

Causal Structuralism, Dispositional Actualism, and Counterfactual Conditionals

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Abstract

Dispositional essentialists are typically committed to two claims: that properties are individuated by their causal role ('causal structuralism'), and that natural necessity is to be explained by appeal to these causal roles ('dispositional actualism'). I argue that these two claims cannot be simultaneously maintained; and that the correct response is to deny dispositional actualism. Causal structuralism remains an attractive position, but doesn't in fact provide much support for dispositional essentialism.

1 Properties and Modality

It is a truism that objects act as they do at least in part because of how they are. Though there may be outside forces that influence how the object behaves, the most significant determiners of that behaviour are the intrinsic properties that the object itself possesses. The role of properties in determining behaviour is so important that we frequently individuate properties by the characteristic behaviours to which they give rise. This is most obvious in the case of dispositions: fragility, for example, just is that property which contributes the characteristic behaviour of breaking when appropriately struck to its possessors.

Orthodox Humean views hold that the connection between properties and behaviour, even in the case of dispositions, is contingent. For example, Lewis adopts a modern version of Hume's denial of necessary connections when he advocates

a principle of recombination according to which patching together parts of different possible worlds yields another possible world. (Lewis, 1986: 87–8)

Using this principle we can easily sever any link between intrinsic properties and behaviour: recognising that any non-overlapping regions of spacetime count as distinct existences, one may apply the principle of recombination to determine that it is possible that any event in a given region may be spatially or temporally adjacent to any

other. The fact that an object which is wholly contained within one such spatiotemporal region has certain intrinsic properties therefore places no constraint on the contents of any other region. If a region is spatially extended but instantaneous, the contents of that region do not constrain the contents of temporally adjacent extended and instantaneous regions. So the properties of an event and its participants do not necessitate the subsequent course of events. In particular, the fact that an object possesses at one time certain intrinsic properties does not determine the subsequent behaviour of that object, for there are possible situations in which an intrinsic duplicate acts differently by giving rise to a different subsequent course of events. So although properties might be actually characterised by their behaviour, this is a matter of physics or circumstances being such as to make it the case that every actual instance of the property will display the characterising behaviour under the appropriate conditions. They are not necessarily characterised by this behaviour. So, at least, the Humean story goes: ‘there is nothing in any object, considered in itself, which can afford us a reason for drawing a conclusion beyond it’ (*Treatise*, Book I, Part 3, Section 12).

1.1 Causal Structuralism

But many have found this Humean story implausible. For one thing, the Humean picture is committed to the thesis of *quidditism*: that there is something to a property over and above any second-order properties that a property has, and thus over and above its causal profile. For example, if having mass actually conveys the power to attract other massive objects, the Humean believes that being massive possibly has the power to repel other masses. So ‘attracts other massive objects’ is a contingent second-order property of being massive. According to the Humean, every (non-logical) second-order property is contingently possessed by the properties which have it; which means that for any first order property P , there is a possible world w in which P lacks every second-order property that it actually possesses. What, then, makes P actually the same property as P in w ? The answer must be that there is some ground to that identity, a shared essence to the two instances which is called a ‘quiddity’. The quiddity is independent of the causal or behavioural role that P actually occupies, so that role can arbitrarily vary even while the property retains its identity.

That properties have quiddities hasn’t been widely accepted. The best argument I’ve come across against quiddities is that they are methodologically otiose. John Hawthorne gives forceful expression to this objection with respect to the property of negative charge:

All scientific knowledge about negative charge is the knowledge about the causal role it plays. Science seems to offer no conception of negative charge as something over and above ‘the thing that plays the charge role’. If there were a quiddity . . . it would not be something that science had any direct cognitive access to. . . Why invoke what you don’t need? Unless certain logical considerations forced one to

suppose that properties are individuated by something over and above their causal role, then why posit mysterious quiddities? (Hawthorne, 2006: 368–9)

Without stopping to evaluate this or other anti-quiddistic arguments (Black, 2000; Mumford, 2004), we may still take them as motivation enough to explore a non-Humean alternative conception of properties on which the causal/behavioural profile of a property is not merely contingently attached to that property.

This alternative conception is difficult for the Humean to accept at least partly because the paradigm examples upon which the Humean rests their account are *categorical* properties. Take again the example of being red. The natural way to think of this property is as giving certain features to the object which has it; but how other objects respond to those features, for instance how observers respond to it, is not part of specifying the property itself. Categorical properties are naturally understood as passive in a certain sense: events occur because other objects respond to the presence of a categorical property. If the paradigm property is categorical, then it is easy to understand how contingency of causal role is an appealing thesis.

If, however, we adopted *dispositional* properties as the paradigm, a quite different conception of properties seems natural and appealing. A disposition is specified by its stimulus conditions and the manifestation it makes in response to that stimulus: as fragility, on the traditional view, is characterised by a stimulus of being struck with sudden force and a manifestation of breaking. The disposition looks explicitly as if it is specified in terms of its causal profile, and the powers it contributes to objects which have it: the power to produce the manifestation under the stimulus conditions. This causal power looks necessary for the property to be the property it is: an object could not be fragile if it did not have the power to break when struck. If we began thinking of dispositions as the paradigm, then one might regard the causal profile as necessary to the property in every case, not just in the dispositional case. The resulting view of property identity is that

what makes a property the property it is, what determines its identity, is its potential for contributing to the powers of things that have it. ... if under all possible circumstances properties *X* and *Y* make the same contribution to the powers of the things that have them, *X* and *Y* are the same property. (Shoemaker, 1980: 212)

In the absence of any agreement on what ‘making a contribution’ to a power might be, we can adopt the thesis that properties just are causal powers, and have an essential causal profile. This view about properties leads to the thesis of *causal structuralism* (Hawthorne, 2006): the thesis that at least some properties, whether natural or less than perfectly natural, have a causal profile that is essential to them. Mumford (2004: §10.6) defends the similar thesis that properties are intrinsically powerful, as does Molnar (2003).

Causal structuralism is also the cornerstone of the thesis of *dispositional essentialism* (Bird, 2005; Ellis and Lierse, 1994): the view that all the most natural properties—

perhaps those delivered to us by fundamental science—have an essential causal profile. In Bird’s formulation, the properties mentioned in the laws of nature are individuated by their causal role. In Ellis’ formulation, natural kind membership is determined by possession of properties that are individuated by their causal role. Whether these formulations lead to different views, or whether they amount to the same view (as might be if, for example, the laws of nature govern the behaviour of natural kinds), I won’t here say. Dispositional essentialism entails causal structuralism, but is not entailed by it.¹

Lewis once claimed that ‘it can plausibly be said that all perfectly natural properties are intrinsic’ (Lewis, 1986: 61). Despite their differences of formulation, all causal structuralists accept this thesis of *intrinsicness* when applied to perfectly natural properties with essential causal profiles (if there are any): ‘Powers are intrinsic properties of their bearers’ (Molnar, 2003: 129), and intrinsicness is ‘one of the crucial appearances which has to be saved by an analysis’ (Molnar, 1999: 3). Ellis elaborates:

The intrinsic properties and structures of things are what make them what they are. They explain how things are disposed to behave, just in virtue of how they are constituted. . . . (Ellis, 2001: 31)

Perhaps not all dispositions or powers are intrinsic, as McKittrick (2003) has argued, using examples like ‘vulnerability’ (the Mona Lisa was vulnerable to vandalism before it was covered with bulletproof glass). Yet even these extrinsic dispositions ‘are reducible to fundamental potencies that are intrinsic’ (Bird, 2007: 125). The intrinsicness thesis entails that intrinsic duplicates have the same perfectly natural powers or dispositions.

