Suppose that Billy and Suzy splash paint on the wall. Billy throws blue paint. Suzy throws yellow paint. A green spot forms on the wall where the blue paint and yellow paint run together. Billy’s throw and Suzy’s throw are joint causes of the green spot. Though each throw causes the appearance of the green spot, it does so only in virtue of the other throw. Had either vandal not thrown, the other vandal’s throw would not have caused the appearance of a green spot.

Cases like this draw out a *prima facie* tension in the way we’ve come to think about causation. On the one hand, they are a simple reminder of the importance of background conditions to causation. What an event causes depends not only on its nature and the laws, but also on the background of events (and perhaps omissions) against which it occurs. Billy’s throw might have occurred in the very same manner and at the very same time as it actually did and, had the circumstances in which it occurred been different, it may have had different effects. Had Suzy not thrown, Billy’s throw would have caused the appearance of a blue spot. Had Suzy thrown white paint rather than yellow, Billy’s throw would have caused a spot in a lighter shade of blue. Causation in this respect is subject to the vagaries of the environment. It involves an element of luck.

At the same time, our routine causal judgments often seem to be guided by the thought that causation, in some respect, is immune to this type of luck. The effects of Billy’s throw are contingent on background conditions such as the occurrence of Suzy’s throw. But intuitively there is something that Billy’s throw *does* — some causal influence that it exerts — that is not contingent on its background conditions. Suzy could have held her throw or used a different color of paint. She could have done anything else at all. The influence of Billy’s throw would have been, in some respect, the same. Call this influence the contribution of Billy’s throw. An event’s contribution is the influence that it has on the world given only its nature and the laws.

Contemporary work on causation has largely lost track of contribution. Our most developed theories of causation do not address it. Contribution is not the causal relation. The causal relation that Billy’s
throw stands in to the green spot depends on Suzy’s throw. The contribution of Billy’s throw does not. By the same lights, contribution is not counterfactual dependence, or the lawful entailment of an event, or any of the more sophisticated variations on these relations that have been put forward as the basis for a theory of causation. Contribution is a recognizable causal notion. But it has received relatively little attention in the current debate on causation. This neglect has come at a cost. By neglecting contribution, we’ve allowed otherwise tractable problems involving causation to fester.

My concern in this paper lies with one such problem: the causal exclusion problem for mental events. The exclusion problem is often posed as a challenge to the efficacy and irreducibility of mental events — believings, desirings, experiencings, and the like. Many of us wish to say that mental events are both causally efficacious and distinct from any underlying physical events in the brain. Should I reach for the coffee on my desk, it would seem that my reaching is caused both by my desire for coffee and by a neural event that realizes that desire. But if that’s the case, the efficacy of the mental is superfluous. The cumulative effect of my desire and its realizer is in no way different from what the realizer itself is sufficient to cause. In this respect, the two events act like a single cause. The presence of the second event adds nothing to the effect. At its heart, the causal exclusion problem is the problem of explaining how this is possible if mental events and their realizers are in fact different causes.

I will argue that contribution provides a new solution to the exclusion problem. Mental events and their realizers interact with one another in a different manner than events like Billy’s and Suzy’s throws because of a prior difference in their contributions. These contributions allow a mental event and its realizer to be two different and efficacious events and yet act in the relevant respects like a single cause. The argument will proceed in four parts. Part one provides a brief account of the exclusion problem for mental events and the puzzle about causation that lends it its force (§1). Part two develops an account of contribution (§2) and part three draws on that account to resolve the exclusion problem (§3–5). Finally, I conclude by comparing this new solution to the exclusion problem with a number of more familiar proposals (§6). Because this approach locates the solution to the problem in the contributions of mental events and their realizers, it remains comparatively agnostic towards the ontological questions that the exclusion problem has traditionally been invoked to settle. It provides a way out of the exclusion problem without an attendant commitment to a theory of mind.

1. The causal exclusion problem

The exclusion problem has developed a bad rap. It is often dismissed by critics as obscure or, worse, a pseudo-problem. As they see it, the exclusion problem simply has not been shown to be a legitimate source of concern (e.g., Sider [2003]). Before we can properly address the problem then, I believe that it is worthwhile to lay out its motivation in a bit more detail than it is sometimes afforded and make the case that the problem warrants our attention.

Consider a rather ordinary case of mental causation. Suppose that you stand and applaud after seeing a play. As a deliberate action, your applause is caused by various mental events such as your decision to applaud. As a physical action, your applause is also caused by certain physical events in your brain, including (it would seem) the physical event that realizes your decision to applaud. Now if your decision to applaud and its realizer are in fact one and the same event, this is innocent double counting; though we refer to the decision and its realizer under different names or descriptions, they are one cause, not two. But if they are not the same event, your clapping has two different, but parallel, causal histories.1 It is overdetermined in the sense that it has

1. The arguments against the reducibility of mental events are well-traveled. Mental events cannot be type-identical with their their realizers because mental events are multiply-realizable. Similarly, mental events cannot be token-identical with their realizers because they have different modal properties. Your desire to applaud — that very event — could have been realized by a different physical event. But if your desire could have occurred in the absence of its actual realizer, it cannot be identical to that realizer.
Causal contribution and causal exclusion

two or more sufficient causes that are not themselves causally related. Given their background conditions and the laws, the decision and realizer are both sufficient causes of the clapping.

