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ON CAUSALITY AND NECESSITY

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Abstract. In this paper I present an argument for causal necessity. Firstly, I introduce the theoretical background about necessary connections and discuss some of the senses of necessitation that can be found in the literature. After inconsistencies are detected in each of them, I develop an additional sense from one of the previous contributions: causal necessity is to be explained by causal production and simultaneous causality. Secondly, I present the contemporary conception of causality in metaphysics, which I call the received view. The received view has as two of its tenets an event ontology and a sequential approach to the structure of causality. Sequential causality is submitted to a recently developed counterargument to stress its untenability. Thirdly, I explore an alternative to sequential causality: simultaneous causality. I expand the argument against sequential causality and show how simultaneous causality entails causal necessity. Fourthly, I consider some potential replies to the argument presented. Finally, some further considerations are drawn.

Keywords: causality • causal realism • simultaneous causality • sequential causality • causal necessity • causal production • causal processes

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1. Necessary connections and senses of necessitation

At least since Hume, the idea of "necessary connexions" between distinct entities has been under attack. Given his epistemological commitments—particularly his Copy Principle[1] — if some necessity is to be found in causality, it should be derived from our impressions, and these should in turn be derived from our ideas. As causality leaves no impression on our senses, Hume came to the conclusion that necessity could play no role in a definition of causality, and that what we take to be necessity is merely a "*determination of the mind*", something arising from our perception's "*accustom'd union*" between causes and effects.[2]

This rationale hasn't gone unnoticed in the analytic tradition: although causal realism has gained traction in the literature, many have still insisted on Hume's rejection of necessary connections. It should be no surprise that many of those who identify themselves as Humeans. Echoes of the Humean doctrine can be found contemporarily in the works of J. L. Mackie and David Lewis: following a tempered

approach, Mackie distinguishes between the many "jobs" necessity has to do in the Humean paradigm and partially follows Hume by rejecting any kind of necessity "*stronger than factual universality*" (Mackie 1974, xiv). On the other hand, Lewis chooses what one could call an outspoken Humean perspective:[3]

> Humean supervenience is named in honor of the greater denier of necessary connections. It is the doctrine that all there is to the world is a vast mosaic of local matters of particular fact, just one little thing and then another. (Lewis 1986, ix)

However, it would be a mistake to suppose that only Humeans reject necessary connections: as stated above, other anti-necessitarianists can be found precisely in the causal realist faction, such as Anscombe (1971).[4] Alternatively, we can consider Mumford and Anjum (2011), if we wish to focus on recent literature. In Mumford and Anjum's case, the denial of necessary connections is one of the columns of their dispositional modality — a middle ground between pure possibility and necessity — and their main argument relies on the alleged possibility of hindering any causal relation in order to prevent causal necessity.[5]

On the other hand, the thesis commonly held by adherents of causal realism regarding the relation between necessity and causality is known as causal necessitarianism, according to which causes necessitate their effects.[6] Unfortunately, as it says nothing about what one should take necessitate to mean, causal realists tend to develop their understanding of necessitation each on their own. Thus, there are at least some senses we may find in the literature regarding what necessitation means.[7]

In the first sense, we have *necessitation*$_1$: necessitation is to be understood merely as *causal sufficiency*, a feature of a complex of causes that is sufficient to bring about their effects. The approach is proposed by Ioannidis, Livanios, and Psillos, inspired by the Mill–Mackie theory of causality in terms of INUS conditions. According to the authors, a cause is an insufficient but non-redundant part of an unnecessary but sufficient condition to produce a certain effect. To say that a cause necessitates the effect is nothing more than to say that a whole and sufficient cluster of conditions for a given effect causally necessitates it (2020: 293), in the same vein as Mill's total cause. Although one can talk about, *e.g.*, the striking of the match causally necessitating the lighting, this would be an improper way to express what really happened since the striking itself is insufficient for the necessitation of the effect; instead, the striking is part of a cluster of factors, and the cluster itself is causally sufficient and necessitates the effect (2020: 294).

In a stronger sense, some develop what we might call *necessitation*$_2$. In a fashion very similar to Kripkean a posteriori necessities, necessitation$_2$ is understood as a form of *natural necessity*. To obtain it, we take causal properties as a starting point in our philosophical investigation of natural necessity. By favoring empirical research,

individuals, their constitution, and patterns of behavior are ascertained experimentally. Eventually, our knowledge of the nature of the particular allows us to conclude that it is necessary for a substance having such a constitution to behave in such a way (Harré and Madden 1975: 125–126). Necessitation$_2$ is commonly found in works related to the dispositional essentialist programme, championed by Ellis (2001, 2002) and Bird (2007).

Ellis argues for a kind of metaphysical necessity, taking essences as the starting point. Making use of possible worlds, Ellis suggests that the relevant possible worlds are those that can really exist. Between them, the worlds that contain all sorts of things that actually exist in our world are of particular interest due to their similarity to ours, and these similar worlds would be from the same family as our own. Given that transworld identity is determined by the identity of the existing things in these worlds with the things that exist in our world, any otherworldly existing thing should share the same essence as the things in our world. Otherwise, they would not be identical, since they have different essences. Now, if the truth of something derives from its essential nature, everything that is true about something in one world will be true about the same thing in another world. And since what is true about the essential nature of something in one world will be true about the essential nature of the same thing in another world, the same can be said about the natural kinds that these worlds share with our own. Thus, a proposition about natural kinds, such as "Water is H_2O" is necessarily true in all the worlds from the same family and vacuously true in the worlds where the truthmakers of the above proposition are not to be found (Ellis 2001: 110–111).

Once essences and natural kinds are deployed, necessitation$_2$ can be obtained via *natural kinds of processes*: a causal process is one species of a natural kind of process that relates two kinds of events: a *causal kind* — including all the events that function as causes in the causal processes — and an *effectual kind* — including all the events that function as effects in the causal processes (Ellis 2002: 48). As the essences are metaphysically necessary and partially constituted by intrinsic causal powers,[8] the dispositions in Ellis's ontology and the causal process are nothing more than the instantiation of intrinsic causal powers; the causal kind and the effectual kind are linked by metaphysical necessity.[9]

Another sense one may have in mind is that of *necessitation*$_3$, where the distinct feature of necessitation is *unimpedibility* (Freddoso n.d.). As Freddoso digresses about some senses of necessary connection beyond what Aristotelians are committed to, some claims are presented, attempting to capture the rationale behind these senses. From these claims, one stands out from the others: consider a potential agent A, a set of circumstances C, and an effect E. Necessarily, if A produces E in C by a necessity of nature, then A's production of E was unimpedible.[10] The idea here is very close to that of natural necessity, but it emphasizes that once A produces E, the

production cannot be stopped due to the unimpedibility.[11] On its own, necessitation$_3$ can be understood as a species of necessitation$_2$ since the production of *E* by *A* follows from the necessity of nature. Nature, in this context, is the same as the nature of things and is — at least in principle — discoverable by experience and scientific inquiry (Freddoso n.d.: 2).

Now that we're acquainted with necessitation, let us assess each of the senses above and discern whether one should be preferred to the detriment of the others.