There are good reasons for causal structuralists to suppose that whatever perfectly natural powers there happen to be are intrinsic (and, I imagine, to suppose that perfectly natural relations, like spatiotemporal relations, are internal). For dispositional essentialists it is obligatory: if any perfectly natural property was extrinsic, intrinsic duplicates with that property needn’t have the same causal behaviour, so that the causal profile of this perfectly natural property would not be invariable between instances, contrary to the dispositional essentialist assumption that all perfectly natural properties are causally characterised powers. For causal structuralism in general, the issue is more subtle, as it is compatible with causal structuralism that some perfectly natural property might be amongst those which do not have an essential causal profile. No plausible candidate springs to mind; nevertheless, it may be so. Yet the hypothesis that there is a perfectly natural property that intrinsic duplicates need not share is at least

¹While I think it’s possible to accept causal structuralism without accepting dispositional essentialism—and will argue in this paper that doing so is clearly the preferable option—defenders of that package in the literature are sparse. Mumford (2005: 424–5) does claim to accept causal structuralism without dispositional essentialism, but there is reason for considerable scepticism regarding his position, as he seems to base his objections on a non-standard conception of what it means for a natural kind to have an essential property.

puzzling. Consider the thesis of *object separability*: the claim that the complete physical state of the world supervenes on the intrinsic character of all of the objects in the world plus their spatiotemporal relations. In a world where there was a perfectly natural but extrinsic power, this intuitively plausible thesis would be violated.² This isn't compelling—many intuitively plausible principles are incorrect—but in the absence of a clear and compelling example of a perfectly natural intrinsic property to substantiate the falsity of the otherwise attractive principle of object separability, I don't find the purely theoretical possibility of such a property very moving. I thus regard it as far more reasonable for the causal structuralist to also accept that perfectly natural powers are intrinsic, and adopt the intrinsicness thesis. Indeed, further reflection on the above considerations suggests that the causal structuralist should probably accept Lewis's stronger thesis that all perfectly natural properties are intrinsic, powers or not. At least for the time being, then, I'm going to assume the intrinsicness thesis (I will reconsider it in section 4).

Causal structuralism relies on a notion of 'sameness of causal profile'. A causal profile is basically the complete record of the behaviours that property does and would give rise to under any possible circumstances. Some properties, like fragility, have quite a simple causal profile, as there is only one type of circumstance (exertion of force), and one characteristic behaviour (breaking). Other properties might have many more complicated causal profiles: perhaps there are many possible circumstances in which the property makes a distinctive contribution, or perhaps the property can indeterministically give rise to more than one possible behaviour in a given circumstance. In all these cases, causal structuralists believe that there is an essential link between properties and certain counterfactual conditionals, those which specify some circumstances (the stimulus) in the antecedent, and specify the behaviour that property gives rise to under those circumstances (the manifestation) in the consequent. Causal structuralists accept, therefore, the thesis of *conditionality*: each causal structural property *P* supports a characteristic stimulus-manifestation counterfactual conditional for the objects which possess *P*.

Causal structuralists are careful to note that the possession of the property does not necessitate the truth of the corresponding conditional. Following on from plausible

²It is true that a related doctrine to object separability has been questioned recently. Maudlin (2007) has argued that entangled quantum systems violate what we might call *point separability*, the doctrine that the complete physical state supervenes on the intrinsic character of each spacetime point. Object separability is much weaker than this thesis, as extended objects whose properties didn't supervene on the properties of their parts could still obey object separability. And indeed the examples Maudlin uses, of entangled 'pairs' of electrons, seem to be of this type—I'm not at all sure that spatially extended entangled systems really should be counted as having distinct objects as parts rather than being extended simples or multiply located individuals. So I don't think these examples violate object separability, and they may even support it if it turns out to be true even in the strange world of quantum theory. In any case I'm not inclined to discuss these quantum mechanical examples much, mostly because I find them too controversial at present to have much dialectical force, particularly since most of the debate over causal structuralism has taken place against a neutral background with respect to discussions of quantum theory.

counterexamples given by Martin (1994), Bird explains that

the claim that perfectly natural sparse properties are essentially linked with characteristic subjunctive conditionals [only requires] that the kind of ability that a disposition (strictly, its instantiation) has to make a conditional true in this world (when it is true) is repeated with respect to the same conditional in all other possible worlds. In another possible world the disposition might not in fact make the conditional true, but that will be because ... circumstances are not suitable.... (Bird, 2005: 438)

It is worth noting the reappearance of the intrinsicness thesis: the link between properties and counterfactuals holds in virtue of the intrinsic properties—those which are repeated in other-worldly instantiations of the very same disposition, assuming that the disposition is natural. Yet it may be the case that other instances of the disposition occur in worlds where the extrinsic circumstances disrupt that instance ‘making true’ the conditional (whatever that might mean). While the link is not necessary, it is ‘essential’, as the counterfactual characterises the essential causal profile of the property. We shall consider further below what this essential but non-necessary link could consist in.

1.2 Dispositional Actualism in the Metaphysics of Modality

Accounting for modality has long been a major project in metaphysics, and some, but by no means all, causal structuralists have seen a possible solution to the problem of modality in their views about properties. We can see why they have held this hope if we look at a controversial thesis that many causal structuralists accept: that the laws of nature are necessary.

Take the essential link that a property P has with its stimulus-manifestation counterfactual. For example, that if some object x has P , then $Sx \Box \rightarrow Mx$. As the link is essential, this conditional holds for every x , in every possible world. So, necessarily, $\forall x(Px \rightarrow (Sx \Box \rightarrow Mx))$. If a counterfactual is true, so too is the corresponding material conditional. Hence, necessarily, $\forall x(Px \rightarrow (Sx \rightarrow Mx))$. And this necessarily true generalisation fits the profile of what many have called a law of nature.³

The causal structuralist who accepts this line of argument seems in so doing to conjure a robust necessity out of facts about the pattern of stimulus and manifestation for a given property—a pattern which, despite its rich modal consequences, is apparently empirically discoverable and hence requires only actual facts to ground it. It is not logical necessity: it is not a theorem of any formal calculus that $\forall x(Px \rightarrow (Sx \rightarrow Mx))$. Nevertheless, it is a kind of necessity, which some have called *natural necessity*, and it has a certain modal invariance despite its basis in facts about the actual causal profile of the property P in question.

³Bird, 2005: 442. Set aside, for the time being, our reservations about counterexamples to the essentially linked counterfactuals.

Given this result, there is a perfectly natural temptation to think that this natural necessity is to be identified with metaphysical necessity. From there it is very attractive to propose that the grounds for metaphysical necessity and possibility are therefore to be found, not in an independent realm of possibilia, but in the constraints that the essentiality of actual causal profiles of properties place on the space of possibility. To put it another way, the identity of the properties in question can be discovered by looking at their actual causal profile; once assured that this identity is essential, because the causal profile is necessary, we know how possible objects with the same properties would behave, and thus deduce modal claims from claims purely about actuality.