This is the exclusion problem. The problem is that while many of us wish to say that mental events and their realizers are different events and that each is causally efficacious, it is not clear that overdetermination of the sort that this would engender can in fact occur. If either the decision or its realizer is a sufficient cause of your applause, the other is in some respect superfluous. As Kim famously worries:

[T]o acknowledge that [an effect] $p$ has a physical cause... is to invite the question: Given that $p$ has a physical cause...what causal work is left for [a mental cause] to contribute? The physical event therefore threatens to exclude, and preempt, the mental cause. (Kim 1998, 37)

Critics have rightly wondered what this concern comes to. Suppose it turns out that mental events are causally superfluous. Why should it follow that they are any less efficacious? Granted, it may come as a surprise to learn that our mental lives are marked by a kind of causal redundancy, that there are physical events that cause any effect we might attribute to the mind. But why then isn’t the lesson merely that some effects have more causes than we might have initially guessed? What’s so bad about superfluous causation?

The answer, I think, is that causal overdetermination by a mental event and its realizer — and in turn the causal superfluity it engenders — raises a problem for the way in which we understand causal interactions. Causal overdetermination is just one type of causal interaction. Say that a causal interaction occurs just in case two or more events that are not themselves causally related cause the same effect. If mental events and their realizers overdetermine their common effects, their interactions are quite unlike those of most other events.

1. The problem may not be unique to mental events and their realizers. As others have noted, fundamentally the same problem can arise in cases where reductions are controversial, such as the potential interactions of biological events and their underlying chemical realizers (Block 2003). In this respect, the exclusion problem itself is a general problem that arises from the rejection of various reductions. Mental events and their physical realizers simply present a paradigmatic and pressing example.

2. In framing the issue this way, I’m ignoring certain extrinsic properties of events, such as those that relate to an event’s causal history (e.g., is caused by two events).
quickly, or with added enthusiasm because your clapping was caused by both the decision and its realizer rather than just one or the other.

Additive causes play a difference-making role that non-additive causes do not. If two golf balls strike the window and shatter it, each impact causes the shattering to have a certain set of properties. But in addition to that, each impact also makes a difference to what properties the other impact causes the shattering to have. Without the impact of the first ball, the impact of the second ball might still have caused the shattering, but it would not have caused the shattering to have all of the properties that it actually did. In interactions that are not additive, the interacting events do not make that difference with respect to one another. They may cause a common effect to have certain properties, but they make no difference at all to what properties the other interacting events cause their effect to have. To put the point a slightly different way, a pair of additive causes make a difference to whether, when, where, or how their common effect occurs and they make that difference with respect to one another. If not for the fact that both causes brought about that effect, it either would not have occurred, or it would have occurred at a different time, or in a different place, or in a different manner. This type of difference-making is absent in causal interactions where additivity fails.

Such failed additivity is puzzling. Consider just how different the case of your applause is from the window shattering example. Suppose that we re-imagine the window shattering such that it involves a failure of additivity. We need to imagine that one ball shatters the window, and the other ball shatters the window, and that the window shatters in precisely the same way that it would have shattered had it only been struck by a single ball. And be careful. This is not to imagine that the two balls subtly impede one another so that they each individually strike the window with half as much force or that one ball strikes the window first and the other sails harmlessly through the already broken pane. No. To do that is to imagine an additive interaction or no interaction at all. Rather, we need to imagine that each ball strikes the window in such a way that it is fully responsible for the shattering's properties, from the time that it occurs down to the shape and momentum of each shard of glass that forms as the window breaks apart.

As I see it, this puzzle is the heart of the causal exclusion problem. Should mental events and their realizers overdetermine their effects, there are two quite different kinds of causal interactions that events engage in: additive and non-additive. By adopting a theory of mind on which there is such a difference, we take on the burden of accounting for it. We need to explain why causal additivity systematically fails in the interactions of mental events and their realizers when it does not fail in causal interactions generally. Absent that explanation, we make causation mysterious in a way that it need not be. We might, after all, have adopted a theory of mind that does not engender a systematic failure of causal additivity. We might have identified mental events with physical events or denied that they have the effects we typically take them to have. Either route leads us away from mental-physical causal overdetermination and the failed additivity that ensues. Embracing that overdetermination means that we have some explaining to do.

Perhaps this is not the only problem that superfluous causation presents. Proponents of the exclusion problem sometimes seem to worry that superfluous causation is inherently problematic, that failed additivity does not need to be accounted for so much as avoided outright.\(^4\) I am not moved by such concerns and won’t explore them here. I’ll assume then that the mere causal superfluity of mental events would not itself be objectionable. In what follows, I’ll argue that contribution explains the systematic failure of additivity we would find in mental-physical causal overdetermination. I believe that the reason that additivity fails in some interactions but not others lies in the

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4. This concern is often attributed to Kim. However, he seems not to hold it either. Kim (2002, 675) has said that his defense of the exclusion problem assumes “a conception of causation as ‘production’ or ‘generation’” rather than mere counterfactual dependence. For whether we think of causation along the lines of production or dependence makes no obvious difference to whether mental causes are, strictly speaking, superfluous. Physical causes are sufficient for the relevant effects either way.
contributions of the interacting causes. Additive causation requires causes that make the right sorts of contributions. While the events that commonly concern us make such contributions, mental events and their realizers do not.

2. Contributions as lawful constraints

So, what is a contribution? Several authors have proposed accounts of contribution (or at least notions of causal influence very much like it) that understand contribution as an influence exerted by one event that is aimed or directed towards some particular outcome. Mumford and Anjum (2011a; 2011b) liken contribution to a vector. Corry (2006; 2009) takes it to resemble a component force. These accounts treat contribution as an unreduced primitive. So, for example, when Billy splashes blue paint on the wall, his splash exerts an influence that is directed towards the appearance there of a blue spot. Whether a blue spot appears depends on what other contributions are made and how these various primitive influences combine. This is not my point of departure. Rather, the idea I want to explore here is that contributions are constraints that events impose on how the state of the world will evolve. Think of the world’s evolution from one state to the next as a path through a state space. Given the laws, an event constrains what path the world may take. It renders some future states strictly ineligible to obtain while leaving others eligible. In doing so, it influences how the state of the world evolves. That influence is its contribution.