Let us start with *necessitation*$_1$. On the one hand, we may grant that it is not trivial to assert that a complex of causes is sufficient to produce their effects. Indeed, some antinecessitarians would promptly oppose this idea, as it seems to concede too much regarding how the productive aspect of causality is to be understood. On the other hand, something seems to be missing if we intend to present a realist picture of causal necessity. But what? Let us consider the following: for the causes to produce a certain effect, each of the causes needs to be jointly present, both locally and causally. On their own, they need to be able to produce change; together, they need to produce the effect. But what if we remove one of the causes? Would the complex of causes be sufficient to produce its effect? This is the *argument of the possibility of prevention*.[12] For any complex of jointly interacting causes, if there is an additive factor that prevents the causal relation by interacting with one (or all) of its causes once they have started to interact, the causes are not sufficient to produce their effect, as one (or all) of them will be missing. And if this is so, the causes are not sufficient to necessitate their effects equally.

As we've seen, necessitation$_1$ takes a cause to be an insufficient but non-redundant part of an unnecessary but sufficient condition to produce a certain effect, where the condition is the cluster of factors. Given what was said about the possibility of prevention, what necessitation$_1$ has to say about it? Its proponents argue that if prevention takes place, something must have altered or removed one (or all) of the causes, thus making the causes no longer sufficient to produce the effect.

Another problem that necessitation$_1$ faces concerns its alleged compatibility with many different causal theories. Although the Mill–Mackie framework is associated with regularity accounts of causality, the authors state that the approach is much broader than this, being compatible with all sorts of theories, including robust ones such as the neo-Aristotelian theories (Ioannidis, Livanios, and Psillos 2020: 294). One should be cautious about this conclusion. From our brief analysis of the senses of necessitation, we can observe that a greater strength of necessitation is associated with a certain philosophical program. This becomes clearer when we move from necessitation$_1$ to necessitation$_2$ and are confronted with a loaded metaphysical apparatus, one that relies on natural kinds and essences to establish necessities, but also one in which dispositions are expected to perform a multitude of metaphysical roles. It would be strange, to say the least, if the proponents of necessitation$_2$

were looking for a weaker necessitation, given their explanatory ambitions through dispositions. In the same direction, it would be at odds with a neo-Aristotelian approach to consider necessitation as so weak and devoid of a productive aspect that it could account — at least partially — for how causes necessarily bring about their effects. Whilst it is clear that necessitation$_1$ is compatible with many realist theories, this alleged virtue ceases to exist when we consider theories where necessitation is expected to be stronger precisely because of its association with other theoretical notions.

Furthermore, it's worth reminding that Mackie himself gave up the Mill-Mackie framework in search of a more productive form of causality, where causal necessity is understood in a similar vein to natural necessity.[13] As Mackie himself asserts:

> What is called a causal mechanism is a process which underlies a regular sequence and each phase in which exhibits qualitative as well as spatio-temporal continuity (...). In relating natural to logical necessity and to the incompatibilities of colours he is adhering to a rationalist tradition; instead of anything of this sort I find that his transcendent hypotheses reveal only continuities and persistences; these are an empirical counterpart of the rationalists' necessity. (Mackie 1974: 222–223)

Surely no one must accept Mackie's reasons as sufficient to bury the Mill–Mackie approach. Nonetheless, when supported by the above context, Mackie's motivations are quite telling: he sought a theory that could say more about causality and its features, particularly causal production and causal necessity. When this attitude is contrasted with that of causal sufficiency, it becomes obvious that we could and should say more about the matter. For this, necessitation$_1$ won't do.

On *necessitation*$_2$, there have been some recent suspicions about it since the dispositional essentialist programme is responsible for the viability of this kind of necessitation and has faced reverses recently.[14] Indeed, one should not be moved to consider or discard philosophical ideas on the basis of suspicions, but if one manages to provide an argument that does not rely on it, its eventual downfall won't be a problem for necessitation. Sadly, there is a subtle but relevant problem: given the role that dispositions have on necessitation$_2$, such necessity is not causal in a proper sense, as it does not proceed from the nature of causality. The dispositions are the ones doing the metaphysical heavy lifting, and it is far from clear that they are strong enough for the purposes to which their proponents subject them. Even if one accepts a posteriori necessities, one thing is to attribute necessity to the particular's possession of some dispositional property; a very different one is to suggest that a disposition triggers its manifestation by metaphysically necessitating it (Schrenk 2010a: 172–173). For the latter, dispositional essentialism will unfortunately not suffice.

Ironically, the dispositional essentialist apologist ends up arguing for something akin to a version of the reduction sentences proposed by the Humean reductive anal-

ysis (Lewis 1997) by suggesting that dispositions cannot fail to trigger their manifestations (Schrenk 2010a: 173), which goes in the opposite direction of the conditionality that guides dispositions.[15] Thus, it is no surprise that this kind of necessitation will be susceptible to counterexamples, such as finks and antidotes (Schrenk 2010b; Mumford and Anjum 2011).

With respect to *necessitation*$_3$, besides facing the same difficulty that necessitation qua natural necessity faced due to necessitation being explained by the particulars' natures, it encounters an additional challenge: regardless of the unimpedible qualification, Freddoso quickly observes that merely asserting that *A*'s production of *C* is unimpedible due to a certain kind of necessity will not be enough to secure real unimpedibility. As the source of necessitation lies in the nature of particulars, such tendencies, even the deterministic natural ones, could still have their outcomes prevented without much effort (Freddoso n.d.: 1–2).

Although none of the senses of necessitation presented delivered an appropriate response to the problem, it seems that unimpedibility can be salvaged from its deficiencies. As we have just seen, the difficulties of unimpedibility lie in its commitment to natures as the source of necessitation and the lack of an ontological feature strong enough to secure necessitation against prevention. That being said, a first step is to look elsewhere for something that can play this role; or maybe consider where *not to look*. From what we have discussed so far, the idea of dispositions is always lurking in the shadows: it is by means of dispositions that entities manage to causally interact with reality and secure the alleged necessities their theorists postulate.[16]

One may remain unconvinced that dispositions are to blame. It may even be argued that it is the dispositional essentialist understanding of dispositions that is unsuited for this task, but not dispositions on their own. In this case, we may capitalize on Schrenk's short but fruitful reflection regarding dispositions:

> [O]ntologically, there clearly are conditions in which, for example, fragile glasses always break, live wires do conduct electricity, salt definitely dissolves, etc. The trouble is not that these conditions do not exist, the trouble is that we fail to be able to spell out exactly what they are in such a way that we arrive at a non-gappy, non-empty, non-circular counterfactual analysis which can be said to reductively analyze the dispositional predicate. (Schrenk 2010a: 174–175)

Despite the fact that Schrenk is concerned with the reductive analysis of dispositional predicates, we may bring his rationale into our discussion about dispositions: most dispositionalists — at least the causal necessitarianist ones — will agree that once certain conditions occur in reality, a disposition will always trigger, such that if the same occurrence happened once, twice, and infinitely many times, it would always trigger. However, when we reconsider these same conditional occurrences, now coexisting with a multitude of causal interactions in the world, something seems to

discourage us from confidently asserting that dispositions are indeed endowed with necessitation, for we can be proven wrong quite easily. Sure, we could maximally specify the relevant circumstances related to the stimulus conditions and the triggering manifestations, and even introduce ceteris paribus conditions, but at the cost of arriving at a circular explanation, as Schrenk entertains. Otherwise, reality immediately disappoints us.

This challenge has haunted dispositions since the early days of the topic in contemporary metaphysics. Harré and Madden tried to secure causal necessity by arguing that the nature of the particular and the obtaining of certain conditions would necessitate the manifestation's outcome (Harré and Madden 1975: 132). When considering the possibility of a change in the course of nature that would prevent the obtaining of a disposition's manifestation, they contend that such a possibility is uncontroversial and wouldn't be enough to support Hume's conclusion of the absolute independence of cause and effect (Harré and Madden 1975: 145). Unfortunately, antinecessitarians who happen to be causal realists need not go that far; they may promptly concede that there is indeed a dependence between cause and effect most of the time, this dependence being a middle ground between necessity and absolute contingency, just as Mumford and Anjum (2011) maintain.