Quite what to call the resulting position on the metaphysics of modality is unclear. I plump for ‘dispositional actualism’, for the reason that this view grounds, or discovers truthmakers for, metaphysical modality in the *actual* causal profile of occurrent properties. I do not think that dispositional actualism follows from causal structuralism, and I think that almost any view on the metaphysics of modality can be rendered compatible with causal structuralism.⁴ Nevertheless, many causal structuralists, especially the dispositional essentialists, do accept something very much like dispositional actualism. Consider

In virtue of being powerful, [properties] provide natural necessity and possibility and are fit to be the truthmakers for modal truths. (Mumford, 2004: 170)

Again,

necessities in nature . . . require truthmakers, and it seems that it will be real powers which provide such truthmakers. . . . (Molnar, 2003: 223)

Finally, Ellis gives a more sophisticated dispositional account: p is necessarily true iff p follows from the essential nature of some natural kind, where, as before, that nature is characterised by some property with an essential causal profile (Ellis, 2001: 275). With this account of natural and metaphysical necessity in place, he explicitly contrasts his actualism with Lewis’s acceptance of mere possibilia:

Either one accepts Humean Supervenience and possible worlds realism . . . or one rejects them both, as I do, and seeks to ground causal modalities and nomological connections in basic dispositional properties. (Ellis, 2001: 245)

Those who propose this dispositional actualist view may also be seduced by remarks that other essentialists of a quite different stripe have made, notably Kit Fine:

Indeed, it seems to me that far from viewing essence as a special case of metaphysical necessity, we should view metaphysical necessity as a special case of essence.

⁴For instance Molnar (2003: §12.2) is apparently a causal structuralist who is a primitivist about modality; in his terms I suppose dispositional actualism would be a reductionist doctrine. I must confess I do not understand his ‘primitivism’: he claims modal operators are primitive, and yet modal claims hold in virtue of powers and supervene on powers. (To avoid confusion, note that this is not the kind of primitivism I discuss in connection with *CP*-laws in section 3.2.)

For each class of objects, be they concepts or individuals or entities of some other kind, will give rise to its own domain of necessary truths, the truths which flow from the nature of the objects in question. (Fine, 1994: 9)

Given that self-described essentialists of one kind favour the reduction of alethic modality to truths about essence, there is precedent and inspiration for the causal structuralist to ‘reduce’ natural necessity to truths about property essences.

The dispositional actualists are well aware that this proposal will call for revisions in our intuitive understanding of modality. Contingency of laws is widely accepted, and abandoning it must be seen as a cost, whatever fixes are available to save the appearances (Handfield, 2004). For much the same reason, many counterfactuals will involve considering possible situations which involve violations of law, at least on the Lewis–Stalnaker semantics. If there are no law-violating possibilities, then these counterfactuals will be vacuously true, and this is a great revision. So it is incumbent upon the dispositional actualist to give an alternative account of the semantics of counterfactuals that secures their ordinary truth values. We now turn to this project; I think a serious difficulty arises for the combination of causal structuralism and dispositional actualism when it comes to counterfactuals.

2 Counterfactual Conditionals

According to the standard Lewis–Stalnaker semantics for counterfactuals, a counterfactual conditional ‘if it had been that A , it would have been that C ’ is true in a situation just in case there is no relevantly similar situation in which A is true but C false. Obviously a lot more needs to be said about ‘relevantly similar’, but on any reasonable understanding of that notion most of the intuitively valid principles of counterfactual implication follow. One of the more interesting principles of counterfactual implication is that the rule known as ‘strengthening the antecedent’ fails. That is, even if ‘ $A \Box \rightarrow C$ ’ is true, it needn’t be that ‘ $(A \wedge B) \Box \rightarrow C$ ’ is true. So this sentence is pretty clearly true:

- (1) If kangaroos had no tails, they would fall over.

Yet adding an additional conjunct to the antecedent leads to a false sentence:

- (2) If kangaroos had no tails, and were held up by scaffolding, they would fall over.

This is in contrast to strict implication: if ‘ $\Box(A \rightarrow C)$ ’ is true, then we can strengthen the antecedent, because ‘ $\Box((A \wedge B) \rightarrow C)$ ’ will also be true.

One way to put this point is as follows. If A strictly implies C , then whatever makes A true thereby makes C true regardless of any specification of further facts additional to those that make A true (so A ’s truthmaker intrinsically makes C true). The same is not true of counterfactual conditionals. The dependence between A and C exists not just in virtue of A , but also on the other facts that hold in the worlds in which A is

true. The standard semantics makes the default assumption that the other facts are as much as possible like the facts that hold actually. But explicitly specifying further facts that must also be held fixed, as when new conditions are added to the antecedent, can disrupt a de facto dependence that holds in situations very similar to actual situations, by rendering the resulting situation quite dissimilar to actuality. In any case, the point is clear: fixing the facts that make *A* true and the facts that make *C* true is not yet enough to fix whether or not there is a counterfactual dependence between *A* and *C*; for that you need to know something about the situation in which *A* and *C* are embedded. That is, whether *C* counterfactually depends on *A* is *extrinsic* to *A* and *C*, so that counterfactual dependence is an *extrinsic* relation, the obtaining of which does not supervene on the individual or joint natures of the relata (Lewis, 1986: 62).

This familiar feature of counterfactuals leads to trouble in the present context. The causal structuralist who is also committed to dispositional actualism—like Bird, Ellis, Molnar and Mumford— accepts the following claims:

- Perfectly natural properties have an ‘essential’ link to certain characterising counterfactuals (Conditionality).
- Perfectly natural properties are intrinsic (Intrinsicness).
- The truthmaker for the characterising counterfactuals is the instantiation of the perfectly natural property (follows from Dispositional Actualism).

We can use a favoured example of the causal structuralist to explore these claims: the property of being negatively charged, *N*.

Suppose, for the time being, that *N* is essentially linked to something like the following counterfactual:⁵

- (3) If *e* has *N*, and *e* had been placed sufficiently near a body *e'* such that *Ne'*, *e* would have moved away from *e'*.

Whether or not a body *e* has *N* is intrinsic to *e*—negative charge is a perfectly natural property if anything is. Finally, what makes any instance of (3) true is that *e* denotes an object which has *N*. The truth conditions for the counterfactual claim, therefore, do not refer to anything other than the instantiation of the dispositional property that is essentially linked to (3).

But it is easy to see that this story cannot be right as it stands. Consider a situation in which we place a negatively charged particle *e* sufficiently near a negatively charged particle *e'*, but then place a positively charged particle *p* between *e* and *e'*. In this situation, *e* will be attracted by *p* and so will not move away from *e'*. In this physically plausible situation, (3), the characterising counterfactual of *N*, is false. This is not due to any intrinsic alteration in *e* or in the nature of *N*, but is wholly due to extrinsic facts

⁵We shall revisit this supposition later (p. 12).

in the situation in which e happens to be located, the obtaining of which interferes with the dependence between negative charge and repulsive motion away from like charges. This is, in effect, just the well-known phenomenon of *masking* of dispositions carried over to properties more generally (Johnston, 1992). This simple example illustrates again the way that the truth of counterfactual conditionals can depend on facts that are not explicitly mentioned in the conditional. In this case, the truth of (3) depends not only on the nature of e but also that there are no interferers around to distort ('mask') the manifestation of e 's nature.

