

CHAPTER 6

A Non-relational Approach to Causation

In Chapter 4, I explained my reasons for wanting to break out of the physicalist triad. I argued that the triad provides an inadequate account of agency. I argued that physicalist/event-causal theories of agency are unable to deliver a comprehensive account of agency because they leave the agent out. This is the disappearing agent objection, which essentially claims that our general concept of agency is fundamentally at odds with a view of the world that assumes that causal reality is nothing but a chain of causally related events. Thus, what is needed to adequately understand human agency is a richer theory of causation, one that allows us to see how the causality of action might be something that casts the agent herself as a causal player, rather than merely the setting for events to cause other events.

In the previous chapter, I examined some existing alternatives to physicalist/event-causal accounts of agency that attempt to avoid the disappearing agent objection. Many of these accounts appeal to the notion of *agent causation*, a kind of causation that cannot be reductively analysed in terms of a causal relation between events. According to this general type of view, agency is a kind of causation where the agent herself exercises causal power and this exercise of causal power cannot be reduced to causation by an event involving the agent. I argued that the chief failing of existing agent-causation-based theories of agency is that they do not go far enough when it comes to rejecting the relational approach to causation. Existing agent-causation-based theories of agency do not cleanly break out of the physicalist triad and suffer problems as a result.

In the remainder of this book I will show how broadening our understanding of causation, and more specifically incorporating the concept of *process* into our understanding of causation, opens up new ways of understanding intentional action and the mental causation associated with it. In this chapter, I present my own non-relational approach to causation.

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6.1 Rejecting relationalism

A theory of causation is relational if and only if it is committed to the following thesis:

Relationalism: causation is always and everywhere a relation between distinct entities ('cause' and 'effect'); the worldly phenomenon that is referred to by our concept 'causation' is not ontologically diverse in this respect.

One important feature of relationalism is that 'cause' is an unequivocal term. All causation everywhere is the same, so the only thing that can discriminate between different categories of causation is the nature of the relata involved.

A non-relationalist approach to causation denies that causation is always and everywhere a relation between distinct entities. One way to be a non-relationalist about causation is to deny that causation is ever a relation, and maintain that causation is something else instead. One theory of causation that I think does this is proposed by Steven Mumford and Rani Lill Anjum (2011). Mumford and Anjum proposed a powers-based theory of causation. On a powers-based theory of causation, facts about what powers things have, or what things can do, cannot be analysed as claims about what events regularly follow on from what others. On powers-based theories of causation, just like on realist theories of causation, causation is something in nature that constrains the ways in which events can unfold, and which therefore *grounds* regularity. In other words, worldly events unfold in a regular way *because* causation exists. On a powers-based theory, causation is the exercise of power, and worldly events unfold in a regular way because what can occur is limited by what powers entities possess: an entity with certain powers must behave in certain ways when the conditions for the manifestation of the power arise, provided there is nothing interfering with the entity and thereby blocking the manifestation.

Steven Mumford (2009) argues that no powers-based account of causation can be reductive, because *power* is a causal notion. For example, it is impossible to understand what it is to have the power to intoxicate without having some grasp of the phenomenon of intoxication, which is a causal process. Mumford (like Woodward (2003)) insists that an account of causation can be informative without being reductive. That is, an account of causation can give some insight into the nature of causation without telling us what non-causal structures exhaustively constitute causation. However, given that the powers-based theory takes causation to be the exercise of power, without saying more about what an exercise of power is, this account is in danger of seeming uninformative, perhaps even circular. What is missing from powers-based theories of causation is a suitable ontology that tells us what an exercise of a power is, what sorts of entities possess and exercise powers, and what sorts of relations those things stand in when they exercise their powers. In the rest of this section, I

briefly outline the ontology that Mumford and Anjum offer before offering in Section 6.2 what I believe to be a more satisfactory alternative.

Mumford and Anjum claim that ‘the world is a world containing real powers’ (2011: 4). In other words, Mumford and Anjum hypothesise that powers are real entities, and causation is *powers tending towards their manifestations*. In slightly more detail, Mumford and Anjum hold that ‘causation happens when powers do their work’ (2011: 30). Furthermore, powers do not work alone (except in exceptional cases). Most effects are the upshot of multiple powers manifesting themselves. For example, for a light bulb to burn me, the filament needs to be manifesting its power to get hot, the glass needs to be manifesting its power to propagate this heat, and my hand needs to be manifesting its liability to be burnt. Each power has a contribution to make to the coming-about-of the effect. Each power, in its own way, ‘pushes’ towards an effect. When many powers make their contributions, these contributions add together, and after they reach a certain threshold the effect is produced. (It is this *contribution* towards the coming-about-of some effect, not the effect that eventually comes about, which Mumford and Anjum take to be the power’s manifestation. This is because Mumford and Anjum want to maintain that powers are individuated by their manifestations, so *distinct* powers cannot have the *same* manifestation, and one and the same power cannot have a different manifestation in different contexts, so Mumford and Anjum distinguish a power’s manifestation from the effect of the power’s manifesting itself.)

Does this make causation a relation between a power and the effect it makes a contribution towards producing? Or between the set of powers that have accumulated and the effect their accumulation has produced? Or between the power and its manifestation, i.e. the contribution it makes towards an effect? Mumford indicates that causation is ‘the whole process going from power to exercise and from contribution to event’ (2009: 108). He writes:

The dispositionalist, instead of seeing causation as a matter of clearly distinguishable cause and effect, with the appropriate relation between them, sees causation as almost always complex, involving multiple powers combining to produce something together through a process. Only in the idealised laboratory conditions would we theoretically have an event produced just by one power acting alone. Instead of discrete, externally related causal relata, we have a process of interconnected powers. Given that a manifestation is a part of the essence and identity of a power, then if the power and its manifestation exists, any such causation would be an internal relation. (2009: 108–109)

Elsewhere, Mumford and Anjum state: ‘We argue that causation is a single, unified, and continuous event or process *rather than a relation* between distinct and discrete events, that causes and effects are simultaneous and that causes tend towards their effects without necessitating them’ (2013: 554, emphasis

added). Mumford and Anjum also describe causation as the passing or shifting of powers from one substance to another. So, when fire heats a person, the power to heat possessed by the fire is passed to the person and, when a stone breaks a window, the power to cut that the window comes to possess after this causal transaction is drawn from powers possessed by the stone. Mumford and Anjum also suggest that this process of passing around powers is more fundamental than the substances that possess the powers (2013: 555). In holding that causation is ‘a single, unified, and continuous event or process rather than a relation’, Mumford and Anjum seem to reject relationalism.