One brief caveat. How we should understand contribution depends on whether the laws are deterministic or indeterministic. As is common in discussions of causation, I’ll assume that determinism is true. That is, I assume that the laws and complete state of the world at any time together entail the complete state of the world at every other time. This assumption may very well prove false, of course. Even so, I believe that it is fruitful. An account of contribution under indeterminism can take the present account as a starting point. Regardless, understanding the contributions of individual events under determinism is valuable in its own right.

Take a step back then. The question that any account of contribution must answer is what influence an event might have on its own, independently of the other events in its environment. Take a case in which there can be no question of how to distinguish the influence of a single event from that of its environment. Consider the complete state of the world at this very moment. The obtaining of this state is an event. Under determinism, that event imposes a well-defined constraint on how the world will evolve in its wake. Together with the laws, it determines the succession of states that will follow. It dictates which events will occur and which will not. It lays out a complete path through the state space.

Most events that concern us do not have such influence. Births, deaths, handshakes, and the like (however world-changing they may be) do not fix the world on a single, unwavering course. It is consistent with the laws for an ordinary, medium-sized event to be immediately followed by the obtaining of any number of different states. For example, Billy’s throwing the blue paint at the wall at time \( t_1 \) may be followed at \( t_2 \) by the obtaining of a world state that includes a blue spot on the wall, or a green spot on the wall, or a light-blue spot on the wall. Each of these states — and many more to be sure — is consistent with the laws and Billy’s throwing at \( t_1 \). The same goes for events. Billy’s throw does not itself assure that any event subsequently occurs.

So, what influence can a single, ordinary event claim? Notice that while an event like Billy’s throw at \( t_1 \) may not assure that any one state obtains at \( t_2 \), it may assure that certain states do not obtain. Many states are just not compossible with Billy’s throw under the actual laws. For if the laws are deterministic as we’ve assumed, the obtaining of the state of the world at one time lawfully entails the obtaining of the state of
the world at every other time. Absent a violation of the laws then, those world states that could have obtained at \( t_2 \) had Billy not thrown at \( t_1 \) could only have obtained at \( t_2 \) had Billy not thrown at \( t_1 \). Billy’s throw makes it nomically impossible that these states obtain at that time.

Billy’s throw at \( t_1 \) imposes a constraint on what the world can be like at \( t_2 \). The state of the world that obtains at \( t_2 \) must be a nomically possible state of the world at \( t_2 \) given Billy’s throw at \( t_1 \). Take the range of possible world states that are themselves internally consistent with the laws. Each of these states is, in a broad sense, a nomically possible state of the world at \( t_2 \). Far fewer are nomically possible at \( t_2 \) given Billy’s throw at \( t_1 \). Billy’s throw imposes a constraint on what the world can be like at \( t_2 \) in that it limits the number of states in this range that are eligible to obtain at \( t_2 \).

In this respect, the influence of ordinary events like Billy’s throw is fundamentally no different from that of an obtaining world state. Both constrain the range of states that may obtain in their wake. They permit the world to evolve towards some states and prohibit it from evolving towards others. Where they differ is the severity of that constraint. The obtaining of a complete world state limits the range of states that may subsequently obtain so thoroughly that only a single state remains eligible to obtain at any given time. It lawfully entails that these states obtain. In contrast, the constraints imposed by ordinary events such as Billy’s throw are open-ended. They limit the range of states that may subsequently obtain, but those limits leave multiple states eligible to obtain at any one time. This is no doubt a significant difference between these constraints. But it is a difference of degree, not kind.

I propose that this constraint is an event’s contribution. Imposing that constraint is what an event does, on its own, simply given the laws. Going forward, it will be helpful to have some formalism. We can understand an event’s contribution as the set of nomically possible worlds in which that event occurs. Each nomically possible world marks one way in which the state of the world may evolve under the laws. An event’s contribution is a subset of this broader range of worlds. It carves out the range of ways in which the state of the world may lawfully evolve given the event’s occurrence. In this way, contributions do indeed serve as a kind of constraint. If it is nomically possible for a world state to obtain in the wake of a given event, the contribution of that event must include a world in which the state obtains in the wake of that event. If it is not nomically possible for that state to obtain in the wake of an event, its contribution will not include such a world.

To illustrate, return again to the paint-throwing vandals. When Billy throws his paint at the wall, his throw makes a contribution. That contribution is the set of nomically possible worlds in which the throw occurs. That set includes the actual world, of course, but also worlds that break with actuality in large and small ways. For example, it includes worlds where Suzy throws different paint or aims at a different target. It also includes worlds where the surrounding environment is quite different: worlds in which Billy throws in the middle of a desert or into an oncoming hurricane. How much variety is found in the contribution depends in part on what event we take it to be the contribution of. For instance, if we suppose that the contributing event is particularly fine-grained and modally fragile, the contribution may only include worlds in which the throw occurs precisely when, where, and how it actually does. Alternatively, if we grant that the throw could have occurred a bit earlier, or later, or that it still could have occurred if Billy had stood a foot to the left and thrown a little harder, then such worlds must also belong to its contribution.

This account of contribution may strike some as incomplete. One may grant that events influence the world’s evolution in that they permit some states to obtain and rule out the possible obtaining of others, but insist that their influence involves a further element — actively bringing about the obtaining of future world states. Seen this way, the obtaining of a world state at time \( t_0 \) necessitates the obtaining of a world state at \( t_1 \) and this consists of something more than ruling out the obtaining of every other possible state at that time. Perhaps events exert such influence, but I currently see no need to suppose that they do. If only a single state is eligible to obtain at some time, that state
must obtain at that time. So if the obtaining of a state $S_1$ constrains what future states of the world may obtain such that $S_2$ is the only state eligible to obtain at some later time, $S_1$ must obtain at that time. This ruling out of other possibilities necessitates the obtaining of $S_2$ because it quite literally makes the obtaining of $S_2$ necessary.