Masking makes for a difficulty for the dispositional actualist who hopes to ground alethic modality in dispositions and not in some independently given modal reality. The dispositional actualist would reject the talk of possible worlds and similarity rankings that the Lewis–Stalnaker semantics requires, and would provide alternative truth conditions for counterfactual claims that depend only on the presence of the appropriately linked disposition:

Many subjunctive conditionals are true. . . What makes such conditionals true is often the existence of a dispositional property. (Bird, 2005: 437)

But, intuitively, this alternative proposal gives the wrong result in the present case. For the dispositional property N is present in e in an unaltered fashion, and since N is essentially linked to (3), the dispositional actualist predicts that (3) is true in every situation in which an intrinsic duplicate of e is present. This is true even in the second situation we considered, with the interfering positive charge p . Hence the dispositional actualist predicts that even in that situation (3) should be true. But the material conditional 'if e is placed sufficiently near e' , then e moves away from e' ' is false in that situation, so the counterfactual is false in that situation too, not true as the dispositional actualist maintains.

Ellis, to his credit, attempts to give alternative truth conditions for counterfactuals that do respect the Lewis–Stalnaker semantics. In fact he regards all counterfactuals as false, basically because they can be interfered with. But even a false counterfactual can be *acceptable* for Ellis just in case there are

no countervailing dispositional properties. . . that are strong enough to overcome or swamp the display of the dispositional property having the outcome [mentioned in the consequent]. (Ellis, 2001: 282)

This proposal is somewhat unclear, as it is difficult to understand how a false counterfactual could adequately characterise the causal role of a property—especially how any particular false counterfactual could do so any better than any other false counterfactual. But set that aside: if the countervailing properties are intrinsic to the individuals mentioned in the antecedent or consequent, this will be equally subject to the occurrence of extrinsic interferers as the more orthodox analysis of counterfactuals. And

if the countervailing properties are extrinsic, it seems that the characterising counterfactual will not be acceptable in those situations, and hence the property will not be essentially linked to that characterising counterfactual.

Further light can be shed on this unfortunate result by examining the kind of contribution to observed behaviour that negative charge is supposed to make. The negative charge on some particular particle is supposed to make a distinctive contribution to the systems of which it is a part. That contribution might take the form of a repulsive force on other negatively charged particles, or an attractive force on positively charged particles; in any case it is supposed to be a *component* force. There has been considerable discussion recently about whether component forces are anything more than a convenient means of representing a physical system (Cartwright, 1983), but what is certainly clear is that the causal structuralist about negative charge who adopts dispositional actualism ends up grounding *every* counterfactual in component forces exerted by the objects mentioned in the counterfactual. So in our above example, the counterfactual (3) was supposed to be made true by the contribution made by e in virtue of its possessing negative charge N . But what the situation with the additional positive charge shows is that explicitly introduced component forces are not enough to determine the *resultant* force exerted on a particle, and this net resultant force is what is important for the overall behaviour of objects in a given situation. Counterfactual claims about forces are made true by the component forces exerted by the objects explicitly mentioned in the counterfactual (like e and e'), *and* by the lack of distorting further forces in the background.

The Lewis–Stalnaker theory ensures the absence of distorting forces by appealing to similarity, which ensures a kind of de facto neutrality of the background. But because the dispositional actualist restricts themselves to intrinsic properties of the bearers of dispositions, they have no obvious way to ensure the neutrality of the background, and thus cannot distinguish situations in which the manifestation of the component forces is straightforward, and those in which it is compromised. On this account, (3) should be true in (at least) those worlds where e and e' exist and possess the same intrinsic properties (alternatively, all those worlds in which intrinsic duplicate counterparts of e and e' exist). But the world with the positive charge p is one such world, and in that world the counterfactual is false. The dispositional actualist could say that the presence of p changes e (or e') intrinsically; but this is antecedently implausible unless we have already accepted the dispositional actualist/causal structuralist package (though see section 4). They can say that e (or e') is such as to cause like charges to move away in the absence of interferers; this, while true, doesn't look like it depends only on intrinsic properties of e to result in the truth of (3), because we would have to be assured additionally of the lack of interferers. If these complaints are valid, the dispositional actualist cannot account for the truth conditions of (3).

All this discussion of component forces might naturally suggest that the problematic results are an artifact of a poorly chosen example, and that some other characterising conditional is appropriate for N . This thought cannot be sustained. For example, consider the obvious and popular option of selecting a characterising counterfactual which is explicitly restricted to component forces:

- (4) If e has N and e had been placed sufficiently near to an e' such that Ne' , e would exert a repulsive force on e' .

This counterfactual respects the intrinsicness thesis, and may well characterise the causal role of negative charge in some sense. But it does not characterise the causal role of negative charge in the robust sense that the causal structuralist requires. For the mere fact that N makes this kind of causal contribution to the situations in which it is instantiated entails nothing that is not itself hedged or conditional about how the objects which possess it will behave in that situation; for all that (4) tells us, negatively charged particles might move towards or away from other negative charges. As such, an object with N might behave in any way whatever if the circumstances are appropriate. Very little can usefully be said about how negatively charged objects will behave simply in virtue of their having N , and arguably the circumstances will make just as important a contribution to the overall behaviour of the object in question as its intrinsic nature, which circumscribes precisely how the circumstances will cause the object to behave.⁶

One might reply that there is no reason to suppose, as I have, that characterising conditionals like (4) need tell us much about how the objects with the dispositions will in fact behave. But this reply concedes too much. For consider (3) again: whether this is true, or false, seems to depend on how in fact e behaves under counterfactual circumstances. If the dispositional actualist cannot say much about this behaviour in virtue of the dispositions that e has, then surely there are counterfactuals, like (3) itself, that the dispositional actualist cannot give an account of. This is one reason why I devoted so much time to (3), which strikes many as an improper rendering of the characterising conditional for N : Even if the dispositionalist rejects the use of conditionals like (3) to characterise the natural properties, she still encounters a problem in providing the truth conditions for conditionals like (4). And it is supposed to be one of the hallmarks of dispositional essentialism that it can provide a superior account of the truth conditions of counterfactuals of all stripes.

For similar reasons, there is no hope of using (4) to ground other alethic modalities. It may be necessarily true but it does not tell us what will necessarily happen consequent upon the exertion of the forces mentioned in (4), which is surely what would be required to ground natural necessity in actual dispositions. This undermines a thesis that many causal structuralists subscribe to: that the laws of nature are necessary

⁶Similar arguments, though used for a different end, can be found in Cartwright, this volume: §7, who argues that nothing in the specification of a causal law, and the capacities that law is linked to, entails that the occurrent behaviour will be in accordance with that capacity.