Misgivings about Mumford and Anjum’s metaphysics have been raised by Jennifer McKittrick (2013). McKittrick objects that Mumford and Anjum’s theory of causation has nothing to say about how dormant powers become active, or come to be exercised. Mumford and Anjum’s view identifies causation with a continuous process of powers pushing towards an effect, but this presupposes that the powers are already being exercised—they are already making their contribution to an effect. Mumford and Anjum respond to this objection by claiming that ‘when a power is not doing its work, it is not part of the causal story, so it is not something we should be trying to include’ (2013: 556). They also insist that they do have something to say about how a dormant power could become active: a dormant power’s becoming active could be the effect of a causal process; it could be something that resulted from the addition or removal of some other active power.

However, I think that Mumford and Anjum underestimate the seriousness of McKittrick’s complaint. According to Mumford and Anjum, causal effects are achieved by the accumulation of many powers manifesting themselves and reaching a certain threshold. One may wonder how, on this picture, anything is really *produced*. On this picture, powers tend towards an effect and, once this ‘tending’ reaches a certain magnitude, the effect has come into being. The effect seems not to be causally produced so much as constructed, in the same way that bringing together the various parts of a statue is a way of bringing a statue into being. Mumford and Anjum deny that their view entails that causation should be thought of as a kind of ontological construction, but this denial seems inconsistent with their proposal that causation is the culmination of power-exercises adding together, as opposed to the transition from a power being dormant to a power being exercised. Although I agree with Mumford and Anjum that a primitive concept of power is needed to understand what causation is, I disagree with the ontology they propose to underpin their powers-based account of causation.

To reject relationalism, one need not go down the route that Mumford and Anjum do and deny that causation is ever a relation. To reject relationalism it is only necessary that one deny that causation is *exhaustively* constituted by a special sort of relation. One need not claim that we *never* think of causation as a relation between cause and effect. My preferred non-relationalist approach is characterised by *pluralism*. What this means is that our concept ‘causation’

refers to more than one kind of thing. In my view, there *is* a distinctive sort of relation that answers to claims like ‘*c* is the cause of *e*’ so *sometimes* what we refer to when we talk about causation is a relation. However, I think causation can also be a process *rather than* a relation, of which processes like breaking, crushing and bending are more determinate species. This view is in line with Elizabeth Anscombe’s (1971) suggestion that causation is a ‘highly general’ determinable concept, which is an abstraction from the plethora of more specific causal concepts represented by verbs of action. I also agree with Anscombe that we come by this concept of causation when we directly perceive substances exerting causal power over other substances and associate what we see with the appropriate specific causal concept. Therefore, giving a full account of causation is not merely a matter of explaining what a relation must be like to be a causal relation. My proposal is that causation is on display not only when events make the difference to the occurrence of other events but also when substances engage in processes and thereby exercise causal powers.

Obviously, it is no good saying that causation can be a process rather than a relation without saying what a process is. I will therefore provide a metaphysical framework for my theory of causation that includes processes in its ontology. In this way, I will explain exactly what it means to say that causation is a process. I suggest that engaging in a process is analogous to instantiating a property, and that events are instances of processes.

6.2 Two concepts of causation

6.2.1 Difference-making

As mentioned, my preferred non-relationalist approach is characterised by *pluralism*, which means that our concept ‘causation’ refers to more than one kind of thing. ‘Cause’ is not an unequivocal term. In my view, there is a distinctive sort of relation that answers to claims like ‘*c* is the cause of *e*’. This relation can be characterised as ‘difference-making’; it is the relation that obtains between an effect and that which made the difference to the effect’s occurring or obtaining. The question of the exact nature of the cause–effect relation, beyond difference-making, is not something I will get into here. Pluralism leaves this question open—it says nothing specific about the nature of the cause–effect relation. Questions I shall remain neutral on include:

- Can the cause–effect relation be given a reductive analysis?
- Does the cause–effect relation hold between events or states or facts or property exemplifications or all of these?

However, there are some questions I will not stay neutral on. I want to insist that substances, including agents, cannot be related of the difference-making

relation. The difference-making relation is distinct from the relation that obtains between a substance exercising a power and the event the substance produces in exercising that power. To give this latter relation a name, I will call it *the agency relation*—the relation that obtains between an agent and the event that agent is an agent of. To be clear, I am not denying that the agency relation cannot truthfully be called ‘causal’, in the sense that it has something to do with causation. What I am denying is that this relation is between ‘cause’ and ‘effect’, when ‘cause’ is interpreted as meaning ‘that which made the difference to the effect’s occurring or obtaining’. This is because substances cannot be that which made the difference to an effect’s occurring or obtaining, as I shall presently show.

I also want to insist that the relation substances bear to the substances they are acting upon, a relation that I will call *the agent–patient relation*, is not a relation between cause and effect. Again, we may sometimes call the agent–patient relation ‘causal’ because we want to indicate that there is causation going on when the relation obtains, but the agent–patient relation is not what causation is.

Substances cannot be that which made the difference to an effect’s occurring, because difference-makers must be *dated entities*. Substances, as I understand them, are entities that exist at more than one time by *enduring*. They are entities that, as it were, ‘sweep through’ time. They exist at multiple times (most of them, anyway) but not by having *temporal parts* located at each time. Proper temporal parts are cut out of the object along temporal dimensions but not spatial dimensions. So, temporal parts are parts that can be described as ‘earlier than’ or ‘later than’ other parts but not ‘to the left of’ or ‘to the right of’ other parts.

On the view I endorse, substances do not have temporal parts at all; they only have spatial parts. Because substances exist at more than one time by enduring, this means that substances cannot instantiate properties ‘atemporally’. To take an ‘atemporal’ perspective on the world is to think about how the world is, while ignoring the distinction between past, present and future. It is not to think about the world as it is now, or as it was in the past, or will be in the future; it is to think about the world as it is independently of what time is ‘now’. On an endurantist view of substances, substances do not instantiate (at least temporary) properties independently of what time is now. If you think about how the world is while ignoring the distinction between past, present and future, it will be impossible to say what properties substances have. It will be impossible to say, for example, whether I have blonde hair or brown hair—this is because I *had* blonde hair in the past and *now* I have brown hair.