Nonetheless, this account of contribution may still serve as part a heavier notion of contribution that incorporates some additional element. Whatever the full extent of an event’s influence on the world may be, it consists at least in part in imposing the type of constraint I’ve described here. Those inclined to adopt heavier notions of contribution may demote the present account of contribution to an account of one aspect of contribution. A heavier notion of contribution may bring with it an additional explanatory burden, but it could in principle be used to ground the solution to the exclusion problem to which I’ll now turn.  

3. Causal contributions and causal additivity

What does contribution have to do with causal additivity? Recall that additive causes are difference-makers. A pair of events are additive causes of some effect only in so far as they each make a difference to what the other causes. The first event in the pair must make some difference to whether, when, where, or how the second event causes their common effect to occur and the second event must make a similar difference with respect to the first event. Difference-making as such is a matter of contrasts. For one event to make a difference to what another event causes, it must do more than merely make it the case that this other event causes its effect to occur when, where, and how it does. The former event must make it the case that the latter event causes its effect to occur just as it does, rather than at a different time, or place, or in a different manner, or as opposed to not causing the effect at all. It must prevent at least one of these alternate possibilities from being actualized.

Take our vandals. Billy’s throwing blue paint and Suzy’s throwing yellow paint cause the appearance of a green spot. But they also prevent one another from causing the spot to be a different color. Had Billy not thrown or had his throw been off the mark, Suzy’s throw would have caused the appearance of a yellow spot. Similarly, had Suzy’s throw not occurred, Billy’s throw would have caused the appearance of a blue spot. Neither of these possibilities are actualized. Billy’s throwing blue paint prevents the spot from being yellow. Suzy’s throwing yellow paint prevents the spot from being blue. It is in part because of this that each throw makes a difference to what the other causes. Billy’s throw makes it the case that Suzy’s throw causes the spot to be green rather than yellow. Suzy’s throw makes it the case that Billy’s throw causes the spot to be green rather than blue.

A pair of events therefore can only be additive causes if they satisfy two conditions. First, there must be a relevant difference for each event to make. It must be possible under the actual laws that each event failed to cause the effect to occur precisely as it did, either because it caused the effect to occur in a different region or manner or because it did not cause the effect to occur at all. Second, each event must prevent at least one such possibility from being made actual. The first event must prevent some possible outcome of the second event and the second must prevent some possible outcome of the first.

Notice that we can think of these possibilities in terms of world states. In so far as one event makes a difference to what another event causes, the former event must also make a corresponding difference to the state of the world at the time that the effect of the latter event occurs. For example, if Billy’s throw makes it the case that Suzy’s throw causes a green spot to appear rather than a yellow spot, it must be nomically possible that Suzy’s throw could have led to the obtaining of a state in which a yellow spot appears. Likewise, when Billy’s throw prevents the appearance of the yellow spot, it necessarily prevents the obtaining of such a state (at least at the relevant time). Framed this way,

6. Most notably, one who adopts a heavier notion of contribution would need to say more about how the contributions of individual events relate to the collective contribution of multiple events than what I address in §5.
the two previous conditions on additive causation ultimately concern the states that may obtain given an event’s occurrence and the states that an event prevents from obtaining. It must be nomically possible that each additive cause could have been followed by a world state in which their effect does not occur when, where, and how it does. Moreover, each additive cause must prevent the obtaining of at least one such state.

It will be helpful to think of states as a species of event. Conceived as such, a state is the largest event to occur at any given time. Moreover, I’ll suppose for convenience that states are both maximally fine-grained and fragile. As such, the state of the world right now is the event that exhaustively fixes the intrinsic character of the world at this particular moment. It could not have obtained a moment earlier or later, nor could it have obtained if the intrinsic properties of any part of the world just now had been different.

Whether a pair of events satisfy the above conditions depends on their contributions. An event’s contribution helps determine both what states are nomically possible given the event and what states the event prevents from obtaining. Since an event’s contribution is the set of worlds that are nomically possible given its occurrence, a world state is nomically possible given that event only if the event’s contribution includes a world in which that state obtains. In contrast, an event prevents a world state from obtaining only if its contribution does not include a world in which that state obtains.

To better see this last point, consider an event \( e \) and a possible world state \( S \). Suppose that \( e \)'s contribution includes a world in which \( S \) follows \( e \). Now under determinism that is the only nomically possible world in which \( S \) obtains. For if determinism is true, the state of the world at one time entails the state of the world at every other time. Every nomically possible world in which \( S \) obtains shares all of its states with every other world in which \( S \) obtains. These worlds differ in name only. That being the case, \( e \) cannot prevent \( S \) from obtaining. Far from impeding \( S \)'s obtaining, \( e \) is its necessary precursor. So while \( S \) may very well fail to obtain in the wake of \( e \), it does not fail to obtain *because of* \( e \).

If \( e \) is to have any claim at all to preventing a state from obtaining then, its contribution cannot include a world in which that state obtains.

Putting this together allows us to spell out a necessary condition on causal additivity in terms of contributions. Should a pair of events interact additively, they must satisfy the following condition.

*Constraint* Events \( e \) and \( e^* \) are additive causes of an event \( e \) that occurs at time \( t \) only if there are a pair of worlds \( w \) and \( w^* \) such that (1) states obtain at \( t \) in \( w \) and \( w^* \) in which \( e \) does not occur in its actual region and manner, (2a) the contribution of \( e \) includes \( w \) but not \( w^* \), and (2b) the contribution of \( e^* \) includes \( w^* \) but not \( w \).

In short, if a pair of events are to interact additively, their contributions must cross-cut one another. The contribution of each event must include some world that the other does not. That world must be one in which the additively caused effect does not occur when, where, and how it in fact does.

