Causation and determinable properties: on the efficacy of colour, shape and size

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1. Introduction

This paper presents a puzzle or antinomy about the role of properties in causation. In theories of properties, a distinction is often made between *determinable* properties, like red, and their *determinates*, like scarlet (see Armstrong 1978, volume II). Sometimes determinable properties are cited in causal explanations, as when we say that someone stopped at the traffic light because it was red. If we accept that properties can be among the relata of causation, then it can be argued that there are good reasons for allowing that some of these are determinable properties. On the other hand, there are strong arguments in the metaphysics of properties to treat properties as *sparse* in David Lewis's (1983) sense. But then it seems that we only need to believe in the most *determinate* properties: particular shades of colour, specific masses, lengths and so on. And if we also agree with Lewis that sparse properties are 'the ones relevant to causal powers' (1983: 13) it seems we must conclude that if properties are relevant to causation at all, then all of these are determinate properties.

I call this 'the antinomy of determinable causation'. On the one hand, we have a good argument for the claim that determinable properties can be causes, if any properties are. I call this the *Thesis*. But on the other hand, we have a good argument for the claim that only the most determinate properties can be causes, if any properties

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are. I call this the *Antithesis*. Clearly, we need to reject either the Thesis or the Antithesis – or we need to find a *Synthesis*. At the end of this paper I will indicate my preferred solution.

Although the antinomy can be framed purely in terms of physical properties (e.g. mass), it also connects with the debate about special science causation in a number of interesting ways. First of all, and most obviously, the special sciences seem to deal in determinable properties too, so they should be concerned with any threat to their causal efficacy. Second, and more specifically, it has been argued by Stephen Yablo (1992) that we should think of the relationship between 'higher-level' properties and basic physical properties in terms of the determinable-determinate relationship. The basic idea is that just as being red is a way of being coloured, so (for example) having one's brain in a certain specific condition is a way of being in pain. Yablo argues that this way of thinking of the relationship between higher-level (or special) properties and physical properties offers a solution to the problem of mental causation, the so-called 'exclusion problem'.[2] This problem is often framed at an intuitive level in terms of the idea of causal competition: how can a mental (or any higher level) property have any effects in the physical world, if physical causes (properties) are always enough to bring about all physical effects? Don't the mental properties 'compete' for causal efficacy with the physical properties, entering a competition that they cannot possibly win?

Yablo answers this question by applying the determinate-determinable distinction. For just as the redness of the traffic light and its simply being coloured do not 'compete' with one another for causal efficacy, so the brain state and the pain do not compete. This is not because these properties are identical, any more than redness

[2] There is a vast literature on this problem by now. For some important recent discussions, see Kim 1989, Kim 1998, Bennett 2003 Kallestrup 2006.

and being coloured are identical. It is rather that in any given case, being in a particular brain state *just is* a way of being in pain. With this account of the relationship between properties, plus an account of causation, Yablo attempts to solve the causal exclusion problem (*cf.* Macdonald and Macdonald 1986 for a earlier, related solution).

Ingenious though it is, Yablo's solution is threatened by the antinomy of determinable causation. For unless determinable properties can be causes, Yablo's solution will not work. It turns out that the ramifications of the antinomy touch any theory which treats any higher-level or special science properties as determinables.

The remainder of this paper divides into four parts. In the next part I lay out some background assumptions about properties, determinates and determinables, and causes and effects. In the third I present an argument for the Thesis: determinables can be causes. Then I present an argument for the Antithesis: only the most determinate properties can be causes. In the final section I suggest how the antinomy might be resolved.

2. Determinates, determinables and properties as causes

By 'property' I understand any general feature or quality or characteristic of things. I will talk about 'properties' in a general way, without prejudice as to whether they are universals, sets, tropes or some other kind of entity altogether. There will be other reasons to distinguish between different conceptions of properties, and we may find reasons for being committed to one or another controversial thesis about them. But for the time being I will simply try and state the obvious.

I assume here that if they exist at all, properties are distinct from the words we use to talk about them. The words we use to talk about properties are sometimes

grouped together as 'predicates'. In fact, we also use words which are not, strictly speaking, predicates to talk about properties. 'Red', for example, seems to be the name of a property, whereas 'is red' or '*x* is red' is a predicate. The natural thing to say is that 'red' is the name of the property which we predicate of something when we say that it is red. (Those with Fregean scruples may ignore this talk of names of properties; nothing turns on it here.)

