

Causal Dispositionalism

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Causation for Dispositionalists

There are various ways that a dispositionalist could go when constructing a theory of causation based on an ontology of real dispositions or what some prefer to call powers. In this paper, we will try to spell out what we take to be the most promising version of causal dispositionalism. The broad aim is to get causes from powers. Many people share this aim and, as Molnar has already said, one of the reasons to accept an ontology of powers is the work powers can do in explaining a host of other problems, causation being among them (Molnar 2003: 186). The delivery of a plausible powers-based theory of causation is, however, overdue. So far we have only hints and false starts.¹ None of these accounts have gone quite in the right direction, in our view, so our ambition here is to set out the first few steps.

Let us begin by assuming the reality of dispositions or powers. There is much debate on the general issue of dispositions² but if we are to make any progress on the issue of causation, we had better leave the former debate alone. We are taking it for granted that in the world there are powers that naturally dispose towards certain outcomes or manifestations. These powers exist in objects and substances and are as real and objective as any other of those things' qualities, such as their height, shape or mass. Although such powers can issue in manifestations, they nevertheless can exist without them and may never manifest at all. Importantly, we reject the proposal that disposition ascriptions can truly be reducible to conditional statements. If that were true, there would be no need to be realist about dispositions at all. If the conditionals used only occurrent or categorical terms then dispositions would be reducible. We think, however, there is a general and systematic reason why the conditional analysis of dispositions could never work, and we will mention this shortly. This would explain why counterexamples to all the proposed conditional analyses have not been hard to come by.

So far, this has all been mandatory in order to get started and enough might already have been said to show that there ought to be some connection between real dispositions and causation. We have stated that powers can issue in certain outcomes and this of course resembles the notion of cause and effect with which we all grapple. There is still plenty of work for us to do, however, in explaining how we get causes from powers.

Before getting on to that detail, however, there is one non-mandatory step that we should signal we are taking. There is more than one general ontology that admits the reality of dispositions. Categoricalism doesn't, but both property dualism and pandispositionalism do. In property dualism, some properties are essentially dispositional but some are not. Our own sympathies are with pandispositionalism. We will be offering a view of causation based on all properties being powerful. Having some properties that are not, or at least are not essentially so, rather complicates the matter. Something would have to be said about these other, essentially powerless, properties and how they deserve their place in our ontology. We would also have to explain how the powerful and non-powerful properties related or interacted, if at all, which also seems no easy task.

¹ Harré and Madden 1975, Bhaskar 1975, Cartwright 1989, Molnar 2003: ch. 12, Martin 2008: ch. 5.

² Armstrong, Martin and Place 1996, Mumford 1998, Ellis 2001, Molnar 2003, Bird 2007.

Instead, we go with the view that all properties are powerful and thus with pandispositionalism (see Mumford 2008).

Assuming pandispositionalism, every power's manifestation is also a power for some further manifestation. Armstrong (2005: 314) sees that this could make of causation the mere passing around of powers. He thinks that is a bad thing, while we think it gives a very good image of causation (Mumford 2009). To take Hume's billiard table, which he claims provides causation's 'perfect instance' (1740: 137), the various balls crashing into each other are thereby passing on power. The first ball rolls across the table, its momentum being a power to move. When it strikes the object ball, it passes on that power. Momentum transfers from cue ball to object ball. And now that the object ball has that momentum, it too can pass it on to any other ball with which it collides. It need not always be the same power that is passed on, however. Causation often involves change but the change need not just be in the cause passing on the same property to its effect, as in the momentum of the billiard balls. Dropping a fragile vase on to a hard surface results in it breaking, which is as good a case of causation as any. But the vase has powers when broken that it did not have before: its pieces can now cut. And its power to hold water is lost when it becomes broken. Powers are passed on to the manifestation, but different powers from our original disposition.

There is a further question that needs to be addressed of the relation between singular and general causal truths. What is the dispositionalist's account of this? For general causal truths, we interpret them as one type disposing towards another type, for instance, such as that smoking causes cancer. It is important to read this dispositionally. Smoking only disposes towards getting cancer. We all know that some who smoke do not get cancer but the general causal claim can remain both useful and true if we read it dispositionally. If general causal truths were interpreted as universally quantified conditionals, then it would have to come out as false that smoking causes cancer since not everyone who smokes develops cancer. But if our general causal claims were restricted only to exceptionless regularities, then we would miss most, if not all, of the general causal facts. The dispositionalist solution is to say that there is an irreducibly dispositional connection involved between smoking and cancer. The connection is less than necessary, because clearly there are some smokers who do not get cancer. But the connection is more than purely contingent. It is no mere coincidence that many who smoke do get cancer. Typically, the chance of some cancers will be far greater for smokers than non-smokers. The dispositions of things would be the chance-raisers: the worldly truthmakers of the chancy truths.

