



# Causal Necessitation and Dispositional Modality

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## Abstract

Rani Lill Anjum and Stephen Mumford have recently defended a new kind of modality, which they call ‘dispositional modality’. The key reason to adopt dispositional modality, according to them, is that causes never necessitate their effects. Anjum and Mumford’s chief argument against causal necessitation makes use of what they call the ‘antecedent-strengthening test’ (AS-test):  $C$  causally necessitates  $E$  iff  $C \ \& \ \varphi$  causes  $E$ , for any possible  $\varphi$ . This test, they claim, fails in all cases of alleged causal necessitation. In this paper we argue that the AS-test is not the mark of causal necessitation. First, we show that if the AS-test is taken as the mark of causal necessitation it leads to either an absurdity or to circularity. Second, we argue that, given the Mill/Mackie framework of causes as INUS conditions, apparent counterexamples to causal necessitation fail.

**Keywords** Causal necessitation · Dispositional modality · AS-test · INUS condition

## 1 Introduction

In their recent book *What tends to be* (2018), Rani Lill Anjum & Stephen Mumford (henceforth AM) put forward a *sui generis* irreducible kind of modality (they call it ‘dispositional modality’) which is stronger than pure contingency but weaker than

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necessity. According to AM, there are two basic principles behind dispositional modality both of which are needed in order to have what AM call ‘a deeply tendential view of nature’ (2018, 11). According to the ‘external principle’ we should accept dispositional modality because ‘any cause can be interfered with in a way that prevents its effect from occurring and this shows that causes do not necessitate their effects’ (11). This implies that ‘causes did not necessitate their effects even on the occasions where they succeeded in producing them’ (11). The ‘internal principle’ goes one step further and suggests that even when all conditions are right for a certain effect (that is, when there is no external additive interferer that prevents the cause from realising its effect), the latter can still fail to occur. As AM put it, ‘[w]ith the internal principle, there is nothing that prevents the effect from occurring, but still, it need not occur, just because the modal nature of the cause is internally tendential’ (18).

Though we have reservations about the internal principle, in this short paper we focus only on the external principle. In what follows, we will argue that the reasons offered by AM for the adoption of dispositional modality are far from compelling because they rest upon misconceptions about causal necessitation, the modality they associate with it and the role of interferers in causation.

## 2 The antecedent-strengthening test for causal necessitation

Here is AM’s key argument for the external principle. Consider a case where E is the typical effect of cause C and let  $\varphi$  be any possible additive interferer with respect to C’s causing of E. AM argue that since C typically causes E but C-plus- $\varphi$  does not cause E, we should conclude that a cause does not *necessitate* its effect. Hence, AM invoke the following antecedent strengthening (AS) test for causal necessitation:

(AS) C causally necessitates E iff C &  $\varphi$  causes E, for any possible  $\varphi$

Since the case of AM for the external principle rests on their commitment to (AS), the first question that comes to mind is this: Is (AS) a kind of test appropriate for causal necessitation? Is it the mark of causal necessitation?<sup>1</sup>

Obviously, something like (AS) is satisfied by *logical entailment*. In fact, the principle (MON) below captures the monotonicity of *logical entailment*:

(MON) If  $\Gamma \vdash K$ , then  $\Gamma, I \vdash K$ , for any possible I

<sup>1</sup> Markus Schrenk appeals inter alia to the monotonicity of necessity in order to reject that it is *metaphysically* necessary that if something has a power and is triggered, it displays the power’s manifestation. In a power-based account of causation, Schrenk’s view amounts to the thesis that causes do not metaphysically necessitate their effects. It is not clear, however, whether Schrenk embraces (AS) as a test of necessity in general or causal necessitation in particular. For instance, concerning the alleged necessity of the proposition ‘electrons are negatively charged’, he says: ‘In other words, one could, in principle, add anything one pleases to the antecedent of a conditional like “necessarily, if x is an electron then x is negatively charged”... Necessity is, to take a notion normally applied to logical entailment, monotonic: antecedent strengthening does not affect the original necessary conditional regarding electrons and negative charge. One might even be *tempted* to suggest that antecedent strengthening is a test for the alleged necessity’ (2010b, 178, emphasis added).

where  $\Gamma$  is a set of premises,  $K$  the conclusion and  $I$  arbitrary extra premises. As (MON) shows, monotonicity is related to the notion of logical validity. In particular, it states the fact that we cannot turn a valid argument into an invalid one by adding premises.