Some properties are related as determinate to determinable.[3] Colours are the standard textbook example. Shapes are another, sizes and weights are yet others. The basic idea is that the properties of being coloured, say, and being red are related in the same kind of way that the properties of being shaped and being triangular (or having a weight and weighing five kilos) are. Being red, being triangular and weighing five kilos are all *determinates* of the *determinables* colour, shape and weight. If an object has a colour, or a shape or a size, then it must have some specific, particular colour, shape or size: it cannot just be coloured, shaped or sized *per se* (or *simpliciter* as it is sometimes said). Similarly, if an object is red or square, it cannot just be red or square *per se* or *simpliciter*; it must be some specific shade of red or some specifically-sized square. So just as red is a determinate of the determinable colour, so scarlet is a determinate of the determinable red. The determinate-determinable relation is therefore a relative one: many properties are neither determinables or determinates in themselves, but rather they are determinates of one determinable, and determinables of other determinates. Thus *red* is a determinate of the determinable *colour*, and a determinable of the determinate *scarlet*.

However, it makes sense to suppose that there are properties which have no further determinates. To use a useful term of Eric Funkhouser's, these are 'super-

[3] Classic texts on this subject are: Johnston 1921, Prior 1949, Searle 1959. Also important are Sanford 2006, Yablo 1992 and Armstrong 1997: 48-63. An excellent recent discussion is Funkhouser 2006.

determinates' (Funkhouser 2006). Likewise, it makes sense to suppose that there are properties which are not determinates of any determinable. These are, similarly, 'super-determinables'. They could also be called 'absolute determinates' or 'absolute determinables'.

Three further features of the determinable/determinate relation are worth noting here. First, the relation is not exactly the same as many other 'determination' relations, like entailment, supervenience, or the genus-species relation. Take genus-species for example. To say that *human being* is a species of the genus *animal*, for example, is to say that being a human being is being an animal *plus* something else (say, being rational). But being red is not being coloured *plus* something else. Being red is simply a way of being coloured. In addition, the determinate-determinable relation is not simply an entailment relation (although of course 'This book is red' does entail 'This book is coloured'). The way we are understanding the relation, the proposition 'P or Q' is not a determinable of 'P'; and 'P and Q' is not a determinate of 'P'. Yet these are examples of entailment.[4]

Second, it is traditionally held that determinates of the same determinable at the same level are incompatible with one another. If an object is completely red, then it cannot be completely yellow. If an object is triangular, then it cannot be square. However, if an object is completely red it can be completely scarlet: determinables can be compatible with those properties which are their own determinates. But they obviously cannot be compatible with other determinates of those determinables with which they are already incompatible (e.g. yellow with scarlet).

Third, determinates of the same determinable can be different in varying ways. Shades of colour, for example, can fail to coincide in at least one of three ways,

[4] So I prefer the treatment of this issue in Funkhouser 2006, as against Yablo 1992.

standardly called (these days) *hue*, *saturation* and *brightness*.[5] Following Funkhouser (2006) I will call these 'ways things fail to coincide' the *determination dimensions* of a determinable. The determination dimensions of colour are as just described; the dimension of mass is measured in units of mass; the dimension of squareness is the lengths of the four sides; and so on. Essentially, the idea is that different determinates of a determinable are distinguished by the values of their various determination dimensions.

There are many more things in general one can say about the determinable/determinate relation, both as a way of distinguishing it from other 'determination' relations, and in terms of its application to other areas of metaphysics. But here I want to put these complexities to one side, and briefly introduce what Funkhouser calls 'super-determinates', since this will be important when we come to formulate the antinomy.

W.E. Johnson, who first introduced the terminology of determinates and determinables, clearly thought that there are superdeterminates, no matter how difficult it might be in practice to specify them:

> The practical impossibility of literally determinate characterization must be contrasted with the universally adopted postulate that the characters of things which we can only characterize more or less indeterminately, are, in actual fact, absolutely determinate. (Johnson 1921: 185)

For Johnson, this is a 'postulate'. And although not all philosophers would agree with him (see Sanford 1980), many have found it plausible. D.M. Armstrong, for example, writes that

[5] The last two are sometimes called *chroma*/*purity* and *value* respectively. For an introduction to the structure of colour, see Byrne and Hilbert 1994.

> A physical object is determinate in all respects, it has a perfectly precise colour, temperature, size, etc. It makes no sense to say that a physical object is light-blue in colour, but is no definite shade of light blue. (Armstrong 1961: 59)

Many difficulties arise out of the assumption of super-determinacy, however. One is the problem of vagueness. However, a belief in super-determinacy will be consistent with the vagueness of our concepts if one were prepared to insist (as Johnson does) that the world *itself* is perfectly precise and non-vague. The boundaries between things in the world could be entirely sharp, even if our colour concepts are irredeemably vague. I will assume here that the vagueness of colour concepts does not imply that colours themselves cannot be super-determinate.

In what follows, I will use the example of colour, and later I will discuss the possibility that there are super-determinate colours. But this is really just an illustration of the general problem; if it turns out that there are no super-determinate colours – i.e. that colours are not among the super-determinate properties of things in the world – then the antinomy can be formulated in terms of another example of determinable properties.