For singular causal truths, we say that they concern one particular disposing towards another, such as the striking of this match disposing towards it lighting. Most typically, though not necessarily always, singular causal claims often contain a success element. If I say (past tense) that my uncle's smoking caused his cancer, I am saying not just that his smoking disposed towards cancer but that it also 'succeeded' in manifesting its disposition. Saying that token *a* caused token *b* entails not just the more-than-contingent less-than-necessary dispositional connection between *a* and *b*, but also that *b* occurred and that *b* was the manifestation of *a*'s disposition. We can say the same about most future and present tense singular causal claims. In contrast, general causal claims do not entail the further commitments but only that there is a dispositional connection between types A and B. There may well be some tokens of those types that do not manifest their disposition and it is even a possibility, if a remote one, that none of the tokens do.

Returning to the three elements of the typical singular causal truth, we can see that all are required. Only the third element might be challenged, as it could be ventured that the causal claim only amounts to *a* disposing towards *b* and *b* indeed occurring. But this is inadequate for dispositionalism. There might have been some other disposition *c* that also disposed towards *b* and it, rather than *a*, might have manifested *b*. Where we say that *a* caused *b*, we must mean that *a* specifically did at least some of the causing of *b*. Perhaps some events are uncaused altogether, so a true causal claim must be about more than just something being disposed towards and occurring. A causal claim is one of responsibility.

Contrasts

The powers ontology has its roots in Aristotelianism in which nature is active. The chief contrast is with Humean views of the world as a succession of events or facts in which we see patterns and project our future expectations on to the world. Setting aside Hume himself, the main contemporary advocate of this view is Lewis, who developed the influential view that causation consists in (the ancestral of) a counterfactual dependence between events (Lewis 1973). Offering an account of counterfactuals within an essentially Humean, extensionalist framework is one of his great achievements (1973a), though few find it easy to believe that there really is a plurality of other concrete worlds, more or less like ours.

The first major contrast between our account and a Humean and Lewisian one is that they offer a reductive analysis of causation, which we do not attempt. The notion of causation, in their view, can be cashed out in non-causal terms. For Hume, causation is understood just as a constant conjunction of event types, in which each cause is also spatially contiguous and temporally prior to its effect. For Lewis, causation is understood as a counterfactual dependence between events, where that amounts merely to the fact(s) that the cause and effect both occur: but in all the closest possible worlds in which the cause does not occur, the effect does not occur either. We have doubts that these, or any other reductive analysis, will be a success. Both are vulnerable to counterexamples: constant conjunctions without causation, causation without constant conjunctions, counterfactual dependences between events without causation and causation without counterfactual dependence. We will not go into the details of these counterexamples at this point, though some will be discussed later that relate to Lewis's account.

Not every concept permits analysis into others. Some concepts may be learnt directly from experience. This does not have to mean that the concept of causation is entirely simple. We think it has two parts, as we will explain shortly, but each part has to be experienced. Causation is one of our first experiences, both as a patient and agent, and it is one of our most basic, fundamental and important. Through our bodies, we act and are acted upon and have an understanding of this as soon as we have an understanding.

According to causal dispositionalism, causation involves an irreducible dispositional modality.³ It is about one thing tending towards another, rather than necessitating it or the two being contingent accidents. If this is right, then we can never say that if some condition *C* occurs, no matter how large or complex *C* is, then an effect *E* will occur. We can only say that it is disposed to happen, will tend to do so, or that it is more or less likely to happen. These are ways of gesturing towards the dispositional modality but they cannot analyse it. They offer synonyms for it, and thus cannot be used in a reductive analysis. But the alternative is that non-dispositional terms would be used that failed to capture accurately the full notion of dispositionality. The putative conditional analysis of dispositions is one that fails for this reason. Something disposing towards something else can never be captured by an analysis of the form *if S, in conditions C, then M*. Even if a disposition is stimulated, and in the right sort of conditions to manifest, it still only tends or disposes towards its manifestation. It doesn't guarantee it. This is why we have a rich, specifically dispositional vocabulary available to us. We cannot replace it, without loss, by the idea of a conditional where, if the antecedent is true, and any associated conditions, the consequent *must* also be true. That has some resemblance to dispositionality, but is not close enough. We only want that if the antecedent is true, the consequent tends to be true, and this only restates dispositionality rather than analyses it.