In contrast to substances, events are paradigmatic dated entities. Events that exist at more than one time do not ‘sweep through’ those times; they are instead ‘spread out’ across those times. That is, events that exist at more than one time exist at those times by having temporal parts at those times. Importantly, events can instantiate properties atemporally—independently of what time is now. For example, the passage of time has made no difference to Roger Bannister’s

record-breaking mile-run taking 3 minutes 59.4 seconds. In 1954, this event took 3 minutes 59.4 seconds, and today 3 minutes 59.4 seconds is still how long the event took. Difference-makers must be dated entities because, in looking for that which made the difference to the occurrence or obtaining of an effect, we are looking for a part of the history of the world that stands in a relation to another part of the history of the world atemporally.²⁴

The fact that difference-makers need to be dated entities also shows why the agent–patient relation cannot be a relation between cause and effect. Effects also need to be dated entities, and patients, being substances, are not dated entities. Another consideration that shows why the agent–patient relation is not a relation between cause and effect is that effects must occur or obtain *after* their causes, but it is not necessary for an agent–patient relation to obtain that the patient came into existence after the agent.

When ‘cause’ is taken to mean ‘difference-maker’, substances cannot be causes, not even when they are agents. Insisting that substances cannot stand in cause–effect relations constitutes a key difference between my view and some of the agent-causationist accounts of agency discussed in the previous chapter. Unlike traditional agent-causationism, I do not claim that agents cause their own actions. Unlike the actions-as-causings view, I deny that ‘an action is a causing of an event by an agent’ (Alvarez & Hyman 1998: 224). When a substance is an agent they are not the cause of the event they bring about by acting. However, an important part of my non-relational account of causation is that causation is also ‘the production of change by the exertion of power by a substance’, a phrase I have borrowed from Thomas Reid (1788: 12–13). That is, I think that substance causation is a special kind of causation that cannot be identified with, or understood in terms of, a causal relation between events. Thus, I agree with E. J. Lowe’s claim that ‘a causal power, as I shall construe this term, is one whose manifestation or “exercise” consists in its bearer’s acting on one or more other individual substances (or sometimes on itself) so as to bring about a certain kind of change in them (or it)’ (2013: 158). How is endorsing the fundamentality of substance causation consistent with denying that substances can stand in cause–effect relations? The answer is to give substance causation a distinctive *non-relational* interpretation.

6.2.2 Substance causation

Although I think there is a distinctive sort of relation that answers to claims like ‘*c* is the cause of *e*’, I do not think this is all there is to causation. Pluralism about causation entails that our concept ‘causation’ refers to more than one kind of thing. I think that causation can also be a process *rather than* a relation,

²⁴ Fales offers a similar explanation for why events, and not substances, are the relata of causal relations (1990: 54).

of which processes like breaking, crushing and bending are more determinate species. My proposal is that causation is on display not only when events make the difference to the occurrence of other events, but also when substances exercise causal powers, and what it is for a substance to exercise causal power is for there to be an entity, i.e. a process, in which the substance engages. As well as being a distinctive kind of relation, causation is sometimes a determinable process and substance causation is engagement in a process. Although substances are not ‘causes’ in the sense of difference-makers, they are *causers*, which is to say they can be, for example, movers, or breakers, or crushers, or scrapers; that is, substances can be things that engage in causal processes.

I have said that what it is for a substance to exercise causal power is for there to be an entity, i.e. a process, in which the substance engages. To fully understand how this is a non-relational interpretation of substance causation it is necessary to give an account of what processes are. The orthodox view of processes is that, if there are any differences between processes and events, they are not significant enough to warrant treating them differently in theories of causation. Many philosophers who have written extensively on causation have not paid the distinction between events and processes much or any attention.²⁵ Others have considered the distinction but have explicitly rejected its metaphysical significance.²⁶ I propose a theory of processes that denies that processes belong in the same ontological category as events.

The best way to explain what I think processes are is to start by summarising an argument put forward by Alexander Mourelatos (1978), which shows that an important subclass of verbal predications, which Mourelatos calls ‘process predications’, do not implicitly quantify over particulars that have (or will have) happened. After summarising Mourelatos’s argument, I will suggest that what process predications implicitly quantify over are processes, which are a special kind of *universal*.

Mourelatos (1978) argues that predications can be distinguished into three semantic classes: *event*, *process* and *state*, the predications in each class reporting a different sort of situation or eventuality. Examples of sentences reporting events include “The sun went down” and “Roger has run a mile”. Examples of process predications include “The plant is growing” and “Roger was running”. And sentences that report states include “He knows Paris is in France” and “Leo loved Lauren”.

²⁵ For example, Bennett, Davidson and Kim. See especially Bennett (1988), Davidson (2001) and Kim (1976).

²⁶ An exception may be Salmon (1984), who does take the distinctive features of processes to be important in understanding causation. However, for Salmon, ‘the main difference between events and processes is that events are relatively localised in space and time, while processes have much greater temporal duration, and in many cases, much greater spatial extent’ (1984: 139).

Merely considering these examples is enough to afford an intuitive grip on the differences between Mourelatos's three classes. However, Mourelatos offers a more rigorous account of the features of predicative sentences that determine which of his three classes a prediction falls into. He suggests that, when it comes to working out what sort of eventuality a sentence reports, the most illuminating feature is the grammatical aspect of the main verb (though semantic and lexical features also play a part). In Mourelatos's view, process predications typically involve verbs with progressive aspect. In English, the progressive is formed by combining the 'present' or 'ing' participle of the verb with the auxiliary verb 'be' as in "She is swimming" or "He was walking".²⁷ An important feature of sentences involving progressive verbs is that these sentences do not necessarily imply that the eventuality reported has or will come to an end. For example, neither "Roger was running" nor "Roger was running a mile" necessarily implies that Roger has finished, or will finish, his task. Based on the first, Roger may still be running and, on the second, Roger may still be running a mile. In the present tense, this is even clearer. "Wendy is walking" obviously does not imply that Wendy has finished walking; it implies the reverse: what Wendy is doing, walking, is still going on. Contrast this with sentences such as "Roger ran a mile", which does not have progressive aspect. It is because the progressive is often used to indicate that something is or was in progress that it is such a reliable indicator of process predications.