So much, for the time being, for the distinction between determinates and determinables. My final preliminary remarks concern the role of properties in causation. I have talked above about properties as causes, or as causally efficacious. I realize that some philosophers will object to this idea. Some might say that *events* are causes, not properties (Davidson 1967). Others will say that *facts* (Mellor (1995) or *states of affairs* (Armstrong 1997) or *tropes* (Ehring 1997) are causes. There seems to be a bewildering variety of entities appealed to as the relata of causation. Why am I focusing on properties? And what does it even mean to say that properties are causes?

Let me first remove one possible source of confusion. It is sometimes said that properties are abstract entities (see van Inwagen 2004). Understanding 'abstract' in a

standard way – according to which abstract entities have no spatio-temporal location – then properties so understood cannot be causes, since causes must have spatial or (at least) temporal location.[6] Therefore, when I say properties are causes, I cannot also mean that properties are abstract objects. I mean properties as concrete entities, the shapes and colours of objects, which we can see and touch. Properties in this sense are as spatio-temporal as objects themselves.

Is this the same as saying that only *instantiated* properties are causes, or that only 'property instances' are causes? Yes; but we need to distinguish two ideas. The first idea is this. Property instances are instantiated universals. I accept Armstrong's (1989) *Principle of Instantiation*: there are no non-instantiated universals. Given this, the thesis that properties are causes is the thesis that instantiated properties are causes.

The second idea is that property instances are tropes, a different kind of entity altogether from properties considered as universals (Williams 1958; Campbell 1990). If this is the right view of property instances, then the question arises as to the relationship between these tropes and the 'general' properties of which they are instances. What is the relationship, for example, between the particular whiteness of my shirt and whiteness as such? Is the relationship set-membership, as is maintained by a reductive account of universals in terms of tropes? Or should we admit universals as well as tropes, so we need some other kind of account of instantiation (Lowe 2006)? These are difficult questions, but fortunately we do not need to answer them yet. For whatever view we have about the relationship between tropes, properties and universals, it will still be true that properties only have effects insofar as they are instantiated. The simple truth is that uninstantiated properties have no effects. And

[6] Those like Keith Campbell (1990) who call tropes 'abstract particulars' will understand 'abstract' in a different way.

this is either because what has effects must exist in space and time, or because uninstantiated properties do not exist.

Properties in this sense are causes because whenever things have effects, they have those effects because of the properties they have. As Hume says in the *Treatise*: 'where several different objects produce the same effect, it must be by means of some quality, which we discover to be common among them' (Hume 1739-40: Book I, part III, section XV). The ice broke, *inter alia*, because it was fragile and because the skater weighed 100 kilos. These are properties of the ice and the skater. You might prefer to say that they are facts – the fact that the ice was fragile etc. – or states of affairs – the state of affairs of the skater weighing 100 kilos. I don't mind you saying this, so long as you allow me to say too that it was the skater's weight – a weight he shares with other people – that was a cause of the ice breaking.

For the purposes of this paper, I do not need to establish that other entities cannot be causes, only that properties can. Followers of Davidson will say that *only* events can be causes, and so will reject one of the starting assumptions of this paper. But such philosophers cannot say either that the skater's weight or the ice's fragility is literally a cause of the ice's breaking; and to my mind this makes their position very unappealing. The other theories mentioned can accept, by contrast, that properties are causes; even if they would rather describe this in terms of facts, states of affairs or tropes. The important point is that they would also accept what I mean by saying that properties are causes.

3. Thesis: the efficacy of determinable properties

Suppose a matador's cape is a certain shade of red (say, scarlet). And suppose that it is the colour of the cape which causes a bull, on a specific occasion, to be enraged.

(This example is empirically false, of course, since bulls have monochromatic vision; but I keep it because it is simple, traditional and vivid.) Then we can say, along with the everyday platitude ('red rag to a bull'), that the bull became enraged because the cape was red.

Or was it because the cape was scarlet? On the face of it, we seem to encounter here an exclusion problem of the sort mentioned in section 1. If the scarlet is sufficient to enrage the bull, then how can the redness play any causal role? Certainly, being red is *entailed* by being scarlet, but this does not imply its efficacy. Being coloured is also entailed by being scarlet, but this does not imply that it is the mere fact that the cape is coloured which causes the bull to be enraged. The cape's redness looks like it is epiphenomenal, because it excluded by the sufficient cause, the scarlet. To say that both the redness and the scarlet are causes seems to be unnecessary double-counting, possibly leading to an unwelcome overdetermination.

Stephen Yablo (1992) proposed a way out of this problem, and then applied it to the mental/physical exclusion problem. Yablo's discussion is rich and complex, but at its heart are the following ideas. Determinates do not generally compete for causal influence with their determinables. For even if a determinate (or super-determinate) is causally or nomologically *sufficient* for a certain effect, a determinable is often a better candidate for being the (or a) *cause* of that effect. This is because a cause must be (in Yablo's terminology) 'commensurate' or 'proportional' to its effects: it should 'incorporate a good deal of causally important material but not too much that is causally unimportant' (1992: 188). Mental properties stand to physical properties as determinables to determinates. Hence, mental properties are efficacious because the 'effect is relatively insensitive to the finer details of [the cause's] physical implementation' (1992: 189). Yablo's claims about mental properties and mental

causation will not be touched on here. I think he is right that mental properties are causes; but this is not because they are determinables of which their physical realisers are determinates. I do not think that the mental and the physical stand in this kind of relation, but this is not the concern of this paper. This paper is concerned with causation as such, not with the mental/physical relation.