It's no coincidence that dispositional essentialists like Bird tried to push the problem of finks and antidotes to the macro-level phenomena and proposed that fundamental dispositions are immune to finks and antidotes due to their very nature.[17] This way, at least at the fundamental level, dispositions would be free from them. However, when considering the possibility of a further condition that acts like an antidote and prevents the disposition from bringing about its manifestation, Bird can only offer us an expectation for a promising prospect with antidote-free properties due to the direction and development of physics (Bird 2007: 63). Ellis goes even further by introducing an explicit clause that excludes defeating conditions that mask the disposition's manifestation (Ellis 2001: 286).

Granted that none of the above arguments constitute a decisive blow against dispositions as the source of causal necessitation, let us at least entertain the idea that causality may be equally fundamental to dispositions in this respect and turn our attention to causality itself.

As suggested above, difficulties concerning necessitation$_3$ are due to its commitment to natures as the source of necessitation and the lack of an ontological feature strong enough to secure necessitation against prevention. As an alternative, we may look for the source of necessitation in some ontological feature of causality that we deem strong enough to secure necessitation against prevention. Although Freddoso didn't succeed in providing it, his insight concerning unimpedibility and the idea of something not being preventable may provide us a route to follow.

According to necessitation$_3$, we have

> Necessarily, if *A* produces *E* in *C* by a necessity of nature, then *A*'s production of *E* was unimpedible.

Necessitation$_3$ gets things right when it emphasizes the role of causal production and considers unimpedibility to secure necessitation — even if it doesn't succeed in its defense. But necessitation$_3$ is also correct in another respect: it preserves the idea of a particular causing something rather than a floating-free property. Causal realism tends to stress the role of particulars in causal affairs, even if there is some divergence about whether the particulars or the properties are to be regarded as the kind of entity responsible for the causal work.[18] As the approach we will pursue here favors the role of particulars, we shall preserve this intuition in our formulation. In this framework, properties and particulars are taken to be an inseparable duo: particulars are the very reason why their properties exist, and properties are specifications of how particulars are — the means by which they interact with reality.

The first amendment is to abandon the set of circumstances *C* to avoid ceteris paribus clauses and circularity, as we have seen above.

The second amendment to be made is to rework it in more causally explicit language. Instead of talking about an agent *A* producing *E* in circumstances *C*, we may talk about a complex of substances S_1, S_2, and S_3, with their respective causal powers p_1, p_2, and p_3 such that we have $S_1\{p_1\}$, $S_2\{p_2\}$, and $S_3\{p_3\}$. Although we're presenting substances with a causal power each, notice that nothing prevents the possibility that the same substance has two causal powers for the same causal relation.

The third amendment is to present a more detailed account of causal production. As none of the senses of necessitation managed to surpass the difficulties presented by the possibility of prevention, and as we are venturing towards an unconventional approach that will not explain causal affairs by means of dispositions, we need to elaborate on how causal production is to be understood and how we may go from causal production to causal necessity.[19] Though necessitation$_3$ says something, there is a considerable explanatory gap between the action of the potential agent *A* and the effect *E* she produced. Here we may take advantage of necessitation$_3$ and supplement it with Ingthorsson's approach to causality as our starting point, followed by some punctual changes.[20] We'll have something like this:

(a) **Interaction:** an interaction — which we'll represent by the symbol "$\rightleftarrows$" — is the mutual exertion of causal influence between two substances — or of the same substance upon itself as another — as they change each other through their causal powers.[21] Thus, when two particulars influence each other by means of their causal powers, they interact with each other.

(b) **Reciprocity of Interactions:** If an interaction demands that causal influence is mutually exerted by substances, every instance of an interaction will produce

an additional interaction. This interaction is reciprocal towards the interaction that influenced it, reducing its magnitude, and takes place concomitantly with the former as it's progressively produced.

Take the familiar example of two billiard balls colliding with each other. Let us call them *A* and *B*. First, *A* moves towards *B*, which is inert. Here we still don't have the causal process of collision. Then, *A* hits *B* and transfers some of its momentum to *B*, leading to *A*'s loss of (some of its) momentum and *B*'s motion. However, just as *A* transfers its momentum to *B*, *B* will offer resistance to *A*'s impact, which will produce some dissipation of *A*'s momentum and reduce the momentum available to be transferred to *B*. When *B* is set in motion, it will have less momentum than *A* initially had. In this example, the resistance offered by *B* which also affects *A*'s magnitude of momentum is a clear example of reciprocal interactions.[22]

(c) **Causal Production:** if an interaction demands that causal influence is mutually exerted by substances, every instance of an interaction will also produce further interactions as a consequence from a previous interaction of the powers which integrate the complex of causes. Each of these interactions take place concomitantly with the former as they are progressively produced, and each of these interactions will produce further interactions in this same pattern until the process achieves its outcome. As each interaction is produced, changes are generated in the substances supporting the causal process.

On this perspective, each interaction can be understood as a cause and each change they produce as the effect. On these grounds, Ingthorsson suggests that "the interaction whole as the cause, and the change in the compound whole of interacting things as the effect" (Ingthorsson 2021: 68–69).

(d) **Simultaneous Causality:** as soon an interaction takes place between two substances and one of them comes to causally influence the other, as soon the causal influence will take place and the causally influenced substance will interact by reacting and offering resistance against the former — hence we'll have a mere reciprocity of interactions — or also by generating a productive and simultaneous interaction over time, unfolding in a series of successive changes due to the causal powers of both substances (Ingthorsson 2021: 76–77).

Let us entertain another example to make the distinction more tangible. Consider the chemical reaction between sodium and water. This chemical reaction is known to be an explosive reaction. In its usual form, we have a portion of sodium, S_1, which has as one of its properties reactivity, $\{p_1\}$. This same portion of sodium is in solid state, $\{p_2\}$. Because water, S_2, is composed of oxygen, it has the causal power of acting as an oxidizing agent, $\{p_3\}$. The water is in liquid state, $\{p_4\}$. When these substances interact, we have a causal process

$S_1\{p_1, p_2\} \rightleftarrows S_2\{p_3, p_4\}$, a chemical reaction. In this chemical reaction, when sodium interacts with water, hydrogen is released. This release leads to the warming of the sodium which, reaching a self-ignition point, goes into combustion. Although it takes a few seconds for combustion to occur and produce its typical outcome, the process is mediated by a series of simultaneous interactions where each of the substances and its properties play a relevant role for its conclusion.

(e) **One-Sided Existential Dependence:** since asymmetry is reputed as one of the distinctive features of causality, it's not unusual that the literature takes this same asymmetry to have a temporal profile. The main reason is to capture the causal asymmetry between causes and effects. However, for those who adhere to simultaneous causality, a different but elegant alternative is available: the causal asymmetry is to be understood as a form of one-sided existential dependence relation, where some substances and their interactions in an instant t_1 existentially depend on and these same substances and their interactions in a prior instant t. Though we have symmetric interactions between the substances, as the process unfolds — in virtue of the interactions — the relations between the many stages of a process is precisely an asymmetric one.