The fact that progressive sentences do not necessarily imply that the eventuality reported has or will come to an end allows us to draw a conclusion with metaphysical import: process predications do not implicitly quantify over particulars that have (or will have) happened. If process predications implicitly quantify over anything, what they implicitly quantify over are not particulars, or countable items. We can see this if we transform process predications into sentences that involve explicit quantification over the eventuality reported. Mourelatos calls this kind of transformation a 'nominalisation transcription' (1978: 425). For example, if we nominalise the process predication "Roger was running" we get "There was running by Roger". This nominalisation does not include an indefinite article. Similarly, the gerund "running" could not be preceded by a word like 'few' or 'many' and yield a sensible sentence. In these respects, the sentence "There was running by Roger" is akin to sentences like "There is snow on the roof" or "There is sand in the bucket", which involve mass nouns. Sentences like "There is snow on the roof" do not involve quantification over countable items; instead they involve quantification over stuff, or 'mass quantification'. The similarities between the nominalisations of process predications and quantifications over stuffs suggests that quantification involved in

²⁷ There is no consensus among linguists as to whether grammatical aspect is a universal feature of languages; it also appears to be encoded differently in different languages. For further discussion of grammatical aspect see De Swart (2012), Filip (2012) and Gvozdanović (2012).

“There was running by Roger” is also not quantification over countable items. As Jennifer Hornsby points out, ‘the sentence “There was running by Roger” tells us that something ... was going on. But it does not say of any event, nor of any particular of any other sort, that it was going on’ (2012: 236). What the nominalisation of a process predication says there is (or was) is not a particular and hence not an event.

In this way, process predications stand in contrast to sentences like “Roger ran a mile”. Recall that “Roger ran a mile” necessarily implies that Roger has completed the mile. When we nominalise this sentence, we get “There was a running of a mile by Roger”. This nominalisation does involve quantification over particulars, and the gerund ‘running’ refers to a particular event. “Roger ran a mile” does say that an event (at least one) has occurred, namely Roger’s running of a mile. It is for this reason that sentences like “Roger ran a mile” are classed as event predications by Mourelatos. This is also why it is plausible to argue (as Davidson (1967) does) that the sentences Mourelatos classes as event predications involve implicit quantification over events.

Mourelatos’s (1978) observation that sentences reporting processes do not report the occurrence of any specific event, and involve mass quantification when they are nominalised, shows that we have a concept of a type of entity that is not particular, and hence not an event, but which exists by unfolding over time. Although one must attend to verbal predications with progressive aspect to establish that English-speakers have a concept of an entity that is not particular and which exists by unfolding over time, the presence of a process concept may be less hidden in other cultures. For example, Zhihe Wang (2013) notes that ‘it is well known that Chinese thought lays great stress on process’ and ‘an emphasis on becoming is implicitly embodied in its understanding of Tao, the ultimate concept in Chinese tradition’ (2013: 178). Wang describes Tao as ‘the creative advance of the world’ (2013: 178) and notes that, although Tao is translated into English as ‘way’ or ‘path’, i.e. as a noun, in Chinese the word serves as both noun and verb—it is the following of a path as much as it is a path to follow. Thus, it seems that Tao is best thought of not as analogous to Jonathan Schaffer’s ‘history’ (2007: 83), which lacks the dynamism essential to the Tao concept, and is more similar to my concept of a highly determinable process (see Chapter 32 of the *Tao Te Ching*).

Some philosophers, inspired by Mourelatos’s argument that nominalisations of process predications involve mass quantification, contend that what the process concept refers to is a kind of ‘temporal stuff’. For example, Hornsby suggests that ‘the relation between the stuff of the spatial world and the particulars therein is analogous to the relation between the activity [a kind of process] of the temporal world and the particulars there’ (2012: 238). Thomas Crowther also maintains that ‘[w]hat things are doing throughout periods of time and substance stuff are constituents of the same basic ontological category; they could be thought of as temporal and spatial masses’ and ‘[b]oth substance-stuffs and time-occupying stuffs, respectively, fill out space and time in the same way’

(2011: 17). Similarly, Helen Steward (2013) proposes that space and time have analogous ontologies. Entities that have spatial extension can be distinguished into ‘stuff’ and ‘things’. Things are countable particulars and have spatial parts. Steward suggests there are two different types of thing: ‘substances’ and mere ‘lumps of stuff’. Substances are entities that can survive the loss or replacement of their spatial parts; they have ‘a certain distinctive form by means of which they are singled out in thought and which underwrites their relative independence from the actual parts of which they consist in any particular instant’ (2013: 487). Lumps, in contrast, may be defined in such a way that ‘the merest addition or subtraction [of spatial parts], however tiny, makes for a different lump’ (2013: 804). In addition to things, there is also the stuff from which things are made. Examples of stuffs include snow, sand, water and clay. Stuffs are extended in space but are non-countable. The metaphysics of stuff is contentious but is not necessary to adjudicate on these questions here. What matters for now is that some philosophers have proposed that events and processes are metaphysically analogous to things and stuffs, respectively.

In what ways processes are analogous to stuffs, and to what extent they are metaphysically analogous, is an open question. Different proponents of the temporal stuff view of processes have differing opinions on how exactly to spell out the process–stuff analogy. For Hornsby, what matters is that processes are not particulars, they are distinct from events, they pervade time and they comprise events. For Steward, in contrast, processes are countable entities metaphysically analogous to substances in that they have a distinctive form that determines what intrusions, shortenings and lengthenings they could and could not have survived.

What could decide between these competing views? Mourelatos’s observations about the similarities between nominalised process predications and mass nouns do not entail that processes are metaphysically similar to stuffs at all. Not all nouns that demonstrate the grammatical characteristics definitive of mass nouns obviously quantify over entities that are stuffs. For example, ‘furniture’ is a mass noun but (arguably) “There is some furniture in here” does not quantify over a kind of stuff; it quantifies over a collection of discrete individuals. Similarly, “There is a lot of happiness in this room” bears all the hallmarks of a mass quantification but ‘happiness’ is not commonly thought to refer to a stuff. Mourelatos has shown that sentences reporting processes do not report the occurrence of any specific event and involve mass quantification when they are nominalised—but this is consistent with processes being unlike stuff in every respect apart from how we typically quantify over them. Mourelatos’s observations then cannot justify any specific metaphysical position on processes.