(Bird, 2005: 442ff). If at least some laws are about observable behaviour of negatively charged particles, then those laws may be violated even if negative charge necessarily always makes the same contribution, for the simple reason that nothing intrinsically about those negatively charged particles ensures that their contribution will result in similar consequences. Even if a law of nature did turn out to hold of necessity, the causal structuralist would have no resources to explain this! For an additional fact, that the power in question was *unable to be interfered with*, is needed to bridge the gap between the actual contribution of the property and the necessity of the manifestation of that property, and that extra fact is not intrinsic to the bearer of the property. And it is no use to abandon the claim that at least some laws concern observable behaviour, for then it looks like the laws are insufficient to describe or predict observable behaviour, which seems to make them substantially incomplete.⁷

This is all even more obvious when we consider the connections between necessity and counterfactual conditionals. As Williamson (2007: §3) has recently argued, the following claim holds on any plausible account of counterfactuals and necessity (where ‘ \perp ’ stands for an arbitrary contradiction):

$$(5) \quad \Box A \equiv (\neg A \Box \rightarrow \perp).$$

If the laws of nature were necessary, it follows by Williamson’s argument that, for the conjunction of all laws of nature \mathcal{L} , $\neg \mathcal{L} \Box \rightarrow \perp$. If \mathcal{L} didn’t describe what would observably happen in worlds in which it obtains, it is difficult to see how this would follow, as the lawhood of \mathcal{L} would in that case be compatible both with things happening as \mathcal{L} says, and as it does not. So laws must describe what happens in worlds in which they obtain. So either of two things hold: (a), (4) isn’t a law (if the forces mentioned are supposed to manifest in appropriate motion), and the best candidate for a law is (3), but, as we have seen, the causal structuralist who subscribes to dispositional actualism cannot account for the truth conditions of (3). Or, (b), (4) is a law, but it must be supplemented by another law that describes how forces manifest in observable behaviour; and this second law will be false (and so not necessary) without an additional non-necessary extrinsic claim that there are no interferers. Either way, there is a claim supposed to be a law that is not necessary. So it does not follow from the dispositional essentialist position that the laws of nature are necessary.

Either way, whether the causal structuralist adopts (3) or (4) as the paradigm characteristic counterfactual for negative charge, they will have difficulty grounding robust modal truths in the intrinsic nature of powers alone. This was to be expected: a shifty modal claim like a counterfactual just doesn’t seem to be the right kind of thing to

⁷Of course it may be that what happens depends on the totality of facts about forces, including all instances of (4), and many other claims. But this serves to make the same point again: for what ensures that any given set of such facts is the *totality* of all such facts cannot be a fact about any particular individual force-exerter, but must be a global fact—just like the fact about the lack of interferers in a particular case. The view that these global facts are all there are is discussed in section 4.

ground a non-shifty alethic necessity, unless one simply identifies the counterfactual with a strict conditional and does gross injustice to our intuitions about counterfactuals. The combination of causal structuralism and dispositional actualism is, in a certain sense, *self-undermining*. The causal structuralist needs certain counterfactuals to characterise the causal profile of a given property. What the preceding arguments have shown is that causal structuralists may adopt the dispositional actualist account of natural necessity if and only if they abandon the attempt to give appropriate truth conditions for these characteristic counterfactuals. Dispositional actualism undermines causal structuralism.

3 Hedged Conditionals

Before abandoning the package of causal structuralism and dispositional actualism, recall that most causal structuralists aren't particularly happy with using conditionals to characterise the causal role of a property in any case. So when they talk of an 'essential' connection between a property and a role, it may be that they don't intend that role to be characterised by a counterfactual conditional. The most common suggestion is that the role should be characterised by a *hedged* conditional. So Bird suggests (almost in passing) that the link is between properties and *ceteris paribus* conditionals (Bird, 2005: 443), while Mumford (1998: §4.9) argues that the appropriate way to characterise dispositions uses 'conditional conditionals', where the antecedent is a specification of ideal conditions and the consequent is the stimulus-manifestation counterfactual. I have no problem with hedged conditionals, in themselves. But I'm far from convinced that the causal structuralist who also accepts dispositional actualism has the resources to give an account of these hedged conditionals.

Let a hedged counterfactual be analysed as a regular counterfactual in the scope of a hedging operator. Taking Bird's proposal as our starting point, let the basic hedging operator be the *ceteris paribus* operator, '*CP*'.⁸ In this framework the causal structuralists' 'essential connection' between a property and a stimulus-manifestation conditional $S \square \rightarrow M$ turns out to be a necessary connection between a property and the hedged claim $CP(S \square \rightarrow M)$. The claim is supposed to be necessary, in that every situation in which the counterfactual $S \square \rightarrow M$ is false will be one in which, though the property is present, the surrounding circumstances aren't appropriate for it to manifest properly. Returning to our example, negative charge will be necessarily linked with the claim that 'other things being equal, negative charges will move away from each other if placed in close enough proximity'. This hedged claim will not be false in the situations I described above, for those cases in which there is a distorting charge in the

⁸Mumford's conditional conditional approach can be implemented in this framework: simply let ' $CP(x)$ ' be true if and only if 'ideal conditions $\square \rightarrow x$ ' is true. I don't much like his proposal, because the supposition that ideal conditions obtain will typically require consideration of very distant possibilities that evaluating a regular *CP* claim seems not to involve.

vicinity are not cases in which other things are equal. This, at least, is the intuition the causal structuralist relies on.

The most pressing worry about hedged conditionals is that they might turn out to be circular and hence trivial. That is, the best analysis we might be able to give of the semantics of the *CP* operator might require a *ceteris paribus* operator. At worst, the everyday truth conditions of ‘*ceteris paribus*, negative charges repel’ might turn out to be just those for ‘Negative charges repel, as long as there are no distorting factors’. This latter sentence entails nothing independently about what constitutes a distorting factor, rendering the analysis of such factors in terms of *ceteris paribus* clauses circular—distorting factors are a mere shorthand for circumstances not being equal.

One proposal which seems clearly threatened by the trivial circularity objection is Mumford’s ‘ideal conditions’ analysis. Mumford argues that we have an independent grasp on what it means for conditions to be ideal for a given property, so whether we need to mention ‘distorting factors’ in the semantic analysis of *ceteris paribus* clauses is neither here nor there. The problem is that intuitively, ideal conditions are those in which possible distorting influences are not present. As such, truth conditions for a *ceteris paribus* clause involves specifying which factors need to be absent to make for ideal conditions. As Fara (2005: 52–3) argues, genuinely *ideal* conditions are those in which nothing interferes in any way with the manifestation under the stimulus conditions—just those, of course, in which the stimulus-manifestation conditional for the property in question are satisfied. Once again, the conditions under which a property is successfully linked with a conditional seem to boil down to simply the conditions under which the conditional is true. Similar triviality worries occur with weakened (or ‘fainthearted’) conditionals (Morreau, 1997), or appeals to implicit context, or appeals to implicature—all appear to come down to a certain proviso, *viz* that normal conditions obtain, but without any independently plausible account of what such normal conditions amount to that is both contentful and non-circular (Fara, 2005: 53–61).