³ For more on the dispositional modality, see Anjum and Mumford 2010a.

How, then can the idea of a dispositional modality be acquired through experience? There must be two such kinds of experience, in our view. In the case where we are causal patients, we must first experience some power acting on our bodies, such as when we walk in a gale which could blow us over. But, second, we feel that we are able to resist it. The gale is for some manifestation, but it can be prevented. Where we are causal agents, it is us trying to manifest a power, such as the power to pull something. But, again, we sometimes feel that it can be resisted, such as when something else pulls in the opposite direction. These two components give us the idea of a power being for some specific manifestation to which its relation is more than contingent, but also capable of being prevented and hence to which its relation is less than necessary.

While we do not see how this dispositional modality can be explained non-circularly in non-dispositional, non-modal terms, this is not to say that it is mysterious or little understood. Indeed, we think it is the most familiar modality to any causally engaged experienter, which virtually all humans are. And given that causation, on our account, essentially involves this, then we have to be primitivists about causation, for it contains an unanalysable element.

So what is the point of a dispositional theory of causation if it does not give us an analysis? There are still reasons to be interested in a theory that falls short of analysis. One is that, if what we have said is right, the theory tells us why an analysis is neither possible nor required, which is an important finding itself. Second, however, the dispositional theory emphasises causation's dispositional nature, which many following in Hume's wake have overlooked. The Humean tradition has concentrated on constant conjunction, and many post-Humeans have thought that the way to improve his theory was to have something in addition, such that constant conjunction has been judged a necessary but not sufficient condition for causation. The dispositional account, in contrast, tells us that constant conjunction is not even a necessary condition for causation. Indeed, where two phenomena really are constantly conjoined, the dispositional view tells us that there is not a causal connection between but something else, such as identity or a truth of essentialism. Finally, while the notion of disposition is clearly itself a causal notion, there are also dispositional accounts of properties, laws, modality, and other things. The theory therefore has a unificatory potential.

What is missed by the counterfactual dependence theory but not by dispositionalism

One way in which to see the power of the dispositional view is to compare and contrast it with another of the leading theories. We choose Lewis's counterfactual dependence theory. There is a major difference at the outset. Lewis takes 'a cause to be only one indispensable part, not the whole, of the total situation that is followed by the effect in accordance with a law' (1973: 159). We are not going to object again to the idea of the cause being followed by an effect in accordance with a law, which we take to be Lewis tipping his cap to constant conjunction. What instead we now want to draw to the attention is that Lewis is interested primarily in what it is to be *a* cause, rather than *the* cause. Dispositionalism has something to say about both and indeed shows how some important features of causation are missed by neglecting the latter.

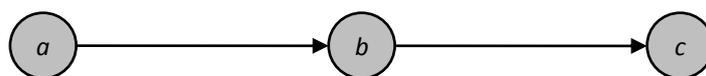


Figure 1: standard neuron diagram showing stimulatory connections.

We can see this when we consider the inadequacies of neuron diagrams, which have become the standard way to represent causal situations since Lewis's work. As Hitchcock (2006) has already pointed out, standard neuron diagrams, as in figure 1, have a number of limitations. One thing the dispositionalist will not like is that they represent causal stimulatory connections between discrete events. The causal relations into which these events fall are in no way essential to them whereas a dispositionalist takes the causal relata to be in part constituted by what they are disposed to do (Mumford 2004, ch. 10). But there are shortcomings of neuron diagrams that are less contentious. The frequency and intensity of a cause is not represented. But a book page may break free when it has been turned a thousand times and its first turn contributed just as much to its breaking as the last. Neuron diagrams can also represent only binary relations: a neuron either fires or it doesn't, which is supposed to correspond to an event occurring or not. But an effect can occur with a greater or lesser intensity, depending on the intensity of the cause. Something can be heated to a greater or lesser degree for instance.