Could it be that causal necessitation satisfies monotonicity? Given the formal identity between (AS) and (MON), do AM actually think that the relation of causal necessitation can be mapped on (or is the same as) the relation of logical entailment?<sup>2</sup>

It should be clear that causal necessitation cannot really be logical entailment; hence (AS) cannot capture it. The reason is this. If (AS) is the criterion of causal necessitation, then the strengthening should hold for any possible interferers. Among the possible interferers of  $C$ , however, is  $\neg E$  (the non-occurrence of the effect). When it comes to (MON), the addition of the negation of the conclusion as an extra premise does not invalidate the original argument. If  $\Gamma$  entails  $K$ , then  $\Gamma, \neg K \vdash K$ . But if  $C$  causally entails  $E$ , it would be absurd to say that  $C \ \& \ \neg E$  causally entails  $E$ . The addition of the negation of the effect to the antecedent of a causal conditional would make the entailment fail, in violation of (AS).<sup>3</sup> For example, it would be absurd to say that if boiling water causally necessitates the evaporation of water, then boiling water plus non-evaporation causally necessitates evaporation. This should be enough to invalidate (AS) as the mark of causal necessitation.<sup>4</sup>

We can think of two ways that AM might reply. The *first* is to note that it remains completely unchallenged that if  $C$  could happen without  $E$  happening, then  $C$  isn't a necessitating cause of  $E$ . Hence, it will be added, (AS) might determine that something is not a necessitating cause of an effect. In reply, it should be stressed that AM do not want to claim that some causes do not necessitate their effects. Their point, in other words, is not simply that there is probabilistic causation. Rather their point is that *all* causes are non-necessitating; and hence that causation is a non-necessitating relation, period.<sup>5</sup> This cannot be shown by pointing to *some* cases in which  $C$  could happen

<sup>2</sup> Schrenk (2010a, 731–2) claims that monotonicity characterises *all* kinds of necessity. If that is true, and given that causal necessitation is a kind of necessity, AM seem to have a reason to use (AS) as a criterion of causal necessitation. But as we will argue below, if AM do not restrict the range of possible interferers, the application of (AS) leads to absurd results.

<sup>3</sup> AM themselves mention the problematic strengthening factor in their book *Getting Causes from Powers* (2011) without however thinking that it might create an insurmountable difficulty for the application of AS-test to the case of causal necessitation: 'If  $A$  necessitates  $B$ , then even  $A$  and  $\neg B$  necessitates  $B$ , according to standard logical theory' (2011, 57). Weckend (2014) also discusses the case of non-occurrence of the effect as a possible interferer. She does not argue, however, that this possibility actually shows that (AS) is not a proper test for causal necessitation, because she thinks that the negative preventer  $\neg E$  'falls short of the authors' own requirement that negative causes do not constitute genuine dispositions' (2014, 119). For our reaction to this kind of way to defend (AS), see below.

<sup>4</sup> It might be argued that an unrestricted (AS) is not even an adequate test for logical necessity within any system of logic and logic of conditionals (for reservations about that, see Lowe (2012)). Be that as it may, it is certainly not an appropriate test for causal necessitation.

<sup>5</sup> Since our aim here is to question the argument given for embracing AM's external principle and this argument can be equally applied both to the cases of probabilistic and non-probabilistic causation, in what follows we will focus on the latter. In that way we avoid all subtleties of the probabilistic case without losing sight of the core of AM's argumentation for the adoption of the external principle, which is not based on the case of probabilistic causation but rather on the possibility of external additive interference. Of course, issues concerning probabilistic causation are not irrelevant to dispositional modality; they are mostly related, however, to the *internal* principle of dispositional modality and their discussion can highlight the relation between probabilistic dispositions, statistical tendencies and tendencies as 'sources' of dispositional modality (which, as AM themselves insist (2018, 7), are not simply probabilistic dispositions).

without E happening (by noting, for instance, that one was smoking 40 cigarettes a day for 40 years but never developed lung cancer). For other cases might well be, *prima facie* at least, such that C cannot happen without E happening too. For instance one cannot have weight in the absence of a gravitational field. Hence, *prima facie*, if the cause (absence of gravitational field) does happen, the effect (lack of weight) must happen too. So, unless there is a general *sound* criterion which shows that *any and every cause* is non-necessitating because it can be interfered with, the very idea that all causes dispose but don't necessitate their effects cannot get off the ground. We have shown that (AS) cannot be such a criterion, since it leads to absurdity.