What we need instead, if we are not to allow the causal structuralist special pleading in this case, is an analysis of the *CP* operator that is non-circular, and that uses only the resources that dispositional actualism makes available. In particular, the analysis should eschew the use of ideal conditions that can only be accounted for in terms of *CP* clauses. If ideal conditions are to be mentioned, they should be cashed out independently of the given property in question so that the analysis has a non-circular content.

The analysis should also eschew the use of possible worlds as an independent notion, and make do with the primitive causal powers that the dispositional actualist regards as the true basis for understanding and analysing modal claims. This rules out a naive (and antecedently implausible) account of $CP(p)$ in terms of the *majority* of possible situations being such that p obtains. But it also rules out a rather more attractive position on *ceteris paribus* conditionals. This is the view that counterfactuals

are *already* implicitly *ceteris paribus* conditionals. The *CP* operator, at least when it operates on a Lewis-style counterfactual, is a null operator. The plausibility of this view rests on the idea that the correct way to understand *ceteris paribus* is as a kind of similarity: *p* holds, *ceteris paribus*, if *p* holds actually and in all similar possible worlds. In that case, a *ceteris paribus* conditional is true iff the material conditional has no counterexamples either actually or in nearby possible worlds; that is, if the counterfactual is true.⁹ This view is fairly plausible in some respects, as the counterfactual does give a good analysis of the de facto dependence of consequent upon antecedent that nevertheless can be disrupted in peculiar situations. It has the apparently unfortunate feature that nothing that actually occurs can ever violate a true *ceteris paribus* claim (unless there can be some fact true of the actual world but true at none of the most similar worlds, which would be odd). But its primary defect is that it relies on a Humean analysis of modality in terms of possible worlds, and this is not compatible with dispositional actualism. Even if the dispositional actualist can give an account of ‘possible worlds’ talk, the story would succumb to the circularity worry, as the analysis of *CP* in terms of possible worlds would be required to give the analysis of modality in terms of dispositions and their characterising counterfactuals. A precisely similar worry would undermine any attempt by the causal structuralist dispositional actualist to adopt the account of *CP* claims in Lange (2002). Lange claims that *CP* claims are connected with ‘reliable’ counterfactuals, but the account needs an independent theory of counterfactuals, one that cannot be given by the dispositional actualist.

So far, I’ve argued that several ways of understanding *CP* claims are unavailable to the causal structuralist who accepts dispositional actualism. These proposals have been of varying degrees of plausibility as analyses; importantly, none of my arguments have expressed any kind of general scepticism about the existence or content of *CP* claims—in contrast to the negative view of *CP* claims urged by Woodward (2002). In fact, I’m cautiously optimistic that an account of *CP* claims can be given in terms of *generic* sentences, to which I now turn. But, once again, I’ll argue that this proposal is unavailable to the dispositional actualist. The upshot is that no non-trivial account can be given of the hedged conditionals that the causal structuralist requires.

3.1 Habituals and Generics

A generic claim is a kind of generalisation that is true in virtue of what typically or normally happens to the *kinds* of objects the claim is about, rather than what exceptionlessly happens to those kinds of objects. For example, if some deformed tigers are born with only three legs, then the universally quantified claim ‘all tigers have four legs’ is false. Nevertheless, the generic generalisation ‘tigers have four legs’ can still

⁹There is, I suppose, a variant which maintains that a *CP* counterfactual is true if the counterfactual is true actually and in nearby worlds; I neglect this view in what follows.

be true, since it is normal for a tiger to have four legs, and three-legged tigers are abnormal.

Because generics are tolerant of exceptions in this way, they hold some promise in giving an account of *ceteris paribus* claims. Recently, this line of approach has been followed by Nickel (2005). Nickel's account is aimed at understanding *ceteris paribus* laws, but we may be able to apply it to the conditionals that are our main topic. His proposal amounts to the claim that ' $CP(\forall x(Ax \rightarrow Cx))$ ' is true in w iff 'every x that is produced by a process characteristic for As in w is a C ' (Nickel, 2005: 13). (Of course the causal structuralist thinks that the characteristic processes are necessary, to ensure essentiality of causal role.) For counterfactual conditionals, this straightforward extension should suffice: ' $CP(\forall x(Ax \square\rightarrow Cx))$ ' is true in w iff in all the most similar worlds to w , every x produced by a process characteristic for As in those worlds is a C , so that ' $CP(\forall x(Ax \rightarrow Cx))$ ' is true at all the most similar worlds to w . If we analyse the CP counterfactuals in this way, it seems, we can associate with each property a generic claim about its characteristic behaviour.

Crucial to the viability of this proposal is the idea of a characteristic process for As in w . There are two ways to understand this notion, and both of them lead to trouble. Firstly we could understand 'characteristic' intrinsically, meaning common or alike to the majority of cases. Yet for a common process to result in the right outcome requires that the process not be interfered with, which throws us right back into the problem we examined in section 2 of having a property instantiated but the characteristic process failing to occur for extrinsic reasons.

The more interesting way to understand 'characteristic' is as including some extrinsic features as well, so that it will be built into the definition of a characteristic process that it results in the right outcome. We can, and do, often understand characteristic in this way: think of the characteristic process of development of a human child, where we have little difficulty in agreeing that it is characteristic of that process to result in individuals with ten fingers, even though development can be disrupted in ever so many ways to prevent that outcome. But once again circularity is a significant threat, as there seems little prospect of analysing 'characteristic' without involving an open-ended unspecified prohibition on possible interferers. Moreover, while this proposal might help with abnormal origins of some A failing to make it a C , it has no grip on the original problem. For we can certainly imagine an electron produced in the most characteristic manner but that nevertheless fails to move away from another paradigm electron, for reasons having nothing to do with the characteristic process that produces them.

The basic problem with the foregoing proposal is that the kind of exception of which generics are tolerant seems to involve uncharacteristic members of a kind. But the interferers/masks objection involves counterdispositional behaviour of a single individual in some circumstances, though it may be perfectly characteristic in other ways. Let us use the term 'habitual' to denote a sentence that, like a generic, is tol-

erant of exceptions, but unlike a generic sentence doesn't concern consistent behavior within a kind, but rather concerns consistent behaviour in an individual over time. The canonical form of a habitual sentence is something like: '⟨Object⟩ ⟨Verb⟩s when ⟨Circumstances⟩', as in

- (6) a. Jack drinks when he's stressed.
- b. Glass breaks when it's struck firmly.

The semantics for such habitual claims is somewhat involved (Krifka *et al.*, 1995), but that needn't detain us, as it is quite apparent that we do understand sentences like (6a) and (6b) regardless of what the correct semantic story turns out to be.

What is attractive, from our perspective, is that these sentences correspond nicely to dispositions—in the case of (6b), the disposition of fragility—while they also admit of non-falsifying exceptions. In fact Fara (2005) has recently made a strong case that the best way to characterise a disposition is via a habitual sentence. Perhaps some of the problems we're run into can be sidestepped by analysing the characterising causal role of a property directly in terms of habituals (rather than link properties to regular conditionals and then analyse the *CP* operator). For instance, we could propose that *x* has the disposition characterised by ' $A \square \rightarrow C$ ' iff *C* habitually happens to *x* when *A* happens to *x*. Better still, we could simply propose that a property is necessarily linked, not to a conditional, but to a habitual claim. This proposal looks promising already: habituals do resemble conditionals in some respects,¹⁰ and this may account for why it has been thought that conditional analyses of causal roles are appropriate. So while it must be admitted that this proposal does away with the letter of causal structuralism because it abandons the essential link to conditionals, it may yet suffice to give a good account of what a causal role is.