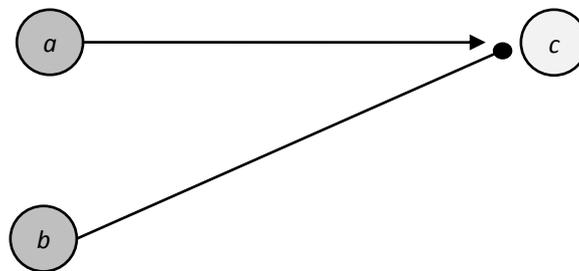


Figure 2: neuron diagram show inhibitory connection

But there are two major shortcomings that make neuron diagrams entirely unsuitable for dispositionalists. The first is that it builds in a form of necessitarianism that dispositionalism rejects. If a stimulatory neuron occurs, then its effect has to occur, and we have already said that we wish to replace such a connection with one that is 'only' dispositional. The one exception to this is where an inhibitory neuron fires (as represented in figure 2). In such a case, the effect in question is always inhibited, even if its stimulatory neuron also fires. The inhibitory neuron is thus the only thing that can stop a stimulation, and it necessitates that the effect does not occur. Nature does not work quite that way.

The second major inadequacy for dispositionalists is that an effect only has one cause, whereas we know that most, if not all naturally occurring, causes are complex. Typically, none of these causes would be sufficient on their own for the effect in question. Rather, each will make a relatively small contribution and produce together what none of them could have produced alone. Neuron diagrams cannot represent this, however. A stimulatory neuron, when it fires, is entirely sufficient for the effect, which looks to us to be a major misrepresentation of causation.

The matter is slightly more complicated than that, however, when we consider it in the light of the interpretation of neuron diagrams for counterfactual dependence theories. Lewis, after all, admits that he is looking for a cause, among the others that make the 'total situation' that is followed by the effect. The reason there can be only one stimulatory neuron represented for counterfactual dependence theories is, given that the effect has to occur if the stimulatory neuron fires, that if there were two or more stimulatory neurons, the effect would counterfactually depend on neither. In short, the situation represented would be one in which

the effect was causally overdetermined, which has to be denied in the counterfactual dependence theory. The reason Lewis wants only one stimulation for each effect then is not that he denies the complexity of causation, because he doesn't. Rather, he is keen to depict counterfactual dependence as grounding the causal relation. He wishes to depict a situation in which, had the cause not occurred, the effect would not have either. Such a situation exists, however, only if causes cannot be overdetermined. We will state at the end that we think there is no good independent reason to deny overdetermination and thus this limitation on neuron diagrams is not justified. Only if one is already a counterfactual dependence theorist will one accept the limitation of denying overdetermination and thus neuron diagrams are not after all an ontologically neutral way of representing causation. Rather, a dispositionalist has good reason to look for a better model.

Modelling causes as vectors

We have an alternative model to propose: one that better represents causation for dispositionalists and, we will claim, solves some of the problems of Lewis's counterfactual dependence view. This is that causation be modelled as the composition of powers in a vector-like way. The analogy between powers and vectors consists in them both having a direction: powers are all 'for' some type of manifestation. It also consists in them both having an intensity or magnitude as one token power can dispose towards a manifestation more than another one. Intensity is represented by the length of the vector.

We propose to plot these vectors on a one-dimensional quality space.⁴ The quality space allows us to show possible changes that powers make possible and frequently produce. Various powers could dispose towards heating or cooling the same room, for instance. From the current temperature, indicated by the central vertical line in figure 3, some powers (*a*, *b* and *c*) dispose towards F, making the room warmer, while others (*d*, *e* and *f*) dispose towards G, making the room colder.

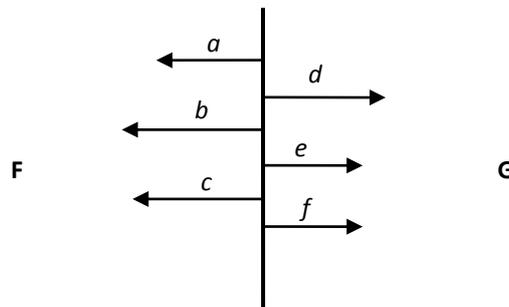


Figure 3: Powers modelled as vectors

There is a further analogy that can be used, which is that of vector addition. The reason that this can be used is that powers can compose, as Mill (1843: III, vi, 3) noted with his idea of the composition of causes. The various individual dispositions at work in some situation can all work together, some towards F and some towards G, to make an overall disposition of the situation. In figure 4 we find a case where this happens. The powers

⁴ The notion of a quality space comes from Lombard (1986).

disposing towards F are greater than the powers disposing towards G such that overall the situation disposes towards F, indicated by the resultant vector R.