The contributions of the vandals’ throws bear this out. Imagine that Billy and Suzy both throw their paint at time \( t_1 \) and the green spot appears on the wall shortly thereafter at time \( t_2 \). Though the vandals throw together, they each could have thrown alone. The contribution of Suzy’s throw includes a world in which she throws alone at \( t_1 \) and the wall bears a yellow mark at \( t_2 \). The contribution of Billy’s throw includes a world in which he throws alone at \( t_1 \) and the wall bears a blue mark at \( t_2 \). The state of each of these worlds at \( t_2 \) is incompatible with the wall’s bearing a green mark at \( t_2 \); they are not states in which a green mark appears. The contribution of Billy’s throw excludes the world in which Suzy throws alone and the contribution of Suzy’s throw excludes the world in which Billy throws alone. As such, the vandals’ throws easily satisfy *Constraint*. Their contributions cross-cut one another in the manner that additivity requires.

To be sure, there is more to additivity than satisfying *Constraint*. *Constraint* only provides a necessary condition on causal additivity.
(and a weak one at that). It is by no means a sufficient condition. Constraint does not demand, and its satisfaction does not entail, that there is any causal relationship at all between the events that satisfy it. However, this is just to say that Constraint sets the bar for additive causation quite low. There are surely more exacting demands that we could place upon additive causes if that was our aim. But a low bar is a bar all the same. If a pair of events are to be additive causes, they must measure up.

4. Solving the exclusion problem

We’re now in a position to address the causal exclusion problem. Recall the challenge we’re confronted with. We need to account for the failure of additivity found in the interactions of mental events and their realizers. To do that, we need to explain how a pair of events could bring about the same effect without doing so additively.

One of the lessons to be had from Constraint is that causal additivity is in part a matter of how the contributions of additive causes are related. Some interactions may not be additive simply because the contributions of the relevant events stand in the wrong relation to one another. Any relation that precludes the contributions of a pair of events from crosscutting one another also precludes those events from interacting additively. Take identity for example. Events that make the same contribution clearly cannot be additive causes. Since no world is both included and not included in the same contribution, events that make the same contribution will always run afoul of Constraint. Neither event makes a contribution that excludes a world found in the contribution of the other. This is one reason why no event can additively cause an effect with itself. It cannot, in principle, satisfy Constraint.

More importantly, causal additivity similarly falls prey to the containment relation—the relation that a set stands in to its subset. If the contribution of one event contains the contribution of another event, every world in the latter contribution is also found in the former contribution. The former, containing contribution does not exclude any world that belongs to the latter, contained contribution. And that’s enough to preclude those events from being additive causes.

For example, suppose we have a pair of events Super and Sub where Super’s contribution is the set of worlds \( \{w_1, w_2, w_3\} \) and Sub’s contribution is the set of worlds \( \{w_1, w_4\} \). Super and Sub partially satisfy Constraint. Sub’s contribution excludes world \( w_3 \) in Super’s contribution. Even so, they cannot be additive causes. Because Super’s contribution contains Sub’s contribution, Super’s contribution does not exclude any of the worlds that belong to Sub’s contribution. So Super and Sub do not fully satisfy Constraint. Constraint demands that the contributions of both additive causes exclude a world that belongs to the other. Containment assures that this condition is not met.

This result is noteworthy because of the close relationship between contribution and supervenience. Should one event supervene on another with at least nomically necessity, the contribution of the former event will contain the contribution of the latter event. Suppose that an event \( a \) supervenes on an event \( b \) with nomically necessity. \( a \)’s supervening on \( b \) consists in part in the upward necessitation of \( a \) by \( b \); in every world that shares our laws, \( a \) occurs if \( b \) occurs. As such, \( a \)’s contribution contains \( b \)’s contribution. Every nomically possible world in which \( b \) occurs is a world in which \( a \) occurs.

This suggests a simple solution to the exclusion problem. Mental events supervene on physical events. That is, necessarily, if a mental event \( m \) occurs, some physical event \( p \) also occurs such that, necessarily, if \( p \) occurs then \( m \) occurs. The strength of those necessities is controversial of course. Physicalists hold that mental events supervene on physical events with metaphysical necessity. Dualists hold that it is only nomically necessity. But most everyone agrees that mental events supervene on physical events with at least nomically necessity. If that’s the case, the contribution of a mental event contains the contribution of the physical event that necessitates it. Those events cannot be additive causes. Should a mental event and a physical event that necessitates it

\[ 7 \quad \text{That is, mental events strongly supervene on individual physical events (Kim 1993).} \]
overdetermine an effect, the failed additivity that this engenders is not problematic. On the contrary, it is to be expected. The contributions of the overdetermining causes would not allow their interactions to be additive.

Unfortunately, the simple solution is a bit too simple. The inconvenient fact of the matter is that the exclusion problem does not only arise for mental events and the physical events that necessitate them. We can find examples of this even in paradigmatic cases of mental causation. We often wish to say that mental events are realized by rather localized events in the brain whose constitutive properties are intrinsic to the regions in which they occur. For example, suppose we indulge the philosopher’s fiction that pains are realized by c-fiber firings. Imagine that you burn your hand on the stove and reach for the freezer to get ice for the pain. Your reaching is purely overdetermined by your feeling of pain and the c-fiber firing that realizes it. But your pain is not necessitated by the firing c-fibers. As Karen Bennett (2003) has pointed out, the c-fiber firing that realized your pain could have occurred in a petri dish if the conditions were right. But c-fiber firings in petri dishes are not accompanied by pains. So, the c-fiber firing that realizes your pain does not itself necessitate your pain. It realizes your pain only under the right circumstances. As such, the contribution of the pain event does not contain the contribution of the c-fiber firing.