How similar you think processes and stuffs are will depend on what work you want your metaphysics of processes to do. Those who propose a temporal stuff view of processes intend this ontological scheme to help explain important concepts within philosophy of action (Crowther 2011: 6). Hornsby (2012) argues that a process ontology is key to articulating a theory of human action

that does not fall foul to the disappearing agent objection. Hornsby argues that ‘the agent is given her due only when it is acknowledged that she engages in activity, where no activity is any particular’ (2012: 233). She claims that ‘one needs to think of a person’s raising her arm as a type of causal activity in which she engages’ (2012: 234). Hornsby’s view is that to properly understand agency we need to think of the causality of action as something other than a causal relation between mental event and action—a proposal I agree with. Hornsby further suggests that construing an agent’s causing something (for example, an agent’s causing her arm to go up) is an activity or process—something that is metaphysically distinct from an event—allows us to think of the causality of action as something that essentially involves the agent herself. The causality of action is thus thought of as a unique sort of entity: an activity or process. Once we acknowledge this, we are no longer at risk of failing to include the agent in an account of the causality of her action.

I agree with Hornsby’s explanation of what work a metaphysics of processes is supposed to do. For me, the justification for adopting a process ontology is that doing so helps articulate a non-relational theory of causation. More specifically, the point of proposing a process ontology is to help explain what substance causation is, which will in turn allow us to put together a theory of agency that recognises the essential role of the agent in the causality of action. The process ontology that I think fulfils this mandate most effectively is, in fact, *not* one that takes processes to be ‘temporal stuffs’ that pervade intervals of time and compose events in the same way that spatial stuffs pervade volumes of space and compose things (see White (2020) for an argument against the temporal stuff view of processes).

I submit that what the process concept refers to is a special kind of *universal*. Processes are universals, so running, singing, respiring and melting are single repeatable entities; when Usain Bolt is running, the very same entity is present, or going on, as when Roger Bannister was running. This is not to say that processes are properties, which are also thought to be universals by some philosophers (including Armstrong 1978a; Armstrong 1978b; Armstrong 1989). The distinction between processes and properties can be drawn in the following way: properties concern the static nature of things—they are ‘ways for things to be’—whereas processes are dynamic, that is, they are connected with how a thing is changing over time (White 2020). My proposal is that processes are ways for a substance to be changing, to be resisting change, or to be effecting change. The last subgroup of processes is particularly important and these types of processes are what I believe are picked out by the concept ‘activity’.

My theory of processes is outlined in White (2020). There I proposed that *process*, *event* and *substance* are three distinct ontological categories. I proposed that processes are engaged in by substances. According to this ontological scheme, ‘A process P exists, or rather goes on, only when, and for as long as, a substance engages in P’, a principle I called ‘the engagement principle’ (White 2020: 118). This means that processes depend for their existence on substances engaging in

them. I also suggested that, when a substance engages in a process, this unity of substance and process can be called a *dynamic* state of affairs (White 2020: 119). Dynamic states of affairs bear a similarity to the states of affairs that feature in Armstrong's account of properties. Armstrong claims that, when a substance instantiates a property, which he takes to be a universal, the unity of substance and universal is a 'state of affairs' (Armstrong 1989: 88). The difference between Armstrong's *static* state of affairs and my *dynamic* state of affairs is the relationship that dynamic states of affairs bear to time.

Static states of affairs persist (continue to exist) by enduring over time. This means that they do not have temporal parts. Instead, static states of affairs exist complete at the instant at which they first obtain, and then continue to exist by continuing to obtain. For example, the state of affairs of this rose's being red exists complete at the instant at which it is true that the rose is red—no part of the state of affairs exists at any other time. Dynamic states of affairs, on the other hand, cannot exist 'complete' at a single moment. Because processes are concerned with how a substance is changing, resisting change, or effecting change, engaging in a process presupposes the passage of time: nothing can be going on for only an instant (although, of course, it can be true *at* an instant that something is going on). This means that dynamic states of affairs cannot obtain for only an instant. If a dynamic state of affairs obtains, then necessarily time has passed or will pass. For example, no-one can be running for only an instant. To run, one must make the right sort of leg movements—one needs to raise one leg, lift off from the other, land on the first, transfer weight, and so on—it is impossible to accomplish this in an instant. If someone made the first movement of running, i.e. raised one leg but got no further than this, then we would deny that that person was ever running. If someone is running, this conceptually implies something about the past or the future. Dynamic states of affairs are, in a sense, stretched out in time. Their obtaining is necessarily dependent on the passage of time. This suggests that dynamic states of affairs do not persist by enduring.

The alternative to persisting by enduring is typically assumed to be to persist by perduring. This means to exist at more than one time by having temporal parts that exist at more than one time. An event persists through time by perduring—it has earlier stages at earlier times and later stages at later times. It is spread out through time. Is this how dynamic states of affairs persist over time? This might seem like an obvious answer, especially given that dynamic states of affairs seem to be 'stretched out in time', but in fact I think it is incorrect. I do not think dynamic states of affairs persist by perduring. Things that persist by having temporal parts are things that happen. Part of what it means to say an entity is an occurrence, something that happens, is that it is temporarily extended and has temporal parts. As Steward (2013) argues, denying this leaves us with no clear way of drawing the distinction between things that occur and things that exist at more than one time by enduring. However, dynamic states of affairs do not happen; they *obtain* and it seems to me that obtaining and happening

are mutually exclusive modes of existence. The relationship that dynamic states of affairs bear to time is thus not straightforward. It is neither enduring nor perduring but something in between. It is very difficult to articulate what this could be. Dynamic states of affairs seem to be stretched out in time but they do not have temporal parts. Indeed, as states of affairs, it seems incoherent to talk of dynamic states of affairs as having parts at all. Dynamic states of affairs have *components*—namely, a substance and a process (a universal)—but not *parts*.

In White (2020) I also proposed that events are *instances* of processes where instancing is analogous to the relationship between kinds, like doghood, and individual substances, like an individual dog (see Lowe's (2005) four-category ontology) and to the relationship between a pattern, like a wallpaper pattern, and a physical realisation of this pattern, for example a piece of wallpaper (as in Galton's (2018) theory of processes as 'temporal patterns'). Events come into existence when a substance engages in a process and then completes or stops the process. For example, when a tank crushes a car, the tank engages in the process of crushing for a certain length of time (e.g. until the car is crushed) and once that process is complete or stopped a crushing event can be said to have happened.