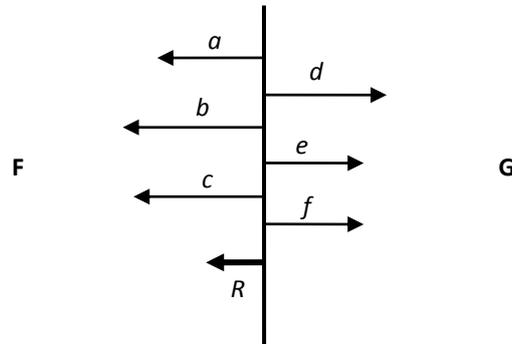


Figure 4: A directed resultant vector R

The analogy with vector addition only goes so far, however. There will be some cases where powers compose in the simple additive and subtractive way. In other cases, however, the mode of composition may be more complex. There are some well-known non-linear causal phenomena. One chocolate bar may dispose towards pleasure when eaten but ten, eaten together, dispose towards nausea. And in pharmaceuticals, it is known that two drugs that individually dispose towards health can be harmful when taken in combination. While some powers may add and subtract, therefore, such as forces, and heaters and coolers, the composition may be by a more complex function. The law of gravitational attraction illustrates such a function where the masses and distances apart of two objects produce a force according to an inverse square function, rather than mere addition.

Having noted that complication, however, we can see that the vector model can explain a number of features of causation. In figure 4, the situation overall disposes towards F, as shown by resultant vector R. This itself has to be understood in dispositional terms. It only disposes towards F. F may well be produced, if this disposition is indeed manifested, and when it is produced, it is so by the powers acting together. The vector model thus illustrates polygeny: the idea that an effect is almost always produced by many powers acting together (Molnar 2003: 194-8). *The* cause of F occurring is then understood as the totality of all the powers that were disposing towards F and manifested their disposition in something becoming F. Those powers disposing away from F could still have had some responsibility for *when* something became F or the *degree* of F that the thing became. In the case of the room temperature increasing, for instance, powers disposing towards cooling still had some relevance to the degree of increase. When we consider what it is to be *a* cause of F occurring, we will just focus on the powers that were actually disposing towards F. It would be perverse to call a cause of F something that was actually disposing against it and had to be overcome. F's occurrence was caused in spite of such things, which may thus have limited the degree to which F occurred.

The vector model also allows us to count as cases of causation effects in which nothing happens. There are a number of cases where the effect is not a change or occurrence but a non-occurrence in which, macroscopically at least, nothing changes. Two books leaning at an angle and propping each other up is one instance, another is a fridge magnet sitting motionless on a fridge, and a third is the steady orbit a planet retains around a sun. Dowe (2001) would call these cases of *causation of absence*, given that the effect is a non-change. In the model, these are explained as equilibrium cases, where powers are at work but they

balance out (figure 5). For the realist about powers, there is a huge difference between the case in figure 5 and a case where there are no powers at work, even though the result may be the same: nothing happens. Hence, in a tug-of-war, the two sides may be equally balanced and the rope thus progress neither east nor west. Powers are at work, however, and thus the case differs from another one where the rope does not move: namely where no one is pulling it.

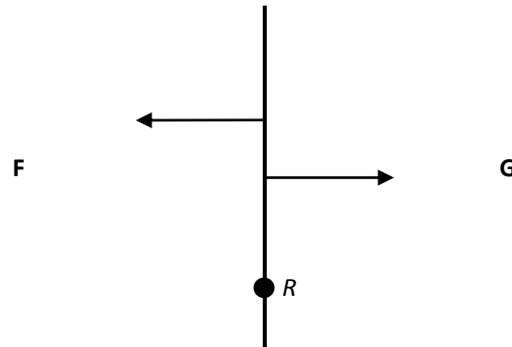


Figure 5: a zero resultant vector where powers are in equilibrium (causation of absence)

The employment of a notion of threshold is also of use. There are some cases of causation where at a certain point some novel or particularly interesting phenomenon occurs. Water can be heated to various temperatures, for instance, but at 100°C we get the significant phenomenon of it turning to steam. This is a point of discontinuity where a significant new process is triggered. We may therefore want to represent such a threshold, T , on our vector diagram (figure 6). Such thresholds are often important to us as causal agents. Our desire is often that some effect be brought about and in our deliberative actions we are trying to assemble enough for it. In striking a match, for instance, I am seeking that it lights. I know that I have to produce adequate friction against the match box, with a match that is dry enough, which has its flammable tip intact and is kept out of the wind.