Among the features presented above, two will be of particular interest in addressing this argument: causal production and simultaneous causality. Where the former emphasizes the productive aspect of causality which Freddoso could merely nominate without providing further explanation, the latter emphasizes the temporal aspect of causality: an unfolding of productive interactions that temporally overlap due to the mutual influence between the substances. With these things in mind, it's quite easy to see how the idea of unimpedibility is present here. Just as a causal process develops, one cannot talk about the absence of its effect when a change has been produced.

But what about the possibility of prevention? Neither necessitation$_1$, necessitation$_2$, nor necessitation$_3$ could tackle it. All they could say is the same as what Harré and Madden said decades earlier: in such cases, something must have altered or excluded one of the causes. In other words, once the causes are interacting, something will happen. In this respect, many of the causal necessitarianists can argue that their theory delivers the same result, even in the senses of necessitation presented above. However, what will happen in cases where a cause is altered or excluded seems to contradict the very idea of necessitation. Here we may go even further: once the causes interact, it is not possible to prevent *that very causal process* without the obtaining of their effects. As soon as substances interact with each other, they produce changes in one another. In this approach, causal production and simultaneous causality are intertwined. In other words, there is no interaction without change. All thanks to causal production and simultaneous causality.

Now we may introduce *necessitation*$_4$ as inevitability:

> for a substance S with a property p, If $S_1\{p_1\}$ and $S_2\{p_2\}$ interact such that we have a causal process $S_1\{p_1\} \rightleftarrows S_2\{p_2\}$, it's not possible to prevent the causes without the obtaining of their effects.

Having found the relevant sense of necessitation for our purposes, before we argue whether it is truly the case that simultaneous causality cannot be prevented, let us say something about causality, how it is usually understood, and the problem that emerges from this contemporary understanding.

2. The Received View and its problem

Those acquainted with analytic philosophy — particularly its metaphysics — have surely heard of causal relations as a relation where *C* causes *E*. In fact, a more accurate description of this view would be something like this:

> Causality is a two-place asymmetric relation between two events, *C* and *E*, where *C* causes *E*.

It would be no exaggeration to suggest that this is the intuitive conception of causality in the contemporary analytic tradition and that it remains a quite popular view among contemporary metaphysicians. Let us call it the *received view*.

The first component of the received view is the *event ontology*. Events have been defended by several philosophers in the analytic tradition. Going back to the roots of analytic philosophy (Russell 1927; Whitehead 1919; Broad 1923; Ducasse 1926) and all the way to the present time through four-dimensionalist approaches to persistence (Sider 2001; Hawley 2001) and contemporary process philosophy (Meincke 2019; Nicholson and Dupré 2018; Baratella 2019, 2023), events are one of the most common kinds of entities — if not the most common one — proposed in the history of this tradition. An event can be characterized as "a happening with a spatio-temporal location" (Emmet 1984: 6), where its spatial boundaries may be somewhat indeterminate, and its temporal boundaries are precise. Thus, the first landing on the surface of the Moon is an event; the 2025 FIFA World Club Cup Finals is an event; your marriage to your significant other is an event; and so on.

Due to its peculiar nature, events don't move (Dretske 1967); hence, they cannot change. In the event ontology, change is commonly understood as the difference or variation in the properties of a given particular (Russell 1903; Sider 2001). What we perceive as change can only be obtained through the composition of a sequence of events that succeed one another. It's for this very reason that the received view not only postulates events, but *C* and *E* as events. As *C* embraces every particular

relevant to the cause of a certain occurrence, *E* embraces the particulars relevant to the outcome of a causal relation, along with their respective differences or variations in their properties.

The received view also suggests that a causal relation may be obtained with the following steps: let *C* be the event described by the statement 'The throwing of the brick at the window by Jimmy' and *E* the event described by the statement 'The breaking of the window'.[23] The next step is to introduce an asymmetry relation, allowing us to capture the idea that *C* causes *E*, but not *E* causing *C*. However, asymmetry on its own says nothing about the temporal aspects of causality. Here is where the second requirement of the received view is regimented into the causal talk: *temporal sequentiality*. As *C* and *E* are distinct entities and *E* cannot exist without *C* coming into existence and then ceasing to exist due to its occurrence — because events are temporally-sliced entities whose existence comprises the descriptions attributed to them — for *C* to causally influence *E*, it is necessary that *C* is not only asymmetric but, in some sense, prior to *E*.[24]

Recently, events have been under fire in the literature.[25] Curiously, even though much has been said about events, close to none has been written presenting objections against temporal sequentiality or the received view as a whole. And therein lies the problem: although we're talking about the received view, even among those discontent with the received view, temporal sequentiality is assumed — sometimes defended. In fact, from the senses of necessitation we've seen so far, *both necessitation*$_1$, *necessitation*$_2$, *and necessitation*$_3$ *adhere to temporal sequentiality*. As long as one is committed to temporal sequentiality, one is bound to sequential causality, even if one explicitly rejects the event ontology. According to *sequential causality*, causes are temporally prior to their effects, so that causes and effects are ordered sequentially, with the cause followed by its effect. Therefore, the effect can only occur after the causes have occurred and ceased to exist.

A few lines above, we have qualified the contributions related to temporal sequentiality: we have stated that very few have been written in this respect. And there is a good reason for this qualification. One of the few memorable exceptions is Russell (1913), which stands to this day as the most decisive strike on sequential causality: according to Russell, if time is dense, since there is no overlap in time, cause and effect must be separated by a positive time interval.[26] If this is the case, one may add a third, a fourth, a fifth, and infinitely many instants between any two instants of time. This is particularly important for two reasons: in the first scenario, this might be done between the last moment of the existence of the cause and the first moment of the existence of the effect. In this case, once someone begins to add infinitely many instants between the two relevant instants for causality, causality cannot take place since there won't be a passage from the cause to the effect.[27] In a second scenario also considered by Russell, the same problem can be extended to all the instants that

C comprises: for any two instants contained within *C*'s time-interval, there will be infinitely many instants between them. The problem is even worse since it's not a matter of *C* not ceasing to exist and being succeeded by *E*, but none of *C*'s time instants can be completed to produce change. For any possible change that could be produced by the passage from a given time instant to another, such change will be prevented by the infinitely many instants between the mentioned time instants.

For most of the 20th century metaphysics, this was far from being a drawback given the antirealist tendencies of the period. Nevertheless, times have changed, and realism is in vogue now. Thus, attempts to revive sequential causality have been made. Following this path, Hansson-Wahlberg (2017) employs his semi-open interval strategy. An interval can be defined as the set of all numbers lying between two boundaries, which may or may not be contained by the interval. The smallest value of an interval is its lower boundary, and its largest value is its upper boundary. Hansson-Wahlberg aims to exploit the fact that, just as the interval itself will contain any numbers within its boundaries, semi-open intervals will contain all numbers *except one of their boundaries*. Many combinations are possible: one may have *C*'s semi-open interval [t,*) with *E*'s closed interval [t*,t**], *C*'s closed interval [t,t*] and *E*'s semi-open (t*,t**], both *C* and *E* with semi-open intervals where *C*'s upper boundary and *E*'s lower boundary combined allow for a sequence from one to another, and so on (Hansson-Wahlberg 2017: 109-110). As Hansson-Wahlberg himself states: "there is no first instant from there is no first time of the effect's existence, only a last time of its non-existence (as well as of the cause's existence), the instant t*" (Hansson-Wahlberg 2017: 110). Therefore, it seems that Hansson-Wahlberg's strategy is successful and sequential causality can resist the possibility of temporal gaps between cause and effect.