The *second* way AM might reply is by noting that the application of (AS) is based on a restriction in the range of possible interferers, which excludes  $\neg E$ , thereby avoiding the foregoing absurdity.<sup>6</sup> In fact, in answering Lowe's criticism (2012, see footnote 2), AM explain: 'we do not take our test of necessity as having universal application within any system of logic and logic of conditionals. But it must be remembered what it is of which we are testing the necessity: naturally occurring causal processes' (2018, 17). So, AM argue that their test concerns 'naturally occurring processes'; hence, not all logically possible antecedent-strengthenings are to be accepted.

What, however, is the criterion of admissibility of possible interferers or antecedent-strengthenings? If it is not mere logical possibility, there must be some way to describe a notion of *natural* possibility, which is distinct from logical possibility. Given AM's idea that there is a 'third worldly modality' (2018, 5) distinct from logical necessity as well as from contingency, i.e. 'dispositional modality', the best candidate for natural possibility is dispositional possibility. Indeed, AM take the dispositional modality to be the 'modality of natural causal processes' (2018, 22). It should be obvious, however, that the use of dispositional possibility to restrict the possible antecedent-strengthenings from all those that are logically possible to only those that are naturally possible creates a circularity problem for AM's account. The AS-test is introduced in order to motivate the existence of dispositional modality; if, at the same time, dispositional modality is *presupposed* for the restriction of possible strengthenings to naturally occurring causal processes, the circle is too tight to be anything other than vicious: which processes are naturally occurring? Those which satisfy (AS). Which causal processes satisfy (AS)? Those that occur naturally.

To recap the point so far, (AS) is inadequate as a test for causal necessitation, since it leads to an absurdity. But if, in order to avoid the absurdity, the range of possible interferers is restricted to naturally occurring processes, thereby illuminating the idea of dispositional modality, the defence of (AS) becomes circular.

<sup>6</sup> Gozzano (2020) argues that a plausible constraint on the possible interferers  $\varphi$  is the consistency of  $C \& \varphi$ . This restriction obviously excludes  $\varphi$  to be  $\neg C$ , but not  $\varphi$  to be  $\neg E$  which is the case that leads to absurdity. He also argues that for something to qualify as an interferer of a causal relation it must interfere either with some member of the set of properties that comprise the cause or with some member of the set of properties that comprise the effect or with one or more members of both sets. Since Gozzano understands interference as interaction between powers, his definition of interferers most probably limits their range to the physically possible ones.

### 3 Causal necessitation and the Mill/Mackie framework

How then should we understand causal necessitation? Let us start with some platitudes.

There are at least two (general and uncontroversial) conditions that an account of causation needs to capture. The *first* is that effects are seldom brought about by a single factor; typically, there is a cluster of different factors (conditions) which (strictly speaking) cause the effect. For example, a fire in a building can be caused by the occurrence of a short circuit plus the presence of oxygen, since without oxygen there would be no fire. The *second* is that a specific effect-type can be brought about by a number of distinct causes. For example, a fire in a building can be caused either by the occurrence of a short circuit or by a fire in a nearby forest. These two conditions are logically independent: in a case of causation, it is possible that only one but not the other holds: maybe there is just one cluster of factors that produces a certain effect, or maybe, while there are several different potential causes, the cause has to be seen as comprising just a single condition. Typically, however, both conditions will hold, i.e. there will be several distinct clusters of factors, each of which will be *sufficient* to bring about a token of a type of effect, but none of them will be necessary.