It is dynamic states of affairs that are reported by Mourelatos's process predications. It is also dynamic states of affairs that, I propose, are referred to by expressions such as 'the agent caused her arm to rise'. The infinitival phrases that are commonly used to describe exercises of agency refer to dynamic states of affairs. Phrases like 'the agent caused her arm to rise' should not be taken to mean that a relation of causation comes to obtain between the agent and an arm-rising event. Thus, unlike the accounts of substance causation outlined in Chapter 5, what it is for an agent to be causing something is not for that agent to cause an event to happen.

I have said that, as well as being a distinctive kind of relation, causation is sometimes a determinable process that substances engage in. What it is for a substance to exercise causal power is for there to be an entity, i.e. a process, in which the substance engages. However, not all processes are examples of causation. If any process is a determination of causation, then it is causal *intrinsically*, just as if a colour is a determination of red (as scarlet is), then that colour is red *intrinsically*. As to *which* processes are determinations of causation and which aren't, my answer is that the distinction is not absolute, and can be difficult to determine.

I have said that processes are ways for substances to be changing, to be effecting change or to be resisting change. This means that some processes are active, i.e. those that are ways for substances to be effecting change, and some processes are passive, i.e. those that are ways for substances to undergo change (resisting change, I think, can be both active and passive). Only those processes that are (to some degree) ways for substances to be effecting change are species of causation. This way of distinguishing between processes that are causal and those that are not makes use of the distinction between active and passive powers.

An active power is a power to wreak change. Activity is the exercise of an active power. A passive power, or a liability, is a power to undergo or suffer change. Passivity is the manifestation of a passive power. Active powers are powers to change, and passive powers are powers to be changed. Substances that exercise active powers are agents, and substances that manifest passive powers are patients. The difference between agent and patient is not a difference between two different kinds of substance; it is rather a difference between two different roles substances can adopt (Hyman 2015: 35). This is demonstrated by the fact that one and the same substance can be an agent at one time, and a patient at another time—for example, when I push you, I am the agent, when you push me back, I am the patient. It is also possible for one and the same substance to be both agent and patient at the same time—for example, as Hyman notes, a victim of suicide is both agent and patient.

The active–passive distinction is thrown into doubt when we consider the fact that in many cases when an intuitively active power is manifested the manifestation of this power involves the possessor of the power suffering change as well as producing it. For example, when salt is dissolved in water, we may intuitively class the power of the water to dissolve the salt as active: the water is producing change in the salt. However, the water is also changed by the dissolution process, and necessarily so—if the water were not liable to become uniformly salty when salt was added to it, then it wouldn't be possible to dissolve salt in water. So, it seems that the intuitively active power of water to dissolve salt is *also* passive. It seems like the distinction between the exercise of active power and the manifestation of passive power, and hence the distinction between activity and passivity, is spurious. At best, the distinction is a matter of there being two alternative ways to describe the very same sort of eventuality.

The solution to this problem is, I think, to reject the idea that for a substance to exercise an active power the substance must, in exercising this active power, be 'purely active', that is, suffer no change at all. Similarly, it is not the case that a substance exercising a passive power needs to be 'purely passive'. Erasmus Mayr suggests that 'the distinction between active and passive powers is one of degree, with all powers situated on a more or less continuous spectrum of more or less active and passive powers' (2011: 204). What this means is that some powers are such that when they are exercised the substance in possession of the power produces much more change than it undergoes. For example, when I squash a grape, the grape is drastically changed, whereas I remain much the same. Other powers are such that when they are exercised the substance in possession of the power undergoes as much change as it produces—as in the case of the water dissolving the salt. The power of the water to dissolve salt is, as it were, less active than my power to squash a grape.

The danger with this solution is that it means that the distinction between activity and passivity is not absolute. It is therefore more accurate to say that some processes are more active than others, and some are more passive than others, but (probably) no process is completely active, and no process is

completely passive. For example, the process of crushing something is mostly active: in crushing something, a substance is effecting more change than it is undergoing. The process of dying, on the other hand, is mostly passive: in dying, a substance is undergoing more change than it is effecting. And many processes involve ostensibly equal degrees of activity and passivity. For example, processes by which we move ourselves about, like walking, and running, seem to involve a mix of activity and passivity: when we move ourselves about, we effect change on ourselves, so we are both agent and patient with respect to those changes. Processes that result in no overall change, like thermoregulation or keeping still, also seem to involve elements of activity and passivity. When one stands still, for example, one must exert some degree of force in opposition to the forces that would cause one to fall to the ground (e.g. gravity), but not so much force that one ends up moving. Thus, standing still seems to involve a roughly equal mix of activity and passivity.

The mostly active processes I will call *activities*. What it is for a substance to be causing something is for there to be an *activity* that the substance is engaging in. A substance engaging in an activity is an agent, and the event that results once the substance has completed the activity it has been engaging in is an action. For example, when I crush a grape between my fingers, I engage in the activity of crushing. When I complete that activity (when the grape is crushed), a crushing action can be said to have happened. Actions are thus events of a special kind: they are events that are instances of activities, and as engaging in an activity is what it is for an agent to be causing something, actions can also be said to be instances of substance causation. Importantly, the agent does not stand in a cause–effect relation to the event that comes into existence after she completes an activity. Agents are not causally related to their actions. Individual actions are events that come into existence when an agent engages in an activity and then completes that activity. So understood, actions are ‘produced by’ or ‘brought into being by’ agents, but the sense of production here is a kind of ontological construction. Actions depend for their existence on agents engaging in activities and completing them, so actions come into existence because of agents engaging in activities—but this ‘because’ indicates ontological rather than causal dependence.

Another issue with the active–passive distinction is that it is less than fully objective. Whether what a substance is doing is activity or passivity is relative to the degree of change it is wreaking and/or undergoing and assessing how much change a substance is wreaking and/or undergoing may not be a fully objective matter. How much change one thinks the water undergoes when salt dissolves into it may depend on one’s views about the nature of water. If the distinction between activity and passivity is partly a subjective matter, and this distinction is key to distinguishing processes that are determinations of causation from processes that are not, then it seems that what is and is not causation is itself partially a subjective matter. I think that this reasoning is sound, so I accept that what is and is not causation is partially a subjective matter.

However, I do not consider this to be problematic. This is because, while it may be true that how we classify the processes being engaged in by substances is partly dependent on our own perspective, the *existence* of dynamic states of affairs, i.e. substances engaging in processes, is not mind-dependent.