Yet while habitual sentences make for a very promising analysis of disposition ascriptions, they serve the dispositional actualist's purposes very poorly. And both of these facts can be traced to the exception-tolerance of habituals. Dispositions can exist despite occasionally being interfered with, so exception tolerance is necessary for a correct characterisation of when a disposition exists. But if our aim is to characterise all natural necessity in terms of dispositions, as the dispositional actualist intends, exception tolerance is a bad feature. For one of the characteristics of genuine necessity is that it is truly exceptionless. To fix ideas, consider the following naive characterisation of necessity in habitual terms:

- (7) 'Necessarily *Fx*' is true iff *x* *F*s under any circumstances.

¹⁰In this connection the popular thesis that habituals involve an implicit generic adverb of quantification **GEN** is particularly noteworthy (Heim, 1982). This proposal connects with the thesis that some apparently conditional claims involving an 'if' clause do not feature a conditional connective, but rather merely serve to highlight the restrictor Lewis (1975). (Kratzer (1986) goes further, and argues that no conditional features a conditional connective.) If this is right, and the evidence for it is persuasive, the mistake of regarding dispositions as linked to conditionals instead of habituals is readily explicable.

If this is a genuine habitual, we should expect x to habitually satisfy F —but also if on occasion x failed to F , that needn't falsify the habitual. But of course if, on at least one occasion, x fails to F , then we know that it is not necessary that Fx . Because any necessity operator \Box exhibits the characteristic feature that $\Box p \vDash p$, if ever it occurs that $\neg p$ we can conclude $\neg \Box p$. Moreover, there seems no way of modifying the simple account of (7) to secure genuine exceptionlessness—no matter what conditions one inserts, it is always possible that a genuine habitual could be true even if the object fails to manifest in those conditions. Things are not better with 'possibly', as the obvious analysis is such that 'possibly Fx ' holds iff it is not the case that x fails to F under all circumstances. So 'possibly Fx ' is false iff the right hand side of this biconditional is false; iff the habitual sentence is true; and the habitual sentence can be true even if x does sometimes satisfy F . But we then get the implausible result that even if x does F sometimes, it can still be impossible that Fx !

It may be that some uses of 'necessary' share this exception tolerance with habitual claims. After all, consider the following use of 'always', which is a temporal analogue of an alethic necessity:

(8) Jack is so unhealthy; he's always smoking.

(8) can be true even if Jack sometimes doesn't smoke. But even if there are uses of 'always' that basically express habituals, that doesn't mean that every use of 'always' does, so an across the board habitual-based account of 'always' must fail. The same is true of 'necessary', with the additional feature that cases like (8) involving 'necessary' are much harder to generate. Consider:

(9) To obtain a grant it is necessary to complete an application form.

It is perhaps possible to read (9) as being compatible with someone getting a grant without applying. But it is much more plausible to regard (9) as straightforwardly incompatible with the possibility of a grant without application.

So while generics and habituals might provide a good account of CP and causal roles, they do not do so in a way that is suitable for the needs of the dispositional actualist. I conclude that some other approach is necessary for the causal structuralist and dispositional actualist to avoid the problem of interferers in an acceptable manner.

3.2 Primitivism

Some causal structuralists who are tempted by dispositional actualism recognise the problems I've raised. Here, for instance, is Brian Ellis acknowledging that properties are susceptible to interference and masking:

[W]hat dispositional properties do is dispose the things that have them to behave in certain ways, depending on the context. (Ellis, 2001: 129)

No guidance is given about how we might separate what is contributed by context from what is contributed by the disposition, and one might well think that if the resulting behaviour depends on context that will make the link between property and behaviour contingent, precisely what the causal structuralist objects to in the Humean picture. (And while the Humean says explicitly that the relevant contextual factors under which a property leads to a behaviour are the laws of nature, Ellis says nothing much about his ‘contexts’.)

Elsewhere, however, Ellis is a bit more explicit about the kinds of impact that context can have:

[T]hings may not interact as they are intrinsically disposed to interact. For other forces may come into play. But then the laws of nature we call “causal laws” allow for this. The causal laws are not contingent universal generalisations about how things actually behave, but necessary truths about how they are intrinsically disposed to behave. (Ellis, 2001: 239)

The new concept introduced here is of being ‘intrinsically disposed’ to behave in a certain way. Of course, as Ellis recognises, this is not the same as being disposed simpliciter, because the latter kind of disposition would necessitate a conditional that could be interfered with. Ellis therefore is proposing instead that a property is to be necessarily linked with a description of its intrinsic disposition, so that a property P is characterised by a new kind of hedged conditional—a conditional prefixed with ‘intrinsically’, so that anything instantiating P is such that intrinsically ($S \Box \rightarrow M$), even if it is not the case that $S \rightarrow M$.

This proposal is somewhat obscure, to say the least. Ellis (2001: 28) does give an account of intrinsicness in his causal sense: G is a causally intrinsic property of x iff x would display G iff there were no external influences affecting the display of x ’s properties. I suspect that this merely describes the problem of interfering conditions, rather than answering it. The proposal also seems susceptible to counterexample: the property ‘ x is not under external influences that affect the display of x ’s properties’ seems to turn out causally intrinsic but is, extremely plausibly, extrinsic.¹¹ Even if the proposal was explanatory, and survived the counterexamples, the definition tells us only when a property is intrinsic. There seems no straightforward way to derive from this the semantics of the one-place sentential operator ‘intrinsically’ that Ellis seems to be appealing to in the above quotation.

A charitable reading of this passage takes Ellis to be advocating a kind of primitivism. This is the doctrine that the connection between a property and its characterising conditional is not to be analysed or understood in terms of other, more primitive notions. The main problem facing this interpretation of Ellis’ proposal is that we have no independent understanding of how his new ‘intrinsically’ operator works. Normally,

¹¹I believe this counterexample is due to Josh Parsons.

‘intrinsically p ’ is factive, and simply states that the basis for the truth of p is intrinsic to some object. But Ellis’ operator is not factive, as the characterising conditional in the scope of ‘intrinsically’ can be false even while, presumably, the whole claim is true. It is thus difficult to see how any evidence we might have for the falsity of the conditional could ever lead to the falsity of the ‘intrinsically disposed’ ascription, and this seems rather to undermine Ellis’ claim that the discovery of the essentially dispositional properties of natural kinds is the main task of science. Until we have more details on what Ellis’ proposal involves, it is impossible to accept it.