Mill's (1911) theory of causation nicely captures these two conditions. According to the Millian view, clusters include, besides positive, negative conditions as well (that is, absence of some conditions) and the conjunction of all members of each cluster is a sufficient condition for the occurrence of the effect. Mackie (1974) has elaborated this Millian view, arguing that each single factor of each distinct cluster is an INUS (an Insufficient but Non-redundant part of an Unnecessary but Sufficient) condition for the effect, and can be (loosely) regarded as *a* cause of it. Note that, although it is, typically, associated with (some version of) the regularity account of causation, the Mill/Mackie framework is much broader – in particular, it is compatible with other accounts of the metaphysics of causation, e.g. with neo-Aristotelian accounts that take causation to consist in the manifestation of powers. Thus, in adopting the Mill/Mackie framework as a general conceptual framework for understanding the notion of causation, we don't beg any questions concerning the metaphysical issue, i.e. what causation in the world really is (or in other words, what the nature of the truthmakers of causal claims is).<sup>7</sup>

We are now going to apply the Mill/Mackie framework to the notion of causal necessitation. When we say that the cause necessitates the effect we should not mean that an INUS condition causally necessitates the effect, which is clearly wrong. Instead, we should imply that it is the whole cluster of conditions which is sufficient for the effect, that causally necessitates it. For instance, it is wrong to say that the striking of the match causally necessitates lighting; rather, the striking is a factor which is part of a cluster of factors which is causally sufficient, and hence

<sup>7</sup> It is important to note that the Mill/Mackie framework has been used in areas other than physics. Epidemiology provides a nice example. As Rothmann & Greenland put it, a central notion in epidemiology is a sufficient cause, which 'can be defined as a set of minimal conditions and events that inevitably produce disease; 'minimal' implies that all of the conditions or events are necessary to that occurrence' (2005, S144). According to Tam & Lopman, this so called 'component-cause' model (essentially the Mill/Mackie's framework, which was independently applied to epidemiology by Rothmann (1976)) 'has been the predominant causal framework on which epidemiological research has been based, and it has been of great use for the identification of individual risk factors associated with disease and the development of the advanced statistical techniques that are now widely used for this purpose' (Tam & Lopman 2003, 477).

necessitates, the effect. According to this framework, then, causal necessitation is nothing but causal *sufficiency*.

Suppose that a cause, that is a cluster of factors/conditions, causally necessitates an effect but the effect does not follow. What has happened? In order not to have the effect, an additive factor should change or eliminate at least one of the causally relevant conditions which constitute the causally sufficient cluster of factors. Therefore, when the cluster fails to causally necessitate the effect, it must be the case that the cluster has changed. It's not then that the original cluster no longer causally necessitates the effect. Rather, there is a different cluster of factors at play that no longer causes the effect. There is no surprise here: with a different cause there should be a different effect. For instance, for the striking not to light the match it should be the case that either a part of the causally sufficient cluster of factors is eliminated, e.g. oxygen is removed, or that one of the factors is interfered with by some external condition which changes it, e.g. strong wind blows. If this is right, the AS-test is not the mark of causal necessitation simply because when the cause (cluster of factors) changes, the original effect is no longer expected to follow.

This explanation of the non-occurrence of the effect holds also in equilibrium cases, where there is no change involved. Consider, for instance, the following case. An iron object stands still in the air because of an electromagnet attached to it. In this case we have no action because two opposite forces, the magnetic and the gravitational, cancel each other out. Suppose now that an extra force is added which pulls the object in some direction. We no longer have the equilibrium-effect since the object accelerates. AM view this as a case where an additive factor (the extra force) prevents the effect (equilibrium) from occurring, and thus as a case in which the cause does not necessitate its effect. Here again, on AM's view, the AS-test fails, the reason being that the cause, that is the joint action of the magnetic and the gravitational forces, is still there, but the effect, that is the iron object standing still, is no longer present. However, it can be easily seen that the joint action of the magnet and the gravitational forces is an INUS condition for the effect. That is, it is part of a cluster of factors that causally necessitates the effect. And this cluster includes the condition that no other forces affect the object (or, more plausibly, the resultant of all other forces is null). When the new force is introduced this condition changes, therefore the cause changes and hence the effect is no longer the same. Here again, the antecedent strengthening changes the cause, i.e. the cluster of factors, hence the effect changes too.