Yablo's conception of causation is expressed in terms of counterfactuals: he takes himself to be expanding on the apparent platitude that the cause is the 'thing that made the difference'. Effects are what he calls *contingent* upon their causes:

> If x caused y then: If x had not occurred, then y would not have occurred either.[7]

These 'would'-counterfactuals are interpreted in Stalnaker's way: '"if it had been that P, then it would have been that Q" is true iff Q is true in the P-world best resembling actuality' (Yablo 1992: 274 note 56).

Yablo describes the essence of his solution as follows:

> Suppose we stipulate that it contributed nothing to Socrates' demise that he guzzled the hemlock rather than simply drinking it. Then Xanthippe is mistaken when, disgusted at Socrates' sloppy habits, she complains that his *guzzling* the hemlock caused his death. Assuming that the drinking still would have occurred if the guzzling hadn't, [the counterfactual condition above] explains the error nicely. Even without the guzzling, the death would still have followed on the drinking. So while Socrates' death may have been contingent on his drinking the hemlock, it was *not* contingent on his guzzling it. (Yablo 1992: 188)

Abstracting away from a lot of detail, we can see that if you have such a counterfactual conception of causation, then it is easy to derive the causal status of determinables. For on Yablo's preferred semantics for counterfactuals, and assuming

[7] See Yablo 1992: 274. Yablo holds that the 'contingency' of effects on their causes is one necessary condition for causation; hence he differs from Lewis (1973) and many others in thinking that counterfactual dependence is a necessary condition of causation. For his way of dealing with problems of pre-emption (etc.) see Yablo 2004: 121ff.

the truth of the (false) empirical claim about bulls, the following counterfactual, call it 'RED', is true:

(RED) If the cape had not been red, then the bull would not have been enraged

While the following, 'SCARLET', is false:

(SCARLET) If the cape had not been scarlet, then the bull would not have been enraged.

The idea is that the closest world in which the cape had not been scarlet is one in which it would have been a slightly different shade of red, and hence the bull would still have been enraged. Red is more proportional to the bull's anger than scarlet, even though scarlet is (in the circumstances, let us suppose) sufficient.[8] The fact that the cape is scarlet contains 'too much that is causally unimportant'. Therefore redness is a better candidate to count as the cause.

In broad outline, then, we can see how a determinable property like redness can be a cause and not compete with its determinates. The exclusion problem for determinables is solved. Or so it seems. For I now want to argue that given some other plausible metaphysical hypotheses about properties, predicates and causation, determinable properties cannot be causes after all.

4. Antithesis: only superdeterminate properties are efficacious

[8] We can assume determinism here for the sake of argument, although this is not essential.

I begin by introducing what Lewis (1983) calls properties in the 'sparse' sense, or 'sparse properties'. The doctrine of sparse properties essentially involves a denial of the thesis that to every distinct (type of) property-word, there corresponds a distinct property. Not every distinct, non-synonymous word for a property introduces a new property. For the purposes of this discussion, predications can be distinguished by the meanings of the predicates expressed therein, or by the concepts expressed when predicating something of an object. So when I talk of 'predications' I refer to types of application of predicates to objects, unified by the meanings of the words involved.

It is uncontroversial that we should distinguish between property-words (general terms or predicates) and the properties they refer to – just as we should distinguish between names and what they refer to. But this does not itself imply that there is no one-one correspondence between property-words and properties. The following is a possible view: each object has one and only one name, each property has one and only one distinct property-word associated with it (a general term or a predicate), yet objects and properties are distinct from names and property-words. Of course, we know that what this view says about names is false. Objects have many names; some objects have no names; some names refer to no objects at all. But how do we know that this view is false of properties and property words?

One obvious answer is that there are property words (general terms or predicates) to which no property corresponds. If there is no such thing as phlogiston, then there is no such thing as the property of being phlogiston. Yet the word 'phlogiston' has a meaning, and predications of the property of being phlogiston have a meaning (most of them are just false, that's all). So in this case, at least, we know that there is a general term which corresponds to no property whatsoever.

To this it might be responded that properties are necessary existents; so even though it is not actually instantiated, the property of being phlogiston still exists, since the property itself exists in all worlds. This is sometimes said to be a difference between properties and objects: properties exist necessarily and (some) objects do not. I myself find this an implausible view of properties; but fortunately we need not refute it in order to criticize the idea that properties and predicates correspond one-one. For even if properties are necessary existents, they need not correspond one-one with predicates.