The notion of ‘effecting change’ is clearly a causal notion, hence my account of substance causation cannot be reductive. However, I deny that my account is circular (i.e. analyses causation in terms of causation). This is because we are acquainted with the determinate forms of causation (like breaking and crushing) via direct observation, and, to borrow an argumentative strategy from Peter Menzies and Huw Price, ‘this common and commonplace experience ... licences what amounts to an ostensive definition’ of effecting change (1993: 194). We directly observe the determinate forms of causation, which allows us to point to an example of a substance effecting change and say ‘*that* is what effecting change is.’ In this way, it is not necessary for one to already understand what causation is before one can know what ‘effecting change’ is.

Rom Harré and Edward Madden (1975) also argue that we directly perceive processes in which causal powers are manifested. They argue that David Hume’s denial that we directly perceive powers being exercised is based on the false assumption that our perceptual experience is primarily atomistic. Hume assumes that what we directly experience are ‘punctiform’, ‘atomistic’ sensations. Once this assumption is made, it follows that it is impossible that a single impression could be the experiential origin of our idea of causal power, and hence some story must be told about how the idea of causal power arises from multiple impressions. However, why assume that our singular impressions are all and only ‘punctiform’, ‘atomistic’ sensations? Why assume that we directly perceive the leaf as green and, later, the leaf as brown, but that we do not perceive that leaf *changing* from green to brown? Anscombe objects to Hume’s idea that we cannot observe causality in the individual case by pointing out that ‘someone who says this is just not going to count anything as “observation of causality”’ (1971: 8). Anscombe is, I think, making a very similar point to Harré and Madden. If one assumes from the outset that perceptual experience is primarily atomistic, then of course it will turn out that ‘all we find’ are impressions of events that ‘seem entirely loose and separate’ (Hume 1975: 74), but that’s because ‘the arguer has excluded from his idea of “finding” the sort of thing he says we don’t “find”’ (Anscombe 1971: 8).

6.3 Objections to pluralism

I believe pluralism is the best way to do justice to the diversity of our causal thinking. When it comes to explaining why the relation between the collision with the iceberg and the sinking of the ship, or the relation between the fluttering of the flag and the bull’s charging, are instances of causation, appeals to powers and their exercise may not provide the answer. (Appeals to powers

and their exercise may explain why such relations exist, without explaining what the relations actually are.) On my view, there is no demand to provide a semantics for all causal discourse in terms of powers. I can allow that the conceptual scheme that relates the concepts *power*, *substance* and *process* may not (and, I suspect, cannot) be sufficient to clarify the content of *all* our causal claims.

The idea that we have more than one way of thinking about causation is not such a novel idea. Brian Skyrms has suggested that, rather than being a single concept, causation is an 'amiable confused jumble' of concepts (1984: 254). My view honours this suggestion: on my view the concept 'causation' covers an ontologically diverse 'jumble', including a distinctive cause–effect relation and a determinable process, which is in turn associated with two distinctive sorts of relation, the agency relation and the agent–patient relation.

My view is perhaps most similar to a position put forward by Richard Taylor (1966). In his introduction to *Action and Purpose*, Taylor distinguishes between two meanings that have been attached to the words 'cause' and 'causation'. On the one hand, there is a notion of causation that is tied up with notions of power, which was once regarded as a 'basic' concept 'more obvious and more clear than any concepts by means of which one might try to describe or define it' (1966: 16). On the other hand, there is the notion of causation as a 'complex relationship between changes or events, analysable in terms of other familiar relations such as constant conjunction and not, in any case, one that can be understood only in terms of some further primitive notion of active power, or the power to make things happen' (1966: 16).

One potential objection to my view is that the idea that we think of causation in two distinct ways—as a process and separately as a cause–effect relation—is inconsistent with the fact that we use just one word, 'causation', to cover the worldly phenomenon. As Randolph Clarke presents the objection:

To say that entities of both these categories [substance and event] can be cause is to say that causation can work in two dramatically different ways. Causation would then be a radically disunified phenomenon. It may be claimed, with some plausibility, that this cannot be so. (2003: 208)

I think this objection can be dealt with by acknowledging that, even though we think of causation in two different ways, our two causation concepts are not entirely disconnected from each other. One way to spell out this claim is to offer a plausible story of how one of the two causal concepts may have grown out of the other. The story I find the most plausible runs as follows. As noted above, if substances possess and exercise causal powers, then substances with certain powers must behave in certain ways when the conditions for the manifestation of the power arise, provided there is nothing interfering. In other words, when a power is properly triggered, it will manifest itself in 'canonical ways', as Nancy Cartwright puts it (2009: 144). The exercise of powers will therefore be the source of regular and stable relations between trigger events and manifestation

events. We can use knowledge of these relations to change how powerful substances behave. For example, if one knows that being near flowers triggers an allergic reaction, then one can prevent the allergic reaction by avoiding flowers; similarly, if one knows that a release of luteinising hormone by the pituitary gland triggers ovulation, then one can prevent ovulation by preventing the release of luteinising hormone. From this we get the idea that events, particularly (but not exclusively) trigger events, can be *devices* for manipulating later events and can *produce* later events. However, this is a metaphor: events are not literally devices, and cannot literally produce events because they are not the right sort of thing to be devices or produce events—only substances can literally play these roles. This is because producing an event is a process. A trigger event cannot produce a manifestation event because the manifestation event occurs after the trigger event is over and done with—the trigger event is in the past when the manifestation event begins to occur, hence the trigger event is not around at the right time to produce it. Only something that endures for the occurrence of an event can produce it. However, even though talk of events as devices or producers is a metaphor, this does not mean there aren't conditions under which use of this metaphor is correct and conditions under which use of this metaphor is incorrect, just as the fact that feelings can only metaphorically be hurt does not mean it is never incorrect to say my feelings have been hurt. This metaphor is thus the source of the idea that there is a special sort of relation between events, which is causation.

Another objection to pluralism is that the two ways of thinking about causation I have proposed are not both needed. One might think that the concept of difference-making is sufficient to fully capture the concept of causation, or alternatively that the concept of substance causation is sufficient to fully capture the concept of causation.

The reason I do not think that difference-making on its own is sufficient to fully capture the concept of causation is because, as Steward puts it, 'an important aspect of our conception of causation seems to involve the idea that causes do things' (2011: 152). Here we seem to have a platitude included within our concept of causation that ascribes to causes the power to do things. In agreement with Lowe (2013), I do not think that events are the sort of entity that possess causal powers. Lowe's definition of a causal power, which I think is correct, is a power 'whose manifestation or "exercise" consists in its bearer's acting on one or more other individual substances (or sometimes on itself) so as to bring about a certain kind of change in them (or it)' (2013: 157). Given that this is what a causal power is, only entities that can act on substances or themselves could possess causal powers and, as Lowe correctly points out, 'events and properties cannot literally act: only substances can do that' (2013: 158).

