections. Consequently, it runs into trouble with things whose essences are partly extrinsic. And anyway this is not the whole story. Things can vary not just in number but also in their properties and relations. Indeed, variation in cardinality is simply a special case of this, one of many dimensions along which a collection may vary in its properties. [R2] correctly suggests that modal variation is rooted ultimately in the properties of things. But from the perspective of determinablism, [R2] misidentifies both the units and the mode of variation. Its units are complete intrinsic natures. This renders it unable to accommodate variation of less-than-maximal properties. And its mode of variation is recombination. This renders it unable to accommodate possibilities involving alien properties. It also renders it trivial (no wonder it seemed so plausible!) For that sort of recombination—varying independently among distinct things—is just part of what it means for properties or natures to be intrinsic.

## References

- Armstrong, David M. (1989). *A combinatorial theory of possibility*. Cambridge, UK: Cambridge University Press.
- Denby, David A. (2001). Determinable nominalism. *Philosophical Studies*, 102(3), 297–327.
- Denby, David A. (2006). The distinction between intrinsic and extrinsic properties. *Mind*, 115(457), 1–17.
- Lewis, David K. (1983). New work for a theory of universals. *Australasian Journal of Philosophy*, 61, 343–377.
- Lewis, David K. (1986). *On the plurality of worlds*. Oxford, New York: Basil Blackwell.
- Sider, Ted (2001). Maximality and intrinsic properties. *Philosophy and Phenomenological Research*, 63, 357–364.