A more plausible kind of primitivism is to be a primitivist about *ceteris paribus* claims. At least in this case one can claim that the various difficulties that people have faced in giving accounts of the *CP* operator do motivate taking it as a new primitive, completely independently of dispositional actualism. Yet even setting aside the methodological unpleasantness of simply taking the *CP* operator as a new primitive, this move will not help. Primitivists will maintain that, even despite the impossibility of an analysis, there will be some way to understand the behaviour and function of *CP* operator. Presumably this understanding will be provided by our ordinary familiarity with the idea of ‘other things being equal’. This causes problems for the combination of causal structuralism and dispositional actualism, because as a thesis primarily about perfectly natural properties, most of the properties it is centrally concerned with are not going to be manifested in isolation from other properties. In that case, it seems intuitively plausible that other things are *never* equal: there are always actually interfering factors. If other things are never equal, the *CP* operator seems, intuitively, to give trivial results in this case: $CP(p)$ is true for any claim p involving perfectly natural properties (even if *CP* is not trivial for claims about higher-level phenomenological properties). If the intuitive understanding of *CP* renders any property-specifying conditional trivially true, we can reasonably claim that no genuine property specification has been given. If the causal structuralist wishes to retain a contentful version of their conditional thesis, they should wish for an understanding of *CP* which does not give this trivial result. As such primitivism is not an option, and we must see whether the causal structuralist can provide a non-trivial analysis of the *CP* operator.

This is practically important for the causal structuralist too. Many causal structuralists regard their position on property identities as the only scientifically respectable one: any other view, involving mysterious quiddities, seems to have little empirical support. But unless the concept of *ceteris paribus* conditions can be spelled out in an independent fashion, there will be little empirical content to causal structuralism either. For suppose we witness a manifestation M in circumstances S ; do we conclude that a property P is present which has the characteristic conditional $S \square \rightarrow M$? We should not, unless we are antecedently convinced that conditions are ideal and thus that it is really S that M depends on (rather than S plus some interfering background conditions). So there seems no way to fix the identity conditions for properties without a way of char-

acterising *CP* conditions. And, as we have seen, there is no currently plausible theory of *CP* claims that is acceptable to the causal structuralist who accepts dispositional actualism.

4 Everything is Connected?

The problem of interferers (or masks) arises because the intrinsic nature of some object places no constraints on its surroundings, and thus the manifestation of the characteristic behaviour of that object can be prevented in many cases. We saw in the previous section that there is no acceptable way for the dispositional actualist to rule out all and only these interference situations. But some dispositional essentialists have countenanced a more radical response: denying that there is a distinction between an object and its surroundings. This amounts to abandoning the thesis of object separability discussed above (section 1.1).

Ellis, for one, gives hints that he accepts something like this claim. At one point he makes the offhand remark that the Humean picture of the world as a collection of loose and separate entities is in conflict with quantum mechanics, and that the correct picture of our world should be more ‘holistic’ (Ellis, 2001: 52). (Perhaps the source of this view lies in Popper’s (1990) view that the only non-arbitrary ground of probabilities in quantum mechanics lies in a propensity of the whole world to produce a certain outcome.) Whatever its provenance, the view is highly controversial as an interpretation of quantum mechanics, and for that reason alone doesn’t provide strong support for the denial of object separability.

Regardless of its scientific merits, this view is radically revisionary of our ordinary practices in using counterfactuals—so revisionary as to be unacceptable. What we attempt to capture using counterfactuals is a kind of robust dependence between the antecedent and consequent: a dependence that persists through external disruptions. If there are no external disruptions, because all properties are global properties of the whole world, then it is hard to see how our practices in using counterfactuals can even make sense. Moreover, as our discussion of habituals shows, we can make sense of ascribing regular habits to localised individual objects; the response to the existence of localised claims is not to deny that they make sense, but to deny the overly holistic approach advocated (albeit in passing) by Ellis.

5 Conclusion

So far, I’ve argued that the combination of causal structuralism and dispositional actualism is subject to the problem of interferers: that the characterising conditionals for properties aren’t going to hold whenever the property is instantiated. I argued in the previous section that the most plausible strategies for hedging these characterising

conditionals are unavailable to the dispositional actualist. In the absence of plausible alternatives, I conclude that one of the three claims (p. 9) that characterise causal structuralism and dispositional actualism has to be given up. But which?

The discussion of habitual claims, I suggest, shows that it can make sense to ascribe habits to individual objects in relative isolation from their environments. If habituals can be used to analyse dispositions, then I think causal structuralism is a viable option: perfectly natural properties are to be individuated by the habits they convey to intrinsic duplicates which possess them.

The culprit, rather, is dispositional actualism: the claim that necessity and possibility are grounded in perfectly natural dispositional properties. It was dispositional actualism that gave rise to most of the trouble in section 3, and by abandoning it, and keeping a more Humean understanding of modality, the causal structuralist has the resources to give a plausible account of property identity.

Few causal structuralists will be happy with this option, I suspect. I don't think this is because causal structuralism is itself in tension with a Humean picture of modality. Rather, I think many actual adherents of causal structuralism (including dispositional essentialists like Bird and Ellis, and powers-theorists like Molnar and Mumford), are in the grip of a non-Humean picture of the world, one consequence of which is causal structuralism. For many dispositional essentialists, the Humean picture is of a 'dead' world, moved from without by laws of nature. By contrast they wish to maintain that powers within objects animate the world and explain why things happen as they do; causal structuralism follows as the most natural way to individuate these animating powers. On reflection this seems to take a very robust view of properties as *things*, acting and causing observed behaviours. Such a robust view seems to inherit many of the objectionable features of quidditism, particularly the idea that properties somehow are something over and above the behaviour of the objects which have them.

By contrast, a more minimal causal structuralism does away with a robust commitment to properties as things, perhaps proposing rather that having a property is just satisfying a habitual sentence.¹² None of the more radical anti-Humean aspects of dispositional essentialism seem to follow from this view alone. There is no commitment to properties as entities. There needn't be commitment to the necessity of the laws of nature: while salt might habitually dissolve in water, they may be exceptional cases. And the recognition of the possibility of exceptional cases shows that there mustn't be a repudiation of possible worlds, whether concrete or ersatz, as we shall need some such possible situation to be one in which there is an exception to the habitual claim. It follows, I suggest, that arguments for dispositional essentialism

¹²A similar, overtly nominalist option is explored by Ann Whittle (this volume); many aspects of her position are reflected in my discussion above, particularly the observation that a causal structuralist can tread a middle way between realism and phenomenalism. However, she appears more resistant to the independent appeal to facts about possible situations that I think is the fundamental upshot of this discussion.

that appeal to causal structuralism beg the question—they only appear to lead to the controversial dispositional essentialist view because some aspects of the latter view are implicitly presupposed when characterising causal structuralism.

In this paper I've been concerned to articulate what causal structuralism by itself is committed to. I've argued that the problem of interferers (or masks) means that causal structuralists cannot explain counterfactuals purely in terms of dispositions; and no weaker hedged conditional can fulfill the dual role of characterising properties and explaining alethic modalities. So I conclude that there is excellent reason even for a causal structuralist not to attempt a reductive account of modality in terms of dispositions. It follows that the dispositional essentialists and powers-theorists were too quick to repudiate a Humean conception of modality, as no acceptable alternative conception is available to them. In that case, many of the supposed ontological economies of powers and dispositional essentialism disappear, and many of the arguments from causal structuralism to dispositional essentialism fail. The question then becomes: what arguments can these philosophers give for their position if causal structuralism doesn't entail it? My suspicion is that no such arguments exist; but I don't have space to defend that here.¹³

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