To see this, consider the debate over whether there are 'disjunctive' properties. It is perfectly meaningful to say, for example, that a wine is red or white, and hence that the predicate '*x* is red or white' can be applied to it. But we are not obliged to say that a particular bottle of red wine has, in addition to the property of being red, the property of being red or white. This seems like over-counting properties. Surely it is better to say that the wine has one property, redness, and it is because of this that it is true to say that it is red or white. Anything which is red or white is either red or it is white. The disjunctive predication does not correspond to any disjunctive property. And this could be true even if properties were necessary existents.

This does not show that there are no disjunctive properties; only that we do not need to postulate them in order to explain why a disjunctive predication is true. But nonetheless it gives us enough of an understanding of the idea that properties may fail to correspond one-one with predicates, and once equipped with this idea we can move on to consider what role properties might have in our theorising about causation, without them having to correspond one-one to predicates.

So one reason to reject disjunctive properties is that we do not need them in giving an account of what is true and why. There is an important and simple

connection between the ideas of predication, property-hood, and truth. The properties of a thing are the ways it is, its general characteristics or qualities. When a predication of a property is true, it is true because of the way that thing is (and perhaps its relations to other things too). It is because the wine is a certain way – *red* – that it is true to predicate 'is red' of it. But it follows that it is also because the wine is that way that it is true to predicate 'is red or white' of it. The redness of the wine itself is enough to explain why it is true that it is red or white. We do not need the wine to have a further property, the property of being red or white.[9]

The central idea here is just the simple one that although there are many colour predications of things, there is a sense in which a uniformly coloured object only has one colour. After all, this is part of what it means to call it uniformly coloured. Although a uniformly coloured object may be said to have many colours in one sense – many distinct colour-descriptions are true of it – there is also a sense in which it only has one colour. In this sense, the colours of objects (if they exist at all) are sparse.

When a predication is true, it is the instantiation of a property which makes it true. This 'truth-maker' idea is, I think, one main motivation for believing in sparse properties. The same property (or instantiation of a property: see section 2 above) can make true many distinct types of predication. Now this truth-maker principle is difficult to spell out in detail. Armstrong has argued for an unrestricted version of the principle, while others (such as Lewis and D.H. Mellor) have denied that all truths have truth-makers, even though they do accept something like the idea. Here I do not endorse the thesis that all truths have truth-makers. Rather, I endorse a weaker thesis:

[9] I would also say that same thing about conjunctive properties: the wine does not have the property being red and dry, only the property being red and the property being dry. But opinions differ on this: see Oliver 1992 and Mellor 1992. Perhaps I should make it explicit that by 'white' in this context I mean some transparent non-red colour which so-called 'white' wines have.

that *if a predication has a truthmaker, its truthmaker is the instantiation of a sparse property.*

The first role for sparse properties, then, is as truthmakers. The second is their role in causation. In introducing the terminology of sparse properties, Lewis distinguishes Armstrong-style universals from properties in his own special sense: 'almost all properties are causally irrelevant, and there is nothing to make the relevant ones stand out from the crowd' (Lewis 1983: 13). By 'property' here, Lewis simply means the extension of a predicate. He accordingly distinguishes between properties as such, which are abundant, and *natural* properties, which are sparse. Natural properties are 'the ones whose sharing makes for resemblance, and the ones relevant to causal powers. Most simply, we could call a property *perfectly* natural if its members are all and only those things that share some one universal' (Lewis 1983: 13). Perfectly natural properties are sparse, and they are the ones responsible for the causal powers of things which have them. Ignoring the distinction Lewis makes between perfectly natural properties and universals, I will express the connection between sparseness and causation as follows: only sparse properties are the causally efficacious properties. If a property has effects, then it is a sparse property.

Why think only sparse properties have effects? Lewis says that they are the ones 'relevant to causal powers' but is this just a stipulation, or can some argument be given for it? I think an argument can be given. Consider first the case of disjunctive properties. The colour of a wine might have causal powers; it might cause Vladimir to buy it when faced with a choice in the wine shop, for example. Suppose Vladimir wants a red wine, and chooses this particular bottle because it was red. The redness of the wine is therefore a cause of his action. Given that the wine is red, it is also true that it is red or white. But how can its *being red or white* have any effects on

Vladimir's action? He did not choose it because it was red or white, he chose it because it was red. In general, we can say that if the wine's colour has any effects at all, then it is the *actual* colour which matters, not the disjunction of that colour with a colour which it does not have. For how can a colour *not* possessed by something play any role in what that thing causes?

Perhaps it will be obvious in this case that *being red or white* cannot have any effects, because whiteness is nowhere instantiated in this situation. But this point cannot be applied to all non-sparse properties, unless we have some independent reason for thinking that only sparse properties exist.[10] Some philosophers (Armstrong 1997, Mellor 1993) do hold that view, and it does have some plausibility. However, I will not commit myself to it here; instead I will argue that only sparse properties are causes, even if there are also (epiphenomenal) abundant properties.