Examples like this show that the simple solution to the exclusion problem is inadequate. Causal additivity fails in some cases of mental causation because the contribution of the mental event contains the contribution of its realizers. But this cannot be the sole reason that mental causation leads to a failure of additivity. Even so, I believe that the simple solution is almost correct. The contributions of mental events and their realizers are indeed responsible for the failed additivity that arises from mental causation. However, to account for that failed additivity we need to understand those contributions in the circumstances in which they are made.

5. Failed additivity in the circumstances

The discussion of additive causation in the previous sections has been ambiguous between two different types of additivity. As we’ve said, additive causes play a distinctive difference-making role. If the interaction of a pair of events is additive, each event makes a difference to their common effect with respect to the other. However, there are different types of differences that an event might make and still play that role. In particular, we can distinguish the differences that an event makes independently of the circumstances in which it occurs from the differences that it makes given those circumstances. In the latter case, an event makes a difference to its effect, holding fixed the fact that some further event or events occur. That is, it makes a difference between the world being one way rather than another, both of which are possible given the occurrence of these further events. The former case involves no such restriction. For example, suppose that you accidentally back your car over a glass bottle and two shards of glass puncture your tire. Without taking either puncture as given, it is reasonable to suppose that each puncture makes a difference to the tire’s inflation. If neither puncture is taken as given, there is an open possibility that the tire remains inflated. It is reasonable to suppose then that each puncture prevents such a possibility from being actualized and thereby makes a difference to the tire’s inflation. In contrast, neither puncture makes a difference to the tire’s inflation given that the other puncture occurs. For given that one puncture occurs, it is no longer an open possibility that the tire remains inflated.9 Without such an open possibility to prevent, the other puncture cannot make the difference between the tire’s remaining inflated and not remaining inflated.

Talk about difference-making in the context of causation typically concerns difference-making of this latter sort. The causal exclusion
Causal contribution and causal exclusion

problem is no different. Mental events and their realizers are not sufficient for their effects entirely on their own. Rather, they are sufficient for their effects given the particular circumstances in which they occur. Recall the way in which we arrived at the problem in §1. We imagined that, given its background conditions, the physical event that realized your decision to applaud was a sufficient cause of your applauding when, where, and how you did. This qualification is important. Had it not been for those background conditions (e.g., your possessing a certain sort of physiology) the event that realized your decision may not have caused you to applaud at all, much less caused you to applaud precisely as you did. When we regard the realizer as a sufficient cause of your applause, we consider it in the context of the circumstances in which it occurs. Likewise, when your decision fails to make a difference to that effect with respect to its realizer, it fails to make a difference to what its realizer causes given those background conditions.

The failure of additivity that we need to explain in these cases is the failed additivity of mental events and their realizers in light of the conditions in which they occur. We need to show that mental events and their realizers do not interact additively given at least some of the events in their environment. Contributions can provide that explanation. If they are to do so, it will be helpful to extend the notion of contribution to include two different types of influence: individual contributions and collective contributions.

Say that the type of contribution that we have been concerned with thus far is the individual contribution of an event. The individual contribution of an event is an influence that the event has on future states of the world independently of any other events in its environment. Additionally then, say that the collective contribution of multiple events is the influence that those events have together strictly in virtue of their individual contributions. It is an influence that those events have on future states of the world independently of any further events in their environment. For example, the collective contribution of events \( a \) and \( b \) is the influence that \( a \) and \( b \) have on future states of the world independently of surrounding events \( c, d \), and so forth. The account of contribution I offered in §2 easily extends to capture this notion of collective contribution. As before, an event’s individual contribution is the set of nomically possible worlds in which that event occurs in its actual region and manner. The collective contribution of multiple events is the intersection of the individual contributions of those events. It is the set of nomically possible worlds in which all of the contributing events occur.

Just as the contribution of a supervenient event contains the individual contribution of any event that necessitates it, its contribution will also contain the collective contribution of any events that jointly necessitate it. Suppose that a mental event \( m \) supervenes on a pair of physical events \( p_1 \) and \( p_2 \). Since \( p_1 \) and \( p_2 \) together necessitate the occurrence of \( m \), any world in which \( p_1 \) and \( p_2 \) occur is a world in which \( m \) occurs. As such, the contribution made by \( m \) will contain the collective contribution made by \( p_1 \) and \( p_2 \). And it will do so even if it does not contain the individual contributions of \( p_1 \) or \( p_2 \). It is entirely possible that \( p_1 \) and \( p_2 \) might each have individually occurred in \( m \)'s absence and that \( m \) may similarly have occurred in the absence of \( p_1 \) or \( p_2 \). If so, the contribution of \( m \) does not contain the individual contributions of either \( p_1 \) or \( p_2 \). But it does contain their collective contribution.

Here again, containment relations stand in the way of additivity. No supervenient event can additively cause an effect together with all of the events on which it supervenes. As we saw in §3, if a pair of events are additive causes, each event must make some difference to what the other event causes. By extension, if \( m, p_1 \), and \( p_2 \) are all to be additive causes, \( m \) must make some difference to what \( p_1 \) and \( p_2 \) cause together. To make that difference, \( m \)'s contribution would need to exclude some world that belongs to the collective contribution of \( p_1 \) and \( p_2 \). But \( m \)'s contribution contains the collective contribution of \( p_1 \) and \( p_2 \). It does not, in principle, exclude worlds in their contribution. So \( m, p_1 \), and \( p_2 \) cannot be additive causes together and, more generally, supervenient events cannot be additive causes with all of the events that necessitate them. Their contributions simply do not allow it.
By the same lights, supervenient events cannot be additive causes with some of the events that necessitate them given the occurrence of the others. A pair of events that are additive causes with one another given some third event must each make a difference to what the other causes, holding fixed the fact that the third event occurs. For example, if \( m \) and \( p_1 \) are additive causes given that \( p_2 \) occurs, \( m \) must make some difference to what \( p_1 \) causes holding fixed the fact that \( p_2 \) occurs. It must prevent the obtaining of a state that is not only incompatible with some effect of \( p_1 \) occurring in the region and manner that it does, but one that that may obtain in the wake of both \( p_1 \) and \( p_2 \). After all, \( m \) must make a difference to what \( p_1 \) causes when it occurs in an environment that includes \( p_2 \). But \( m \) cannot prevent such a state from obtaining. Preventing such a state from obtaining would require the contribution of \( m \) to exclude a world from the collective contribution of \( p_1 \) and \( p_2 \). Since \( m \) does not do that, it cannot make a difference to what \( p_1 \) causes given \( p_2 \).