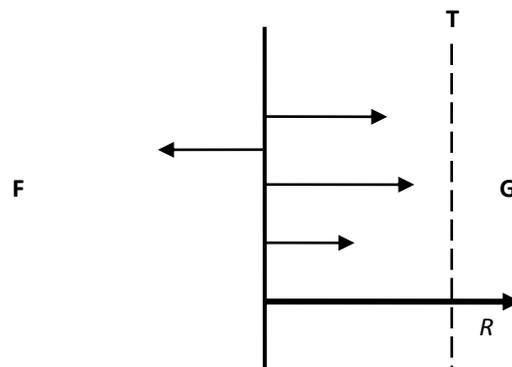


Figure 6: A resultant vector that passes threshold T

We can broaden out from the last point and note that vector diagrams could be used in decision theory. Simply plot out all the relevant considerations according to the directions in which they point and their

importance, indicated by their length. We do not develop that idea further here but it does bring us to an important point. When we make such decisions, we sometimes have just two choices and we will often have an overriding desire that one of those two choices be made. I may be invited to both Sydney and Auckland on the same day, for instance, and if I am equally disposed towards each it might indicate that I end up in the sea.⁵ But in such a case, even if I find it hard to split the two, I would rather go to one of them rather than none. This means that I will allow only one of two outcomes, even if there is only slightly more in favour of one than the other. And if there is nothing at all that disposes overall towards one outcome, I would rather toss a coin than make no decision. This decision-theoretic case can, however, be reflected in natural processes. The vector diagrams presented thus far were designed to allow effects that would admit of degree. But not all do. F and G may not concern magnitudes but may be simple states: effectively like off and on switches. Whether there is overall a lot or just a little that disposes towards the switch being on, it is simply on nevertheless. Effectively, the threshold for being on and off is the same line and what counts is which side of that line we end up. The neuron model was criticised for depicting all effects as simple binary, all or nothing cases. In allowing degrees of an effect, we do not want to make the mistake of denying that any effects have this binary nature.

Cartwright versus Mill on component powers

There is a threat to the account presented so far that comes from a surprising source. Although Cartwright is a supporter of causal powers or capacities, she also argues against the reality of component forces. There are good reasons to believe in resultant forces, because they are measurable, but we can only be instrumentalist about the components (Cartwright 1983: ch. 2). Cartwright's discussion concerns forces and it should be clear that causal dispositionalism is not an attempt to reduce all powers to physical forces. A decision between reductionism and holism is another matter, on which dispositionalism remains neutral. What is important here, however, is that Cartwright's argument could be applied to powers as well as forces. Might it be said that only the resultant powers are real and that we should be instrumentalist about the components?

Cartwright's concern is with whether vector addition is an accurate story for the composition of forces and, for our purposes, causation in general. She is sceptical, thinking that we do the addition, not nature. She explicitly rejects Mill's view on composition of causes in which all the component causes exist in the overall composed cause:

In this important class of cases of causation, one cause never, properly speaking, defeats or frustrates another; both have their full effect. If a body is propelled in two directions by two forces, one tending to drive it to the north and the other to the east, it is caused to move in a given time exactly as far in both directions as the two forces would separately have carried it ... (Mill 1843: III, vi, 1, p. 370-1).

Cartwright quotes this (1983: 60) in order to deny it. The body makes no movement north at all, nor any movement east, just a single movement north-east (figure 7). And if we had bodies forced at an obtuse angle to each other, the resultant would not move as far in one direction (west) as it would have done had there not also been the force north by north east (figure 8). Worse still, Cartwright cites the example of counterbalancing north and south forces acting on a body, which does not then move at all (1983: 61). How

⁵ This objection due to Mark Colyvan, in discussion.

can Mill say that each force has its full effect if a northerly force and southerly force produce no movement at all?