To get to this conclusion, we need to make explicit some assumptions about causation: that it is relational, and that its relata are properties (or property instances). When we make a true causal claim, we are describing a real relation between cause and effect.[11] So if a causal truth has a truthmaker, this truthmaker must be itself relational: it must relate cause and effect. The relata of the causal relation will then be the truthmakers for the relata of the causal truth. Causation, then, is a relation between truthmakers. And by our truthmaker principle proposed above, these truthmakers are sparse. Therefore the relata of the causal relation are sparse.

The view that causation takes place at the level of truth-makers should be welcome to any realist about causation who believes in truthmakers. Causation is a

[10] Sartorio (forthcoming) has an interesting argument for disjunctive causes, based on a situation where there are two actual causes of an effect, neither of which is sufficient for the effect, but which are not joint (i.e. conjunctive) causes. Her argument is construed in terms of events, however, and so does not touch the point made here about properties.

[11] *Pace* Mellor (1995) who denies that causation is a relation. Mellor has been effectively answered by Menzies (2003).

mind-independent relation between instances of properties in the world. How causes and effects are then described is another matter. Causes can be picked out in a number of different ways, and only some of those ways will make explicit their identity as sparse properties. Nonetheless, what are picked out are the sparse properties. The thesis that causes are causes no matter how they are described will be familiar from Davidson's (1967) classic discussion of causation, but it applies equally to those views which deny that causation relates events.

Do *all* sparse properties have effects? Lewis seems to think so, since he describes them as those 'relevant to causal powers', suggesting that they all are. Others would agree: those who agree with Shoemaker's (1979) view that properties are individuated by their causal powers, will hold that it is in the nature of any property that its possession by something which instantiated it was enough to dispose that thing to have certain effects. Of course, the claim would have to be restricted to empirical properties, rather than properties of numbers and other abstract objects. But if this Shoemakerian principle, applied to empirical properties, were correct, then we could say that all and only sparse properties are causes, or have causal powers. However, it is the 'only' direction which is important to the present argument.

The next stage is to apply these ideas about sparseness and causation to determinables and determinates. Consider a particular determinable property I have, say, my height. If I have a height, I must have a specific height. I am tall, but that too is a (species- or culture-relative) determinable: to be tall is to have a specific height within a certain range of specific heights. (Of course, it is vague what this range is. But that is not relevant here.) I am also over 150cm; over 160cm; and so on. Let's suppose that my height is exactly185cm. Then arguably *this* is what makes it true that I have a height; this is what makes it true that I am tall, and this is what makes it true

that I am over 150cm and so on. It is very plausible, then, that determinate properties are the truth makers for the predications of determinables. Indeed, if there are any super-determinate properties, then these will be the ultimate truth-makers for any predications of less than super-determinate properties. For nothing more is *needed* in order to make all the determinable predications true. If it is true that I am exactly 185cm tall, then this will be enough to guarantee the truth of the predications of all the other determinables.

Super-determinates, then, are sparse; and since predications of determinables have truth-makers, then these sparse properties will be the truth-makers for these predications (see Gillett and Rives 2005 for further defence of this claim). If it is true, as argued above, that only sparse properties are causally efficacious, then the conclusion follows that where properties with a determinable/determinate structure are concerned, only super-determinates are causally efficacious. So being red, being tall, having a height above 150cm, being triangular, being heavy … none of these are really among the causally efficacious properties of things. The causally efficacious properties of things are always the super-determinates, not the determinables.

This is a conclusion which will be accepted by many philosophers (Armstrong 1997; Mellor 1993 and 1998; Gillett and Rives 2005) many of whom think that there are in reality no determinable *properties* only determinable *concepts*. But the problem is that, as we saw in section 3, there are good reasons for believing that determinables can be causally efficacious. So something has to go.

5. Responses to the antimony

The antinomy is the conflict between the Thesis and the Antithesis:

THESIS: *Determinable properties can be causally efficacious*

ANTITHESIS: *Where properties allow of a determinate/determinable classification, it is only the superdeterminate properties, and not their determinables, which are causally efficacious*

The argument for the Thesis is Yablo's . The essence of this argument is that our intuitive judgements about causes and effects often favour the counterfactuals which make the determinables causes. The argument for the Antithesis relies on two ideas: truthmakers for predications of determinables are sparse; and if a property is causally efficacious, then it is sparse.

I will now consider a number of responses to this antinomy. Assuming our starting point that properties are causes, there are three kinds of option available. One could reject the Thesis, the Antithesis or find some way of reconciling them (a synthesis). I will examine these options in reverse order.