#### 4 Causal necessitation and power realism

The use of expressions such as 'condition' and 'factor' is meant to highlight that our account of antecedent strengthening is largely independent of the metaphysical account of causation one embraces. There is nothing in our argument against the AS-test that would, for example, prevent power realists from embracing it. In fact, some power realists explicitly endorse it. For instance, Neil Williams (2019, 142–3) has recently argued that some of the counterexamples that the opponents of causal necessitation give are in fact just cases where different arrangements of powers produce different effects. Given that for Williams a cause is nothing but an arrangement of powers, the previous claim is tantamount to our view, viz., that

strengthening changes the cause and, hence, the effect changes too. Gozzano (2020) too embraces the same view in a power-based context for causation. In his words: '[Causal] necessity applies to maximally specified [causal] relations. Modifying any of the conditions would bring about a different relation because different powers would be at stake' (2020, 11).

Williams and Gozzano both argue in favour of causal necessitation and think that interferers of a causal relation are just more powers that join "unexpectedly" the arrangement of the original powers whose manifestation is the initial effect. Only Gozzano, however, discusses the implications of the 'different cause-different effect' view for the AS-test. He argues that although the AS-test (expressed in the form: If A necessitates B, then: If A plus  $\varphi$ , for any  $\varphi$ , then B) does not show the falsity of causal necessitarianism, it nevertheless can (and actually does, in scientific practice in experimental settings) make the *causally relevant* properties apparent.

AM too adopt a power-based account of causation. They take a cause to be an 'active causal power' (2018, 12). On their view, a causing occurs when several powers, by 'coming together' and interacting, bring about a mutual manifestation. Now, among the factors/conditions that form the cluster of factors that is causally sufficient for the effect might well be (and typically are) some negative factors (for instance, the 'no other force' condition in our equilibrium example above). But negative facts or events or states of affairs seem incapable to have any causal powers. So, for AM, it is not legitimate to include negative factors in the (complete) cause.<sup>8</sup>

The issue of the admissibility of negative entities in one's ontology is complex and controversial. Fortunately, we do not have to 'solve' it to make the argument for causally sufficient clusters of factors work. Two things are relevant here. *First*, negative descriptions, as in the case of the 'no other force' requirement above, are typical in science; hence, they have to be accounted for, instead of being easily dismissed based on prior metaphysical grounds. In the equilibrium case, the 'negative' requirement that there are no other forces acting on the object is always part of a cluster of other 'positive' factors, i.e. the forces acting, and so it seems that it does causally 'contribute' to the effect. But *second*, from the fact that scientists employ negative descriptions, it does not follow that they are automatically committed to the existence of negative *truthmakers*. In the example above, for instance, we can say that the condition that there is no other force acting is made true by the positive *totality* fact that the magnetic and gravitational forces are the *only* causally relevant factors.

AM insist that no matter how many factors are included in the cause, the *possibility* of interference cannot be excluded and hence that causal necessitarianism should be rejected. They add that, in order to secure causal necessitation, an extra premise is needed which *excludes* all possible interferers (2011, 67). As we noted above, this extra premise could be a *totality* fact. In effect, this would be the claim that the cause C of an effect E includes not only all the causally relevant factors  $C_1, \dots, C_n$  but also the higher-order totality fact that there are no more additional causal factors than  $C_1, \dots, C_n$ . AM go a step further and claim (2011, 69) that even excluding the possibility of interference (either by invoking a totality fact or by other means) we do not have a reason to hold

<sup>8</sup> Cross (2014) also thinks that AM can evade the conclusion that a cause which includes a specification that no other factors are involved cannot be interfered with, on the basis that such a specification would be an absence and absences cannot (according to AM's view) be causes.



that causes necessitate their effects. But this seems strange. Suppose that a cause *C* actually brings about an effect *E*. If *C* does not necessitate *E* (as AM insist) then, on a different actual occasion, *C* might fail to produce *E* although nothing interferes. In such a case, nothing relevant to the causing has changed but nevertheless the effect does not occur. Since in cases of probabilistic causation causes do not necessitate any of their possible effects, AM owe us a reason to believe that causes do not necessitate their effects in *all* cases.