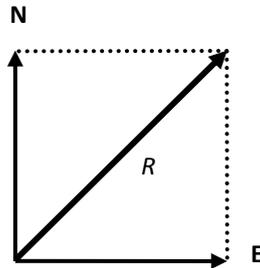


Figure 7: Mill's example of a resultant force

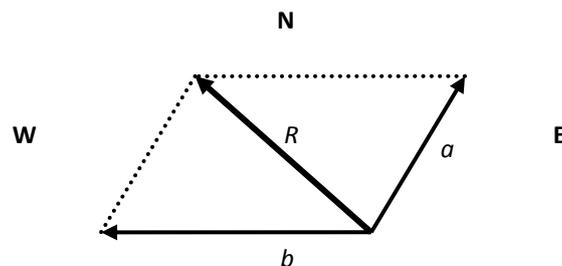


Figure 8: An example not considered by Mill

There is an answer from Mill himself, however, which can be found just if we continue the sentence where we left off in the previous quotation: 'it is caused to move in a given time exactly as far in both directions as the two forces would separately have carried it; and is left precisely where it would have arrived if it had been acted upon first by one of the two forces, and afterwards by the other.' (Mill 1843: III, vi, 1, p. 370-1, emphasis added) Thus, it is as if one force first did its work and then the other did. Even in Cartwright's case of a body subject to opposing balanced forces, resulting in no movement, the body is left where it would have been had first one, and then the other, moved it. And in one very important sense, both forces have their effect. For if we consider counterfactually, what would have happened had one of them been absent, then we can see that their presence made a difference.

This is what we want to say about all the component causes in a combined cause. All of them make a contribution to that combined cause. They tend to make a difference, setting aside cases of overdetermination, which will be considered in the next section. There are cases where they come together and get subsumed in the resultant power of the situation, but they nevertheless retain their reality. It is the individual powers that drive causation, not the resultant ones. Both the components and resultants can be understood as causally active, however. The resultant and its components are not wholly distinct existences so we can allow that they do the same work without it being a case of overdetermination. But it is the components that make up the resultant, rather than the other way round. Given the components, there can be only one resultant, but we

could not derive from a resultant what its components were. It is best to take these components as real in themselves.

A return to counterfactuals ... with an unexpected pay-off

We return now to the issue of counterfactuals. We have introduced an alternative way to neuron diagrams for modelling causal situations. But Lewis's possible worlds also ground an account of counterfactuals and counterfactual dependence is a key notion in his theory of causation. Can we account for causal counterfactuals?

There is a very simple answer to this, though unfortunately we cannot quite agree with it. The simple response would be to say that real, worldly causal powers were the truthmakers of the counterfactuals. There is, after all, a strong counterfactual intuition when we have causation. We think causes should make a difference such that had they not occurred, something would have been different: the effect would not have occurred, for instance. A power could be the truthmaker of a counterfactual because it is precisely the difference maker. In a standard case, it contributes to an effect such that, without it, the effect would not have occurred. What is in mind is depicted in figure 9. This vector model depicts a case in which there is a resultant vector directed towards F, and let us assume that this resultant power manifests in something becoming F. However, we can see that had component power *b* not been present, which is indicated by the vector being a dotted line, overall the situation would not have disposed towards F but would have been in equilibrium. The suggestion would be, therefore, that we are entirely fictionalist about the counterfactual situations themselves. They have no existence, whereas they do in Lewis's metaphysics, albeit in other worlds. The counterfactual situations we model are entirely in our imagination. But there are nevertheless worldly truthmakers of the counterfactual truths in the real powers that cause effects.

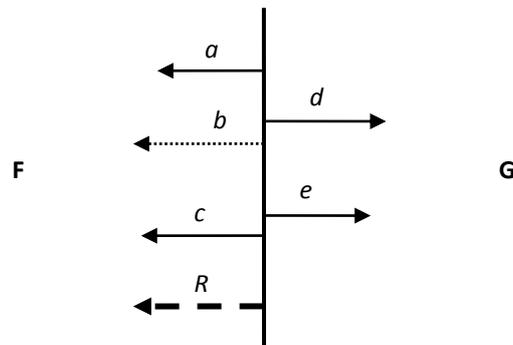


Figure 9: Vectorial modelling of a counterfactual

The unexpected pay-off of this account of counterfactuals is that it can also be used as our account of causation by absence, although with one important difference. Causation by absence, if it is real, could be a problem for our account. We say that powers do all the work. But a genuine absence is nothing at all (it is not a *something* by another name, for instance). And an absence cannot bear any powers, for that would be like them floating freely and not being powers of something. An account is not hard to find, however. In cases of causation by absence, we maintain, a component power is removed not just in the imagination but in reality. In a case where we forget to water the plant, we might say that absence of water caused its death. But this

cannot be quite right. Absent water is nothing and cannot cause anything: that would be *creation ex nihilo*. What has happened is that the plant was in equilibrium, avoiding the twin perils of death by drowning and death by dehydration. The surrounding atmosphere has a power to suck moisture out of the plant's leaves and soil but this is counterbalanced by the addition of new water. When I cease to water the plant, it is not the absent water that kills it: it is the dehydrating power of the atmosphere. This is depicted in figure 10. Power *b* – the hydrating power of water – is removed and its removal is the occasion for the plants death. But it does not cause its death. The causes are the powers *c* and *d* that dispose towards its dehydration. Once *b* is removed, the situation moves from an equilibrium to a directed resultant vector, *R*.