Certainly it would be nice to find a reconciliation or synthesis. One strategy for reconciliation would be to identify an ambiguity in the use of the word 'cause' in the Thesis and in the Antithesis, and remove the appearance of conflict by insisting that they are using the word in different ways. In the mental causation debate, for example, a distinction is sometimes made between causal efficacy and causal relevance of properties.[12] Some physicalists attempt to preserve a belief in mental causation by saying that even though physical properties are the causally *efficacious* properties, mental properties can nonetheless be causally *relevant*. Perhaps this distinction can be applied independently of physicalism. In relation to our example from section 3, we might say that redness is causally *relevant* to the bull's anger,

[12] This kind of response (although writers differ in their terminology) is common in the mental causation debate: see Macdonald and Macdonald 1986, Jackson and Pettit 1988, Segal and Sober 1991. In the present context, it seems as if Funkhouser (2006) accepts something like this too.

since this is what the counterfactual RED tells us: the counterfactuals are guides to what is causally relevant. RED tells us that redness is a causally relevant property. But the argument for the Antithesis tells us that the superdeterminate shade of scarlet which is actually causally efficacious in producing the effect. Hence there is no real conflict between the Thesis and the Antithesis, since different causal notions are involved in each of them. Yablo's argument reveals causal relevance, while the argument of the Antithesis reveals causal efficacy.[13]

The success of this response depends on the plausibility of the distinction between causal relevance and causal efficacy. Without a fully developed account of causal relevance and its distinction from efficacy, the response can simply look like an insistence that in one sense, redness is the cause, and in another sense, scarlet is the cause. But this is a way of describing our problem, not a solution to it! Kripke (1977) has commented on philosophers' tendency to postulate an ambiguity whenever their theory runs into counter-example. Without a detailed account of causal relevance, plus an *independent* account of efficacy, there is a danger that this reconciliation strategy is a case of this tendency.

In an influential paper, Ned Hall (2004) has given an account of two concepts of causation, which he calls 'dependence' and 'production'. Dependence is just the familiar relation of counterfactual dependence between distinct events (2004: 257). Production is a relation between events which results in a causal process which is intrinsic, transitive and local (2004: 252-3; 265). Dependence and production can come apart. The familiar examples of double prevention and causation by omission show how you can have dependence without production (my failure to water my plants causes their death because their death counterfactually depended on my failing

[13] This proposal would not please Yablo (1992), since he identifies *causation* as a relation distinct from what he calls *causal sufficiency* and *causal relevance*. But this is hardly surprising since Yablo is not attracted to the ideas that lie behind the Antithesis.

to do this). And the familiar examples of late pre-emption show how you can have production without dependence (Suzy's rock causes the bottle to break, even though Billy's would have done so if she had missed, because there is a 'productive' process linking her throw with the breaking).

Hall gives us a detailed analysis of two notions which are plausibly contained within our everyday and more scientific thinking about causation. Could this account provide us with the notions needed to say in what sense the red and the scarlet are both causes? No. It seems to me that, whatever the merits of Hall's account, it cannot provide a resolution of our Antinomy. To be sure, the argument for the Thesis relies on the appeal of the notion of causation as dependence. But the argument for the Antithesis does not rely on anything like the notion of causation as production, as Hall construes it. The sense in which the superdeterminate property is a cause does not entail that the relevant causal relation is transitive, for example. All that was appealed to in the argument was the idea of truthmaking, and the idea of truthmakers as causes. These ideas, it seems to me, do not entail the conception of causation as production in Hall's sense. Hall's disambiguation does not provide us with a Synthesis.

I am not saying that there cannot be a Synthesis; but in the absence of any more concrete proposal, I would rather look elsewhere for a solution to our antinomy. For it turns out that one can give an account of the role of the determinable property in the explanation of effects without asserting any ambiguity in the ordinary word 'cause'.

Before dealing with this, I must dismiss the second possible response to the antinomy: to reject the claim that truth-makers must be super-determinate. On the face of it, this might seem intuitively plausible. Surely it is true that something is red simply because it is red; so what is wrong with stopping at the idea that the *redness* of

things as such is one of the truth-makers of predications? This approach has some appeal, especially from the perspective of those (unlike Gillett and Rives 2005) who want to accept the existence of determinables as well as the existence of superdeterminates. But for this response to be a general solution to the antinomy, it has to work in every case. Take the case of height. There is a potential infinity of true height predications which are true of me (of the form 'I am at least *n* cm tall'). If the absolutely super-determinate height property is not the truth-maker for all these predications, then I see no non-arbitrary way of distinguishing among this infinity which ones are the truth-makers and which ones aren't. And to say that I have an actual infinity of height-properties and none of them is privileged is, in effect, to give up on the idea of sparse properties altogether.

To defend the idea that there is one truth-maker for the predication of an object's colour is in effect to defend the principle, mentioned above, that there is a sense in which a uniformly coloured object only has one colour. There may be another sense in which it has many colours – it is truly described as having many colours – but surely there is also a sense in which it only has one. As I said above, this is part of what it means to call it *uniformly* coloured. Once one has accepted this, then it is easy to see that the uniform colour is a sparse property in Lewis's sense. Given the additional claim about the efficacy of properties, the Antithesis follows.