In a recent paper, I delivered some objections against Hansson-Wahlberg's argument (Silva 2025). For this paper's purposes, the relevant objection is the one concerned with Hansson-Wahlberg's above-mentioned strategy: the argument of the possibility of prevention.[28] In order to properly grasp the argument, some prior considerations are needed. First, let us consider a complex of causes c_1–c_n that act together to produce a certain effect. If one (or all) of its causes suffers a qualitative alteration due to the causal contribution of an additive factor, the causal process would have suffered an interference.[29] If one (or all) of these causes were neutralized due to the causal contribution of an additive or subtractive factor, then the causal process would have suffered a prevention (Silva 2025: 122). The key idea is that as interference *changes how something happens*, prevention *changes something from happening*. On prevention, this additive or subtractive factor, alien to the causal process, comes to interact with one of the process's causes. As a result of this interaction, one of the causes cannot contribute to the causal process, preventing the process from producing the effect.

Regarding the additive or subtractive factors, they can be defined as follows: a factor is subtractive if the causal process is prevented by the interaction of the factor with one (or all) of its causes before its beginning. A factor is additive if the causal process is prevented by the interaction of the factor with one (or all) of its causes after its beginning (Silva 2025: 122).[30] What will determine whether a factor is additive or subtractive is the instant of its interaction with the causes of a causal process. The distinction is of particular importance as it allows for a more fine-grained analysis of the temporal structure of causal production. Once considered, it becomes clear that the prevention of a subtractive preventer is not truly a case of prevention in the relevant sense of the matter, since the causal process wouldn't have begun yet; even worse, it couldn't even begin due to the absence of causal production of one of its causes as an outcome of the interaction with the subtractive preventer. On the other hand, if the causal process begins and, in a certain moment in its course, it interacts with an additive preventer, the continuity of the causal process is obstructed by the interaction. Nevertheless, that's not to say that causality hasn't taken place; instead, what was prevented was its typical outcome (Silva 2025: 122).

After introducing the conceptual apparatus, we may proceed to the temporal structure of sequential causality: as interaction takes place, there is a moment in time that corresponds to the interaction of the causes. To better suit Hansson-Wahlberg's strategy, the causes' interaction should be taken as ranging over a closed time interval $[t, t^*]$. As the causes exhaust their potential through causal interaction, they are succeeded by the effect. Once again, the effect can be conceived as a time interval that ranges over a semi-open time interval $(t^*, t^{**}]$, preserving Hansson-Wahlberg's rationale to avoid Russell's objection. Under the framework of sequential causality, cause and effect are sequentially ordered and the effect can only be brought about after the cause has exhausted its causal role, i.e., it has ceased to exist (Silva 2025: 122–123).

Now let us introduce the additive preventer into the framework of sequential causality and check if Hansson-Wahlberg's proposal is able to accommodate the argument presented by Mumford and Anjum, especially when considering that Hansson-Wahlberg's strategy is directed towards them. As the powers start to interact, the causes will interact over the closed time interval $[t, t^*]$, which will be obtained. However, the effect will only be obtained on the half-open interval $(t^*, t^{**}]$; until then, all that we have are interacting causes and no effect (Silva 2025: 123). As far as we know, this is not metaphysically possible.[31]

How can sequential causality make sense of this? It cannot; although sequential causality manages to prevent the temporal gaps between cause and effect with the semi-open time interval, given the continuous nature of time, as cause and effect are separated and the effect can only be brought about after the cause has ceased to exist, any of the infinitely many instants inside the cause's time interval allows for

the existence of an additive preventer. Once the additive preventer interacts with the causes, the effect will not be produced, whether during semi-open intervals, overlapping time intervals, or even without time intervals: it is only required that the cause occurs at one time and the effect at another. In other words, the problem is at the heart of sequential causality (Silva 2025: 123–124).

It could be argued that Hansson-Wahlberg could explain the additive preventer cases away by relating them only to prevented causal occurrences. If this were the case, there would be nothing wrong, since prevention would be doing what is expected. Alas, it cannot be assured that prevention will only happen in these cases; even worse, the possibility of prevention does not apply to particular occurrences, but to a hypothetical one (Silva 2025: 125). If this is so, the possibility of prevention can be generalized to all causal relations and for any cause, if a cause happens without its effect, then this cause can be prevented without the obtaining of the effect (Silva 2025: 124–125).

As we can see, there is no way out for sequential causality.

3. From productive simultaneity to necessity

Silva (2025) presents the case in favor of the unpreventability of simultaneity. However, this very same case entails a further conclusion: when combined with productivity, simultaneous causality induces necessity *precisely because it cannot be prevented*.[32] To show how this is so, let us consider some argumentative steps presented throughout the argument:[33]

(1) Causes happen without their effects.

(1) is obtained from the very characterization of sequential causality. If causes and effects happen temporally separated such that the effects can only come into being after the causes have ceased to exist, it is uncontentious that causes happen without their effects. Otherwise, it would not be a proper characterization of sequential causality.

(2) It is possible that causes happen without their effects.

(2) introduces possibility on (1) in order to assess if sequential causality can withstand the argument of the possibility of prevention. It should be noted that (2) is not committed to a particular system of modal logic: at least since Aristotle, if something is actual, then something is also possible. However, this will only be true this-worldly, which is sufficient for our argumentative purposes.

(3) It is possible that causes are prevented without their effects.

(3) is the argument of the possibility of prevention. As we've seen above, the argument's goal is to demonstrate how the temporal structure of sequential causality allows that all instances of causality are preventable in a relevant sense through the action of an additive preventer, thus rendering sequential causality untenable.

But what about simultaneous causality? In order to analyze it, we may introduce (1*)

> (1*) Causes happen with their effects.

On simultaneous causality, effects are produced as soon as their causes interact with each other due to the productive aspect of causality. That's to say: the effects come into being without their causes going out of existence. If we apply the same reasoning here that we applied to (1), we would conclude that the temporal simultaneity of causes with their effects leads them to happen together due to their temporal overlap.

One may clearly see why (3) is so relevant to the argument: as I have addressed elsewhere (Silva 2025: 124–125), (3) is problematic for sequential causality precisely due to the presence of a temporal gap that ranges over all the instants during the interval that contains the cause and the effect. However, as we proceed to simultaneous causality and submit it to (3), we immediately notice that this doesn't follow due to the lack of a temporal gap between the causes and the effects, which is responsible for allowing the interaction of the additive preventer with some (or all) of the causes. Therefore, we may state (4)

> (4) It is not the case that it is possible that causes are prevented without the obtaining of their effects.

Thus, necessity can be obtained from causal production and simultaneous causality.

4. Potential replies

4.1. The Conceivability–Possibility Argument (CP)

Before inquiring about CP, let us become acquainted with conceivability and its role in the argument. Conceivability-based approaches come in two varieties: epistemic accounts (Yablo 1993) and non-epistemic accounts (Chalmers 2002, 2010).[34] Epistemic accounts of conceivability tie what is conceivable to an individual's capacity for knowing or believing, "or what concepts or modes of presentation he has available or is using to think about the situation" (Worley 2003: 17). Non-epistemic accounts, however, take conceivability to be determined "by conceptual coherence or incoherence, and thought in terms of an ideal conceiver" (Geirsson 2005: 290). Epistemic accounts

are agent-dependent, while non-epistemic ones are agent-independent. Agent-independence is significant for conceivability arguments since it offers a robust tool for generalizing metaphysical arguments. Hence, our discussion will revolve around this.