Generally, we have argued that the addition of causal factors would change the cause *C* into some different cause and *E* would no longer follow. Hence, (AS) fails as a criterion of causal necessitation precisely because of the following being the case:

(CC) Possible interferers change (aspects of) the cause, i.e. of the cluster of factors which are sufficient for the effect – they either remove a factor of the cluster or change a factor of the cluster.

Given (CC), the burden is on AM to show that in all cases it's (in some sense) possible to add a non-trivial factor  $\varphi$  to the causal cluster *C* which is causally sufficient for effect *E*, such that *C* does not change but *E* does not follow.

## 5 Causal necessitation and metaphysical possibility

Thus far we have examined typical cases in which the kind of possibility involved in the interference is *physical* possibility. Our conclusion is that none of these cases violate CC above. We could stop here, but there is a possible loose end that needs to be tied. Can there be cases where it is possible to have the complete cause without the effect if we allow *metaphysically* possible interferers? Metaphysically possible but physically impossible scenarios involve cases where there seems to be violation of the actual laws of nature. A convenient way to introduce and illustrate such scenarios is to appeal to a *super-natural* interference factor (for example, divine intervention). Hence, even though we are tempted to exclude the presence of such a kind of possible interferers as irrelevant to the case of causal necessitation, let us consider two cases of divine intervention to see whether they violate CC.

The first example is the case of 'the three young men in the fiery furnace', a famous example in scholastic discussions of causal powers (Daniel 3, 1–30). Saint Ananias, Saint Azarias and Saint Misael were thrown into a fiery furnace, which, however, due to God's intervention, did not burn them to death. Here we have *prima facie* a case where a typical cause (the fire) does not bring about its effect (burning) because an external super-natural factor (God) interferes. Is this a counterexample to CC? The answer is no. According to medieval concurrentism,<sup>9</sup> God's concurrence is a causally relevant condition in all actual causings. In the case under consideration, then, God's action actually changes the cause by removing His concurrence. The cause (fire plus the absence of natural preventers plus God's concurrence) necessitates the effect (burning). So, even if we allow super-natural factors to play the role of metaphysically possible interferers in causal processes, CC still holds.

<sup>9</sup> The rival occasionalist view is irrelevant here, because according to it there are no genuine causes at the level of objects.



As another example, let us consider the case of Lazarus's resurrection. In contrast to the previous example, this is a case of *additive* interference: God positively intervenes and raises Lazarus from the dead. Lazarus is alive again but, after living a second life, he eventually dies. Does being human (causally) necessitate being mortal? Given that Lazarus eventually dies, we want to say that being human causally necessitates being mortal. Yet, this seems a case where a positive interferer (the action of God) changes the effect (Lazarus's mortality) without changing the cause (Lazarus's being human) – thus constituting a counterexample to CC. But that is not the correct description of the case; the cause of Lazarus's mortality has to do with his bodily biological processes that lead to his death only given that the laws of nature do not change. So, the cause of Lazarus's mortality includes the condition that laws do not change; what is really happening in the resurrection case is that God's action changes the cause by miraculously changing the laws of nature. Hence, as in the case of the three young men, the case of Lazarus is not a counterexample to CC, as the relevant cluster of factors that constitute the cause has been changed.

## 6 Conclusion

We have argued that the AS-test proposed by Anjum & Mumford is not an appropriate test for causal necessitation. We noted that if, on the one hand, the possible interferers are logically possible, then (AS) leads to absurdity, while if, on the other hand, the interferers are naturally possible, then the defence of (AS) becomes circular. Moreover, we have shown that, given the Mill/Mackie framework of causes as INUS conditions, apparent counterexamples to causal necessitation fail in all cases of physically (and metaphysically) possible interference: in all those cases, an INUS condition of the cluster is always changed or removed, and so the complete cause changes. Hence, the AS-test is not the mark of causal necessitation simply because when the cause (cluster of factors) changes, the original effect is no longer expected to follow. Given all that, we conclude that Anjum & Mumford's strategy for defending the external principle of tendency fails.

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