I do not think, then, that we have been given any good reasons to reject the reasoning which led to the Antithesis. What we should do instead is to reject the Thesis. More specifically, what we should reject is the idea that there is any *straightforward* link between the truth of a counterfactual like RED and the causal efficacy of the determinable properties directly mentioned in them. We should not deny that these counterfactuals are true, nor that they are explanatorily useful. Rather,

we should reject the claim that because a predicate ‘F’ or name ‘Fness’ occurs in a true counterfactual (of the RED type), this implies that Fness is a causally efficacious property.

If this view is to be adequately defended, we need to explain how counterfactuals like RED can be true, since they are not true because they directly report what the causally efficacious properties of things are. A full account of this matter would fall outside the scope of this paper. Here I can only give a general outline of an account.

To predicate a determinable property (like redness) of an object is, in effect, to specify that the object in question has a sparse property within some *range*. It is true that the bull charged because the cape was red; but that means that there is some property within a range (the range specified by the concept *red*) which the cape has. Suppose that the cause of the bull’s charge was the fact that it was a superdeterminate shade of scarlet; that doesn’t mean that SCARLET is true. For SCARLET, too, specifies a range of properties: all the determinates of scarlet. The point is that it isn’t necessary for the bull to charge that the provocative property only comes from within this *latter* range. For, *ex hypothesi*, bulls charge at red things. (Notice here that the range is along only one of the dimensions of the determinable – hue or chroma – and not along all of them.)

In committing ourselves to a claim like RED, then, we are committing ourselves to the idea that *there is* a property within the relevant range on whose instantiation the relevant effect is counterfactually dependent. So although I would resist Jackson and Pettit’s (1988) ‘programme explanation’ view, some of the examples they use in defence of their view can also be used to defend the present view. Consider a conductor who stops his performance in a concert because someone

coughed. That someone coughed is sufficient explanation for why he stopped; but of course, it merely specifies that *there is* somebody who coughed, it does not say who it is. The role of the determinable property in the relevant counterfactual is analogous to the 'someone'. The determinable concept specifies the range of determinate properties which would produce the relevant effect.

Now the relevant counterfactual is implied by a generalization linking that kind of effect to properties within that range. In our example, there is the generalization, 'bulls charge at red things'; and this implies the counterfactual RED. Counterfactuals about determinables thus contain an implicit generality, and it is for this reason that determinable properties are suited for figuring in statements of laws of nature. Newton's second law, F=ma, is expressed in terms of the determinables mass, force and acceleration, not in terms of determinate masses. But the law implies counterfactuals of the form, 'if x had mass *M* and force *F* were exerted upon it, it would accelerate at rate *A'* for specific values of *M, F* and *A*.[14] The law generalizes: it talks about all determinates of a given determinable. But individual causal interactions take place between the superdeterminate properties. If this picture is right, it turns out that much causation presupposes the existence of superdeterminate properties. If this is right, then sceptics about superdeterminates should therefore be skeptics about causation itself.[15]

6. Conclusion

[14] *Ceteris paribus,* of course. Also, I should add that I am talking here about statements or formulations of laws; not the metaphysical structures (relations between universals) which Armstrong 1997 and others (e.g. Dretske 1977) call 'laws of nature'. How the present suggestion applies to these views is an interesting question, but not one I will address here.

[15] Of course, I have not given any specific account of causation in this paper, only of its relata. Those, like me, who wish to defend this kind of conception of the causal relata must give a consonant view of causation itself. For scepticism about such views, see Loewer (forthcoming).

Although my concern in this paper has not been with the mental/special sciences causation debate, the proposed resolution of the antinomy does have some consequences for that debate. One consequence is that the truth of counterfactuals of the general form 'if I hadn't had mental property M then I wouldn't have done X' cannot, without other assumptions, get you to any substantial conclusions about the causal efficacy of mental property M. Another consequence is that mental properties had better not be determinables with physical properties as their determinates, since this would make mental properties epiphenomenal on the conception of causation and sparse properties defended here. These consequences seem to me perfectly acceptable to someone who has this conception.

However, I do not pretend to have provided a knock-down argument for the Antithesis, or against the Thesis. It is still open for someone to reject sparse properties, and defend the counterfactual conception of causation embodied in the Thesis. But for someone who does believe in sparse properties and their efficacy, I claim the lesson is clear: they should give up the idea that counterfactuals like RED directly track the causal efficacy of properties.

There is, perhaps, a link to a more general issue in the philosophy of causation here. For some years now, many philosophers of causation have wrestled with the problems which pre-emption and redundant causation pose for counterfactual analysis.[16] Some of them have concluded that the analysis must be given up. Within the context of the metaphysics of sparse properties, and of a view on which properties are causes, it seems that the argument of this paper gives us another reason for doubting the counterfactual analysis: these counterfactuals, although they may be true, do not directly inform us about the causally efficacious properties of things.

[16] See, *inter alia*, Menzies 1989 and 1996; Schaffer 2000.

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