It is containment relations of this sort that lead to the failed additivity that we find in cases of mental causation. While mental events are not always necessitated by their realizers, they are in the very least necessitated by collections of events that include their realizers. This is the case if, as we saw in the example of pains and c-fiber firings, a physical event realizes a mental event under the conditions in which it actually occurs but might not have realized that mental event under different conditions. The conditions in which the realizer would have failed to realize the mental event are conditions in which one or more of these other necessitating events are absent. For example, we needn’t suppose that a c-fiber firing that occurs in a petri dish is intrinsically any different than one that occurs in your brain; it does not fail to realize a pain event on account of any fault of its own. The c-fibers that fire in the petri dish simply aren’t in the right environment to realize a pain. Some event or events with which the c-fiber firing could have jointly necessitated a pain event are absent.

The contribution of a mental event therefore either contains the individual contribution of its realizer or the collective contribution of its realizer and some further collection of physical events in their environment. Each of these containment relations is enough to assure the failed additivity that we find in cases of mental causation. If the contribution of the mental event contains the contribution of its realizer, the mental event and its realizer cannot interact additively regardless of their surrounding events. If, instead, the contribution of the mental event contains the collective contribution of its realizer are some further events, the mental event and its realizer cannot interact additively given the occurrence of those further events. Either way, mental events and their realizers cannot interact additively in the circumstances in which they occur. The very conditions that enable the mental event to occur undermine its ability to be an additive cause alongside its realizer.

It bears emphasis that there is nothing remarkable about mental causation lurking behind this result. We needn’t suppose that mental events are second-rate causal players, that mental causation is merely “as-if” causation, or that it is somehow derivative of physical causation. On the contrary, the present solution rests on the assumption that mental and physical events exert fundamentally the same type of influence on the world — that they are causal equals. Each event makes a contribution and could, in principle, serve as an additive cause. The reason that mental events and their realizers do not in fact act as additive causes lies in the fact that, at least given their physical background conditions, their contributions simply do not line up in a way that permits it. The contribution of a physical event poses a more severe constraint on the world than that of the realized mental event. It closes off the possibility that the state of the world will evolve in ways that the contribution of the mental event leaves open. But its contribution is not logically or metaphysically prior to (or more important than) the contribution of the mental event as a result. To borrow Kim’s idiom, both mental events and their realizers may do real causal work. Their work simply isn’t additive.

6. The present view in context

It may be helpful to consider my position in the context of more familiar proposals aimed at solving the exclusion problem for mental causation. Quite a few philosophers have thought that the solution to the exclusion problem lies in the close relationship between the mental and the physical (e.g., Yablo [1992], Loewer [2001], Bennett [2003; 2008], Pereboom [2002], Shoemaker [2001], Paul [2007]). Proponents of these views hold that while mental events are not identical to their realizers, they are tied to those realizers through some form of dependence such as supervenience (Loewer, Bennett, Yablo), constitution (Pereboom, Shoemaker), or mereological overlap (Paul). Contrast this with paradigmatic cases of additive causal interactions. Billy’s and Suzy’s throws, the impacts of the golf balls on the window, and the causes we single out in other textbook interactions are metaphysically independent of one another. And so the thought goes that these dependence relations make a causal difference. Mental events and their realizers are too closely related to interact in the manner we’ve come to expect of other events.

The solution I’ve offered here belongs in part to this tradition. Like these views, it holds that the solution to the exclusion problem begins with a relation between mental and physical events. The supervenience relations that tie mental events to their realizers assure that the contributions of mental events contain the contributions of their realizers and (perhaps) background conditions. Since containment provides a solution to the exclusion problem and supervenience assures containment, it is reasonable to say that supervenience provides a solution to the exclusion problem for mental causation.

Nonetheless, the present view breaks with this tradition in a number of important ways. The most significant differences lie in the nature and role of the relation that obtains between the causal relata. Philosophers who claim that the solution to the exclusion problem lies in a close relation between events have generally cited relations that involve some form of ontological dependence. The dependence such events exhibit is at least in part a matter of what they are rather than a brute consequence of the laws. This ontic bent applies to their claims regarding supervenience just as readily as it does to the more obviously ontic constitution and mereological relations. While supervenience in its own right needn’t carry any ontic import, those philosophers who have claimed that it provides a solution to the exclusion problem have generally restricted their claim to supervenience that holds with at least metaphysical necessity. Weaker, nomic supervenience—the only sort required under the present view—is generally not considered up to the task.