Chalmers introduces the notion of ideal conceivability, which also comes in two versions and formulates them as follows (Chalmers 2002: pp. 149, 153):

> (INC) a proposition p is ideally negatively conceivable iff p is not ruled out a priori, or in other words, iff p is contradiction-free.
>
> (IPC) p is ideally positively conceivable iff there is a coherent imagined situation, S, such that S verifies, or in other words, entails p.[35]

First, one may clearly see that p's ideal positive conceivability is tied to its being contradiction-free. If p is not ideally negatively conceivable, then one cannot conceive a coherent situation that verifies p (Feng 2019: 137). Therefore, IPC entails INC. Second, IPC and INC only establish the criteria for ideal conceivability. A further step towards possibility is required:

> (CP–) Ideal negative conceivability entails possibility.
>
> (CP+) Ideal positive conceivability entails possibility.

As Feng notes, Chalmers takes ideal conceivability to be equivalent to logical possibility, and when he obtains CP, logical possibility entails metaphysical possibility. This is particularly relevant since INC requires that p is contradiction-free and IPC also needs to be contradiction-free. Given how strong logical possibility is, it's no surprise that contradiction is also to be understood in a strong sense: p is logically possible if and only if it is immune to any kind of contradiction, be it logical, mathematical, conceptual, semantical, etc. (Feng 2022: 1771).

Once this theoretical machinery is presented, CP can be established. The argument has the following structure (Feng 2019: 137):

> It is ideally conceivable that p.
>
> Ideal conceivability entails possibility. (CP+ or CP–)
>
> Conclusion: It is possible that p.

In our case, a potential objector could insist that, even if simultaneous causality and causal necessity are accepted in the terms presented above, one can still conceive that some cause qua addictive factor could interact with the complex of causes and somehow the complex of causes wouldn't produce any effect.[36] If one can conceive that this is the case, one can conclude that this is possible. And if this is possible, it seems that causal necessity is not the case. Hence, we would have something like this:

> It is ideally conceivable that a cause can interact with an interacting complex of causes and prevent the complex of the causes from producing any effect.
>
> Ideal conceivability entails possibility.
>
> Conclusion: It is possible that a cause can interact with an interacting complex of causes and prevent the complex of the causes from producing any effect.

Now, let's proceed to the rebuttal. Recently, Feng (2019) delivered a concerning argument against CP exploiting both modal and non-modal versions of CP, the latter being the important one for our purposes. To put it briefly, once CP- and INC are accepted, one may conclude that all necessary propositions are knowable a priori and the following can be derived (Feng 2019: 144):

> (1) For any proposition p, if p is not a priori false, then p is possibly true.
>
> (2) For any proposition p, if $\neg p$ is not a priori false, then $\neg p$ is possibly true.
>
> (1) is equivalent to (3):
>
> (3) For any proposition p, if p is necessarily false, then p is a priori false.
>
> (2) is equivalent to (4):
>
> (4) For any proposition p, if p is necessarily true, then p is a priori true.
>
> Based on (3) and (4), (5) holds:
>
> (5) For any proposition p, if p is either necessarily true or necessarily false, then p is a priori true or a priori false.

In turn, that p is either necessarily true or necessarily false can be formalized as $\Box p \vee \Box \neg p$. Then, (5) is equivalent to (6) (Feng 2019: 144):

> (6) For any proposition p, if $(\Diamond p \rightarrow p) \wedge (\Diamond \neg p \rightarrow \neg p)$, then p is a priori true or a priori false.

Before a reply is even proposed, an objector could immediately suggest that there is something wrong with (3) and (4). Following Kripke, Water is $C_3H_3O_2$ is necessarily false, but it doesn't follow that Water is $C_3H_3O_2$ is a priori false.[37] One should not conflate Kripke's modal epistemology with Chalmers's. For one, Kripke is moving from a posteriori considerations to metaphysical matters supported by possible worlds via rigid designators; Chalmers is moving from a priori considerations to metaphysical matters supported by possible worlds via the equivalence between ideal conceivability and logical possibility. Not only will their conclusions be quite different, but Kripke's movement is this-worldly–transworld, while Chalmers's movement is transworld–this-worldly. Second, if one accepts Kripke's a posteriori necessities, CP

is ruled out since some identity statements are necessary but only knowable a posteriori (Feng 2019: 136; Feng 2022: 1772). Thus, the objection disappears.

Now, for our first rebuttal, we may stop at (5). As we have seen, both INC and IPC require that a proposition is contradiction-free. Reflecting on this requirement and on the fact that IPC entails INC, one could ask: what is the difference between conceivability and logical possibility? And one would have as an answer: none. As we observed above, Feng stresses the equivalence between conceivability and logical possibility in Chalmers's argument. We arrive at what the literature calls Modal Monism. Thus, not only is the literature aware of it, but Chalmers himself makes this equivalence explicit throughout his works (Chalmers 1997: 123; Chalmers 2010: 185, 191).[38] If this is so, a fitting question arises: if metaphysicians don't take logical possibility on its own as a useful guide to metaphysical possibility, why should they take logical possibility with extra steps as such?

But one may insist that if the argument follows, we should follow it wherever it takes us. That being so, we may offer a further response:

> It is ideally conceivable that a cause can interact with an interacting complex of causes and cannot prevent the complex of the causes from producing any effect.
>
> Ideal conceivability entails possibility.
>
> Conclusion: It is possible that a cause can interact with an interacting complex of causes and cannot prevent the complex of the causes from producing any effect.

Although one comes to know causality through experience, none of the argumentative steps we presented relied on a posteriori knowledge; the argument as a whole was developed by considering whether any contradiction would follow once a certain temporal structure of causality is assumed. In other words, the argument is a priori.

At first, our objector might believe we have gone insane, as our own argument seems to do nothing for us; instead, it may seem to emphasize how simultaneity is devoid of necessity. We only presented the negated version of what we should reply. But that's where the problem lies: according to (5), for any a priori contradiction-free proposition p, CP delivers a disjunction where p is either true or false. However, the motivation behind CP is that it would somehow reveal to us some sort of modal knowledge. If that's all that CP does, for any a priori contradiction-free proposition p, CP on its own cannot provide us with an argument for deciding which disjunct is true. Thus, CP needs to be supplemented by an independent argument and it is insufficient as a guide to metaphysical possibility. Therefore, CP is not the case.[39]

However, the above is still not a decisive objection. Even if it provides an argument against CP, one can still amend CP if an independent argument is provided. If

so, we may rely on a stronger argument, such as the one proposed by Feng (2019). Going back to (6), we have that for any a priori proposition p, between p and $\neg p$, one is a priori true and the other is a priori ruled out. According to INC, between p and $\neg p$, only one can be ideally negatively conceivable. Furthermore, as we've seen, IPC is tied to INC since one cannot conceive a coherent situation that is not contradiction-free. Therefore, p and $\neg p$ cannot be ideally positively conceivable either. Therefore, between a CP argument and its negated version, one of them is not sound (Feng 2019: 144–145).

Feng goes beyond and considers that we have managed to provide an independent argument. In the first scenario, the independent argument allows us to infer that p is ideally negatively conceivable. If so, $\neg p$ is inconceivable; thus, it is a priori false. Therefore, the argument shows that p is a priori true; therefore, it is true. However, if one only comes to know that p is true due to an independent argument, why should anyone resort to CP-? Turns out that CP- is redundant. One could think that arguing from CP+ would yield a different result. Unfortunately, since CP+ is tied to CP-, the same difficulty will taint any argument that takes CP+ as its starting point instead of CP-. Hence, we can conclude that either CP is redundant, or the soundness of CP cannot be justified (Feng 2019: 145).[40]

4.2. The Merely Change Argument

Someone could object that our argument for causal necessity is not strong enough. According to this objector, it could be conceded that simultaneous causality cannot be prevented. However, if what we consider to be the effect is the mere change produced by the interactions of the substances through their causal powers, the causal process clearly has not achieved its typical outcome. Hence, we have merely change.