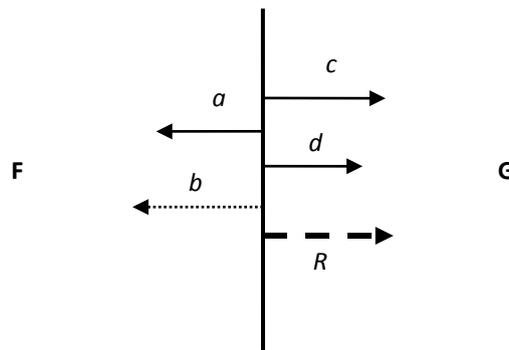


Figure 10: 'causation by absence'

That would be a good place to finish but we cannot do so without offering two major amendments to our theory of counterfactuals. One concerns the dispositional modality and the other concerns overdetermination. The point about dispositional modality concerns counterfactuals in which some power is added to the actual situation; while the point about overdetermination concerns counterfactuals in which a power is subtracted from the actual situation.

The counterfactual dependence view of causation is that A causes B where A and B both occur and had A not occurred, B would not have occurred either. The situation we are fictionalising is one without A but, of course, many causal counterfactual claims will be about what would have happened had some additional power been present: for instance, if there had been a spark, we would have had an explosion. If we accept that causation employs the dispositional modality, we will have to recast such counterfactuals. We cannot say that the explosion would definitely have happened in such a situation. Rather, we will have to interpret such a counterfactual as meaning that had there been a spark, there would have been a tendency towards an explosion. The spark would have disposed towards the explosion, probably made it more likely, and so on. Given causal dispositionalism, necessity is jettisoned. A causal counterfactual that concerns additional powers therefore has to be recast slightly. But is this really to be considered a price of causal dispositionalism? Arguably not because the recast counterfactual more accurately reflects the fact that powers only tend towards their manifestations, without guaranteeing them, and this is how we think the world works. A Lewisian might object that if we hold all else stable, and just add one further power, then the effect has to follow. But we reject this assumption (Anjum and Mumford 2010). A disposition could always fail to manifest, even if for no good reason.

The counterfactuals from which something is subtracted, where A does not occur for instance, face the notorious problem of overdetermination. If an effect *e* can be overdetermined by causes *a* and *b*, each of

which is enough on its own for e , then e counterfactually depends on neither. Counterfactual dependence theorists of causation therefore have to deny overdetermination. Otherwise, there could be cases in which a cause was removed and the effect would still occur just the same. Having no such vested interest in the matter, we can grant the possibility of overdetermination. A room could contain two thermostatically controlled heaters, each programmed to gradually raise the room temperature to 21°C within 10 minutes of being switched on. Someone switches them both on and they do their work. Had one of them not been turned on, the effect would have been the same. We need to go to no lengths to argue away this kind of case as we can accommodate overdetermination, as illustrated in figure 11.

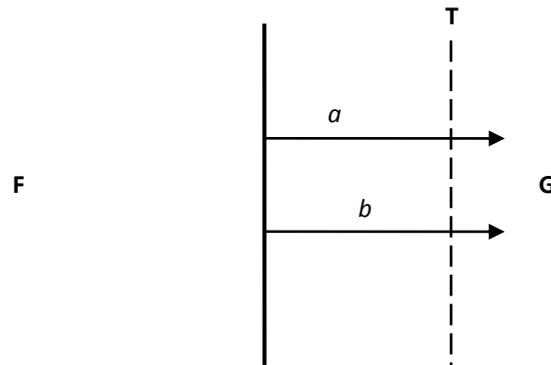


Figure 11: Causal overdetermination

Where does that leave our counterfactuals? One thing it means is that the counterfactual intuition – which is a difference-making intuition – does not apply in every case of causation. Some causes don't make a difference, where they are overdetermining or redundant causes.⁶ Counterfactual dependence can then be used as a diagnostic of causation, allowing us to identify most cases, but it is not an infallible indicator of causation and certainly not in a position to be constitutive of causation.⁷ This last conclusion of course is one that should lead us to look for alternative theories of causation and enough evidence has been presented here, we hope, to make causal dispositionalism a realistic contender.

⁶ For a taste of redundant causes, see Schaffer's (2004) trumping pre-emption cases.

⁷ For a case of counterfactual dependence between events but without causation, see Mumford and Anjum 2009.

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