As a result, the success of these more familiar proposals is tied up with questions concerning the nature of mental events and the mind-body problem to a degree that the present view is not. They assume in the very least a theory of mind in which mental events stand in some general form of ontic dependence relation to their realizers. And often, they assume much more. Proposals like those advanced by Shoemaker and Paul are built on substantial accounts of particular forms of such ontic dependence. Shoemaker’s (2001; 2007) solution, for example, rests on his account of realization as the sharing of causal powers. For Paul (2007), the solution lies in the view that instances of mental and physical properties have overlapping logical parts. These commitments are not at all trivial, particularly given the role that the exclusion problem has played in the debate surrounding the mind-body problem. The exclusion problem is often used as an argument for reductive forms of physicalism over both non-reductive physicalism and dualism: reduce the mental to the physical and the problem disappears. Solutions to the exclusion problem that rely on ontic dependence relations between events resist only half of that argument. They provide a way out from the problem that is at best compatible with non-reductive physicalism and at worst compatible only with some particular strain of non-reductive physicalism.¹⁰

¹⁰. Bennett (2008) puts considerable stress on this point. She argues that only the physicalist can escape the exclusion problem without denying some
The present view does not discriminate between competing ontologies in this way. It is open to the dualist and physicalist alike. So long as a theory of mind allows that mental events supervene on physical events with at least nomic necessity, it is compatible with the view I’ve offered here. As a result, the present view is largely agnostic on questions concerning the nature of mind. It is, in this respect, a comparatively big tent solution. It allows us to adopt a theory of mind free from the pressures of the exclusion problem.

To be sure, philosophers have not gravitated to these more ontologically committal proposals by chance. Ontic dependence promises an intuitively compelling solution to the exclusion problem. Remember, the exclusion problem arises in cases where, for one reason or another, we’re pushed towards the view that multiple events cause an effect, but fail to do so additively. The effect they cause together is no different from the effect that just one is sufficient to cause on its own. As such, we can frame the exclusion problem as the problem of explaining how multiple events bring about an effect in a manner that is indistinguishable from its being brought about by a single event. Ontic dependence can seem to provide a simple account of this. It is often remarked that such dependence entails that the mental is “nothing over and above” the physical. This close, ontic connection between mental and physical events is said to be in some respect like identity. It’s not implausible to think that if multiple events are ontologically like a single event, they are causally like a single event. They bring about certain effects as though they were a single cause because in some respect they are like a single cause.

The view I’ve offered here does not ask ontic dependence to play this role. Dependence relations between mental and physical events matter only in so far as they hold with enough strength to secure the far more important containment relations between their contributions. Ontic dependencies between events may very well be sufficient for this, but they are not necessary. Like those traditional solutions, however, the key to the present approach is a close, non-nomic relation. Containment is a logical relation. While the contribution that an event makes is contingent on the laws that subsume it, the containment relations that it stands in to other contributions hold with logical necessity. In this respect, the present view does not break outright with these traditional approaches to the exclusion problem so much as it shifts the critical relation from more familiar relata (events) to those that have not garnered much attention until now (contributions).

As a result, the present view captures the same intuition that has guided these more traditional approaches to the exclusion problem. It too reflects the idea that the peculiar interactions of mental events and their realizers stem from the fact that the mental is “nothing over and above” the physical. Notice that the claim that the mental is nothing over and above the physical is ambiguous between two related claims: the claim that the mental is nothing ontologically over and above the physical and the claim that the mental is nothing causally over and above the physical. More often than not, philosophers who engage in “nothing over and above” talk have the former, ontic claim in mind. But in the context of the exclusion problem the interesting claim is causal. We want to know how multiple events could act like a single cause. Now one way to argue for the causal claim is to start from the ontic claim. That is the approach to the exclusion problem taken by views rooted in ontic dependence. Shifting our focus from events to causal contributions makes this step unnecessary. It allows us to address the causal claim without the ontic intermediate.

The contributions of mental events are strictly and literally nothing over and above the contributions of their realizers and background conditions. Contributions are constraints that an event imposes on the way in which the state of the world develops and evolves. For one constraint to be nothing over and above another constraint is just for the former constraint to impose no further limitation given the latter constraint. For example, suppose we have a restaurant that requires its patrons to wear shoes and a shirt. This requirement is a constraint. It limits the range of people that may patronize the restaurant. Now
Suppose then that a mental event \( m \) supervenes on a physical event \( p \). Supervenience assures that the contribution made by \( m \) contains the contribution made by \( p \). Every world in which \( p \) occurs is also a world in which \( m \) occurs and so every world in \( p \)'s contribution also belongs to \( m \)'s contribution. Assuming that \( m \) could have been realized by events other than \( p \), the contributions of the two events differ. Certain worlds belong only to \( m \)'s contribution. These worlds correspond to ways in which the actual world may evolve that are permitted by the contribution of \( m \), but not by \( p \). The contribution of \( m \) does not exclude any world that is not also excluded from the contribution of \( p \).

There is a clear sense here in which \( m \)'s contribution is something over and above \( p \)'s contribution. Seen merely as sets, the contribution of \( m \) is larger than the contribution of \( p \). It includes worlds that are not found in \( p \)'s contribution. However, to focus on contributions only as sets is to neglect the more central notion that contributions are constraints. The size of a contribution qua set is inversely proportional to the severity of that contribution qua constraint. The larger an event’s contribution, the more ways it permits the state of the world to evolve. So, while the contribution of \( m \) contains the contribution of \( p \) — and is therefore a larger set — it is in fact a less severe constraint. The contribution of \( m \) does not constrain the way in which the world may evolve in any way that it is not also constrained by the contribution of \( p \). Every world that is excluded by \( m \)'s contribution is excluded by \( p \)'s contribution. So as a constraint, the contribution of \( m \) is quite literally nothing over and above the contribution of \( p \).

With respect to their contributions then, the mental is nothing causally over and above the physical. Mental events do not make a difference to which states of the world obtain in their wake over and above the difference made by their subvenient physical realizers in the circumstances in which they occur. Accounting for that is sufficient to explain the failed additivity that marks the interactions of mental events and their realizers and, in turn I believe, to resolve the causal exclusion problem.\(^ {11} \)

References


\(^ {11} \) I would like to thank Carolina Sartorio, L.A. Paul, and Terry Horgan for their invaluable feedback and discussion. Thanks also to two anonymous referees for insightful comments on earlier drafts of this paper.