Let us try to understand our objector. If someone believes that merely change or a single change is not enough to talk about causality, it seems that this person's objection relies on the fact that a single change is a unique step in a causal march towards its typical outcome. Therefore, when someone argues that causality is always preventable, we should understand that what this person has in mind is causality qua the causal process in its totality. This reasoning aligns with those who reject mere change on the grounds that the typical outcome was not produced. If causality is to be unpreventable, says our objector, it should resist any additive preventer and still produce the same typical outcome.

First, there is a distinction to be made between *unconditional necessity* and *conditional necessity*, a distinction that goes back to Aristotle and can also be found in the recent literature (Ingthorsson 2021: 89). No one who talks about necessity in causal affairs expects it to be endowed with the former instead of the latter. It is for no other reason that Mumford and Anjum's objection is unsuccessful: the authors expect to

rebut causal necessity by understanding it as unconditional necessity (Mumford and Anjum 2011: 59), which is at the heart of their antecedent strengthening objection. However, none of the necessitarians take it to be as such, not even necessitation$_4$ — which is probably the stronger variety of causal necessity. Even when a causal process is obtained and produces its typical outcome without any action of additive preventers, some conditions, the causes, need to be satisfied for necessity to be the case.

The second reply is more of a scorched earth solution than a genuine one. If someone thinks that this mere change should not be considered causality, but rather something that falls short of it, it should be noted that sequential causality cannot even deliver this response since change will not be possible due to the argument we have considered.

The third rejoinder is the standard reply to this kind of objection. According to it, it is clearly a causal process since some other cause interacted with the complex of causes of the causal process and contributed to the outcome (Ioannidis, Livanios, and Psillos 2020: 294; Gozzano 2020: 38; Ingthorsson 2021: 91–92). In fact, even other causal necessitarianists argue that their theory delivers this same result, just as we considered in the end of Section 1. No one should be surprised to see a different outcome with a different causal contribution. In short: different causes, different effects. However, it should be noted that, even if one accepts this reply, all the other senses of necessitation — except for necessitation$_4$ — still have to revisit the argument of the possibility of prevention if they wish to rehabilitate their respective approaches.

Despite all our efforts, an obstinate objector could insist on refusing to accept any of the arguments presented above and further argue that, if this is so, necessitation$_4$ does not provide grounds for the stronger conclusion it aims for compared to the other necessitarian alternatives. As we have stated, it's not possible to prevent *that* occurring causal process without the obtaining of their effects. Maybe we can seek help from Aristotle and his commentators. *Physics* III.1–3 is where the Estagirite digresses about what a change is. What Aristotle considers to be a change comes closer to our concept of a causal process. A distinctive feature that Aristotle attributes to a change is its incompleteness: changes are incomplete actualities.[41] Consider the housebuilding and the house that is being built. Housebuilding is only complete when the house has been built. As long as the building is in this process towards the built house, the change is incomplete. Changes present an instance of the so-called 'imperfective paradox': although changes exist while they are going on, they are not yet complete (Charles 2015: 189). An actuality is something that, when present, is the realization of the relevant potentiality. In the case of housebuilding, the potentiality is to be a house, and it will be realized when there is a house (Charles 2015: 202).

One could think that this only emphasizes the problem with the approach we have developed to causality, as such change would be present when a causal pro-

cess is already done. But here is the upshot: the success condition for the relevant potentiality to change is the change itself. Thus, instead of considering the success condition of the potentiality to be a house, the success condition to be satisfied is that of the potentiality to change a house. Hence, this actuality will be present as soon as there is a change of this type. As David Charles puts it: "Although the house may be the final goal, some goal is achieved in the very activity of housebuilding itself" (Charles 2015: 203).

Now, we must not expect that our peers will promptly become Aristotelians and take all this stuff for granted. But if we bring this rationale to our contemporary discussion about causal powers and causal processes, we can easily conceive how the distinctions match: causal processes are incomplete by their very nature because they are a continuous and productive unfolding of changes towards a typical outcome. Once they achieve this outcome, they are complete. However, one should not take this as a reason to deny that there is a causal process. Due to simultaneity and productivity, the causal process will happen in the very moment an interaction — the success condition — takes place.

5. Further considerations

Not only are there reasons to accept that there is indeed a necessary connection in causality, but causality's own structure explains its necessity. What follows from this?

A first consideration that can be positively asserted is that Hume's Dictum should pose no fear to metaphysical matters, at least as long as causal realism is accepted.[42] As we have seen, not only do Humeans accept the absence of necessary connections between cause and effect. Truth be told, not a few metaphysicians subscribe to this doctrine.[43] Once Hume's Dictum is laid to rest, immediate repercussions can be seen in other topics in metaphysics. On Persistence, for example, those who subscribe to four-dimensionalism tend to see change as the mere difference in the properties from one instant to another.[44] By showing how change relies on a real connection where different substances in a given time produce a necessary connection by means of their interactions, unless the four-dimensionalist gives us some reason to reject causality, it seems her theory would demand some adjustments to accommodate causality — which is doubtful.

A second consideration is that necessitation$_4$ guarantees the connection between cause and effect without incurring in the difficulties stressed by some authors we have seen in the previous sections. It also delivers the grounds for causal necessity without committing one to determinism, just as Anscombe (1971) intended.

A third consideration is that necessitation$_4$ provides a more substantial explanation for the modal profile of causality. On the one hand, it goes beyond modal

primitivism about causality by offering an explanation of causal necessity. On the other hand, it offers a more satisfying account of causal necessity when compared to other approaches, as it can address the argument of possibility of prevention. Although dispositional essentialists prefer to concentrate their explanatory power on essences, what we have seen so far should prompt one to consider whether it is appropriate to concentrate such explanatory power in one place when other concepts compatible with the relevant view can achieve the desired goal.

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Notes

[1]See Garrett (1996; 2008), Kail (2008), Waxman (2016), and Millican (2016).

[2]*A Treatise of Human Nature,* 1.3.14.20–21

[3]Lewis had also rejected the truthmaker theory precisely because of his commitments to the Humean doctrine, or, as he puts it, the principle that "gives us our best handle on the question [of] what possibilities there are" (Lewis 2001: 611). On Lewis and truthmakers, see MacBride (2005).

[4]Steward (2022) suggests that Anscombe should not be read as someone arguing against necessary connections but merely as suggesting that we have no grounds to suppose that causality is exceptionless, nor that universal determinism is true.

[5]For objections against their arguments, see Lowe (2012), Mackie (2014), Ioannidis, Livanios, and Psillos (2020), and Silva (2024, 2025).

[6]From now on, I'll talk about necessitation, necessity, and causal necessity as synonyms.

[7]As I am concerned with the causal realists' understanding of necessitation, I won't detain myself with reductionist approaches to causal necessity. For those interested in these approaches, see Brand (1976).

[8]Ellis also accepts categorical properties that constitute the real essences together with the intrinsic causal powers. As they have no relevance for our present purposes, I have abstained from mentioning their role.