Lowe argues that, 'fundamentally speaking, all causation is substance causation, because only substances strictly and literally possess causal powers' (2013: 157). Lowe suggests that event causation is unnecessary:

[W]e might say, for instance, that the explosion of the stick of dynamite caused the collapse of the building. But really, in my view, this is just an elaborate way of saying that the stick of dynamite, by exploding, caused the building to collapse. It is the dynamite that literally possesses the destructive power, not the explosion. (2013: 158)

Lowe seems to think that the concept of substance causation sufficient to fully capture the concept of causation, and therefore that the difference-making understanding of causation is unnecessary. My reply to Lowe is first that it would be a mistake to infer from the fact that only substances strictly and literally possess causal powers that substance causation is the only kind of causation that exists. For events to be causes, they need to be that which made the difference to the occurrence of an effect—they do not need to strictly and literally possess causal powers. Lowe's characterisation of causation as 'a kind of action—a bringing about of change' is a good description of substance causation, but not of difference-making. Second, although I admit that it does seem frivolous to hold both that the dynamite caused the collapse and that the explosion of the dynamite caused the collapse, in fact there isn't any kind of competition between the dynamite's causal efficacy and the explosion's causal efficacy, because substances and events take part in very different kinds of causation. The dynamite brought the collapse into being by engaging in the process of destroying the building by exploding. The explosion is the event that stands in a difference-making relation to the collapse.

6.4 Objections to substance causation

In the previous section I considered objections to pluralism, the idea that there is more than one kind of causation and that the term 'causation' does not have a single meaning. In this section I will consider objections to my non-relational understanding of substance causation.

Insofar as my view grants that causation can be an exercise of causal power, my view has a lot in common with powers-based theories of causation such as that proposed by Mumford and Anjum (2011) and by Lowe (2013). Like these writers, I also maintain that *power* is a primitive concept, i.e. one that cannot be analysed in other terms. So, one cannot say, in other terms, what is meant by 'can' in statements of what a thing can do. As other powers-based theories of causation maintain, I think that facts about what powers things have, or what things can do, cannot be analysed as claims about what events regularly follow on from what others. Instead, causation is something in nature that constrains the ways in which events can unfold, and which therefore *grounds* regularity. In other words, worldly events unfold in a regular way *because* causation exists. Causation is the exercise of power and worldly events unfold in a regular way because what can occur is limited by what powers entities possess: an entity

with certain powers must behave in certain ways when the conditions for the manifestation of the power arise, provided there is nothing interfering with the entity and thereby blocking the manifestation.

However, unlike Mumford and Anjum, I do not think that powers are *entities*. Powers do not exist in concrete reality; they are not, to borrow a phrase from Lowe (2005: 35), 'elements of being'. This idea has been expressed by Anthony Kenny, who states that 'a power must not be thought of as a thing in its own right' (1975: 10) and by Gilbert Ryle, who states that:

Potentialities, it can be truistically said, are nothing actual. The world does not contain, over and above what exists and happens, some other things which are mere would-be things and could-be happenings. (1949: 119)

In agreement with Ryle, I deny that ascriptions of powers to things report 'limbo facts' or strange nearly-properties. However, as Ryle puts it, 'the truth that sentences containing words like "might", "could" and "would ... if" do not report limbo facts does not entail that such sentences have not got proper jobs of their own to perform' (1949: 120). The concept *power*, it seems to me, is best thought of as a way of thinking about how substances are connected to the processes they engage in, not just currently but possibly in the future and in circumstances that may never come to pass. As Ryle contends, the job of ascriptions of power is to allow us to make inferences about what substances can, will and would do.

Because my view has a lot in common with powers-based theories of causation it risks falling foul of the same objections. For example, Jonathan Schaffer (2007) objects to the idea that worldly events unfold in a regular way, because what can occur is limited by what powers entities possess. According to Schaffer, such a view places implausible limits on what can be. Schaffer regards the view that 'anything can coexist with anything else, at least provided they occupy distinct spatiotemporal positions' (Lewis 1986: 87), as a 'plausible principle about what is possible' (2007: 85). The idea that what can happen is limited by what powers things possess entails 'implausible limitations on recombination'; for example: 'if *c* is accorded the basic property of *causing e*, then the intuitive possibility of *c* without *e* is lost' (Schaffer 2007: 85). However, I do not think facts about what powers entities possess place implausible limits on what can be. To borrow an example from Harré and Madden (1975), if fire has the power to burn a person, and the conditions for the manifestation of this power are met, e.g. a person has stepped into the fire, what this means is that, *unless something interferes*, the person will get burnt. Is that an implausible limitation on what can be? I do not think so. And, as for Schaffer's own example, if some substance is engaged in the process of causing *e*, this does not imply that the possibility of the substance existing without *e* occurring is lost. While the substance is engaged in the process whose completion eventually constitutes occurrence

of e , e has not yet been caused, and may never be caused: something could interrupt the process, and e may never come to be. Interventions are nearly always possible, so the manifestation can be blocked by an intervention.²⁸ So, this objection of Schaffer's fails.

Another common objection to powers-based theories of causation is that such theories are ontologically profligate. That is, they posit the existence of fundamental sorts of entity, or make use of unanalysable concepts, to no explanatory advantage. Schaffer suggests that theories like mine involve a 'terrible metaphysical price for a relatively flimsy intuition' (2007: 89). It is important to be clear on what the metaphysical price of my theory is.

The price involves an ideological and an ontological component. The ideological element is the primitive power concept that I think we need to understand causation: I am maintaining that there are facts about what substances can do, which we can discover, where the notion of 'can' here cannot be analysed in other terms. The ontological element is the process ontology I am proposing: I am positing the existence of processes; as well as the history of events, there is also the bringing-about of those events. And what do we get for this price? The motivation for proposing an alternative to the relational approach to causation is to enable us to fully break out of the physicalist triad. I will leave it to the reader to judge whether this constitutes a 'terrible metaphysical price for a relatively flimsy intuition'.

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²⁸ Mumford and Anjum (2010) make a similar argument.

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