[9]In Bird's ontology, necessitation$_2$ is explained by means of dispositions, which he calls potencies. According to him: "Necessarily, if the potency is instantiated and receives its stimulus, then the manifestation will occur." (Bird 2007: 64)

[10]Instead, Freddoso states in the manuscript that "*A*'s production of *C* was unimpedible", which I take to be a typo — and corrected in the version presented above — since it would make no sense to talk about *A*'s production of *C* when *C* itself is a circumstance for *A*'s production. Thus, *C* needs to be temporally prior or concomitant to *A*, but not produced by *A*.

[11]Note that Freddoso (n.d.) is not defending this approach; in fact, Freddoso has problems with this idea just as Mumford and Anjum (2011) do. However, his disagreement leads him

to present some interesting contributions to our discussion.

[12]The argument will be discussed more extensively in the upcoming section. For now, this brief qualification will be enough.

[13]Schrenk (2017: 199) appropriately observes how Mackie (1974) anticipates the mechanistic tendencies of the following decades. I would add that Mackie also anticipated the very processualist turn in causality.

[14]For criticisms of dispositional essentialism, see Barker and Smart (2012), Tugby (2012), Coates (2021, 2022).

[15]Notice that this is only a problem if someone is committed to a conditional conception of dispositions (or causal powers), such as the stimulus–manifestation view, which is precisely the view to which most dispositional essentialists are committed. As this conception is at the heart of the contemporary understanding of the metaphysics of dispositions, abandoning it would demand some revision in one's theory, such as those proposed by Marmodoro (2017) and Engelhard (2021).

[16]Although one should consider some feature or entity to explain necessity other than essences or even dispositions, I am far from suggesting that one cannot or should not commit to dispositions in one's ontology. My problem with them is restricted to this point in particular.

[17]Bird 2007: Ch. 2 and 3, particularly 3.3.

[18]This divergence is a product of further metaphysical commitments about universals and dispositions, topics where it is not unusual for one to adopt what could be called a properties-first view, where all the metaphysical stuff are explained by a bundle of fundamental dispositions — generally powerful qualities — which ground the derivative ones. As such disputes must be settled at the level of universals, I won't go any further in this respect. For a particulars-first view, see Harré and Madden (1975), Lowe (2008), and Ingthorsson (2021, especially Ch. 8). For a properties-first view, see Mumford and Anjum (2011) and Buckareff (2017).

[19]This should not be read as suggesting that dispositions have no contribution to causal affairs whatsoever. The matter is more subtle: one may try to explain causality and its features exclusively by means of dispositions, as most metaphysicians have done in the last decades. However, one may also accept dispositions as the source of causal interaction but take causality to be something beyond the dispositions themselves.

[20]Ingthorsson (2021, especially Ch. 4) presents one of the most — if not the most — complete works on causality for those who are looking for a more robust and realist approach to the subject.

[21]Ingthorsson also talks about reactions as "resistance immediately offered by a thing when it encounters another thing" (2021: 61). I'm not sure if we need reactions as an additional concept since reactions could be a subclass of interactions. Besides, if one accepts that interactions are reciprocal, I don't see how one would deny that a reaction is one of the reciprocal interactions produced in a causal interaction.

[22]This example and the one below about simultaneous causality were extracted from Silva (2023).

[23]Although I described the aforementioned events by means of a gerundive nominalization, any other description equally capable of accurately representing the relevant state of affairs would be satisfactory.

[24]Temporal sequentiality is to be understood as a form of priority, a temporal one. Although

there are other forms of priority, this interpretation is deeply rooted in the analytic tradition. Partially, it is associated with an allegedly scientifically informed approach that tends to see entities as nothing more than space-time regions succeeding each other.

[25]For a criticism of events and their role in causality, see Harré and Madden (1975), Emmet (1985; 1992), Chakravartty (2005), Ingthorsson (2021), and Silva (2025).

[26]A dense model of time is a dense sequence in $\mathbb{Q}$ where t_1 and t_2 are positive integers and there is an $x \in \mathbb{Q}$ between any two numbers of the sequence. The same reasoning can be applied to a continuous model of time (a model whose sequence ranges over $\mathbb{R}$), the difference being only the set of numbers that the sequence ranges over.

[27]This is precisely the scenario that Hansson-Wahlberg (2017) has in mind in his argument.

[28]The argument was originally conceived by Mumford and Anjum (2011) as an argument in favor of causal antinecessitarianism, the thesis that causes do not necessitate their effects.

[29]In the previous paper, I did not consider whether it is possible for a causal process to have all its causes interfered and still happen. Given that interference merely changes the qualitative aspect, the intensity of the causal process, I fail to see why it should not be possible.

[30]The terms additive and subtractive preventer, as well as additive and subtractive factor, will be employed interchangeably.

[31]It could be argued that since one may conceive interacting causes without produced effects, this should be considered metaphysically possible, with conceivability working as a guide for metaphysical possibility. This is commonly known as the "conceivability entails possibility" argument. Not only is such a move debatable, but once accepted, it is not hard to see how one could derive a contradiction from it: as every subsequent causal occurrence would also be subject to such possibility, change would not be possible. Nonetheless, this argument will be considered in detail in the fourth section.

[32]I originally formulated the argument in terms of abilities such as 'can' — for reasons unbeknownst to myself. As far as I can see, the argument can be perfectly presented with the familiar metaphysical modalities. Maybe if I had developed the argument in these terms, then I would have seen how simultaneity is related to necessity.

[33]Previously, I have emphasized that I was talking in terms of singular cause and effect to better suit Hansson-Wahlberg's approach (Silva 2025, note 4). Since I am not dealing with the received view anymore, but with a process account of causality like that from Silva (2025), the singular "cause" and "effect" may give way to their plural forms.

[34]The distinction between epistemic and non-epistemic accounts is indebted to Roca-Royers (2011).

[35]These formulations are owed to Feng (2019, 2022).

[36]More mysterious and esoteric counterexamples could rely even on God's action preventing the flow of nature and time in the whole universe.

[37]I thank an anonymous reader for pointing out this worry.

[38]Besides Feng (2019, 2022), Worley (2003), and Roca-Royes (2011) have all addressed this equivalence. For arguments against Modal Monism, see Vaidya (2008) and Mallozzi (2021).

[39]Some may think that delivering so much effort to a potential objection that is only indirectly related to the paper's subject is a questionable practice. Unfortunately, conceivability arguments have become a sort of trump card in contemporary metaphysics: when no other argument can be presented against an undesired thesis, one simply argues that it is conceiv-

able that such and such. That being so, something must be said about it, especially if this is one of the few objections one can anticipate.

[40]Since I have established that I would not commit to any system of modal logic, someone could insist that relying on (6) without providing any further explanation about how one ought to understand modality without committing to a particular system is cheating. Although I disagree, as (6) can be asserted this–wordly without further difficulties, I have no problem accepting this reply for the sake of the argument. However, if our objector is committed to some kind of modal logic — as CP proponents usually are committed to possible worlds — it does seem that our objector should worry about this rebuttal even if I am not able to weaponize it against her.

[41]See *Physics* III.2, 201b31–32, VIII.5, 257b6–9; *Metaphysics* IX.6, 1048b28. For an introduction to Aristotle's account of change, see Coope (2009).

[42]Though one should be suspicious about Hume's role in the commitment to his Dictum by contemporary metaphysicians. As MacBride points out, given the abandonment of Hume's empiricist theory of thought by his contemporary followers, the very underlying justification of Hume's Dictum, it remains a curious fact that they managed to accept the latter but left the former out without providing motivations for their views (MacBride 2005: 127).

[43]For example, Armstrong (1983), Sider (2001), and Bennett (2004).

[44]See Hawley (2001) and Sider (2002).

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