

Grounding, mental causation, and overdetermination

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Abstract Recently, Kroedel and Schulz have argued that the exclusion problem—which states that certain forms of non-reductive physicalism about the mental are committed to systematic and objectionable causal overdetermination—can be solved by appealing to grounding. Specifically, they defend a principle that links the causal relations of grounded mental events to those of grounding physical events, arguing that this renders mental–physical causal overdetermination unproblematic. Here, we contest Kroedel and Schulz’s result. We argue that their causal-grounding principle is undermotivated, if not outright false. In particular, we contend that the principle has plausible counterexamples, resulting from the fact that some mental states are not fully grounded by goings on ‘in our heads’ but also require external factors to be included in their full grounds. We draw the sceptical conclusion that it remains unclear whether non-reductive physicalists can plausibly respond to the exclusion argument by appealing to considerations of grounding.

Keywords Grounding · Mental causation · Overdetermination · Causal exclusion

Recently, [Kroedel and Schulz \(2016\)](#) have argued that the exclusion problem—which states that certain forms of non-reductive physicalism about the mental are committed

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to systematic and objectionable causal overdetermination¹—can be solved by appealing to grounding. Specifically, they claim that grounding can be leveraged to establish a causal grounding principle that links the causal relations of grounded mental events to those of grounding physical events, thereby rendering mental–physical causal overdetermination unproblematic.

This result is of obvious interest to non-reductive physicalists, since it appears to get them out of a troubling predicament. It is also of interest to grounding theorists, as it helps to substantiate the claim that grounding is a theoretically fruitful notion.²

Here, we contest Kroedel and Schulz’s result. In particular, we contend that their causal grounding principle is undermotivated, if not outright false. We begin (Sect. 1) by setting up the debate and laying out Kroedel and Schulz’s view, before casting doubt (Sect. 2) on the causal grounding principle. Finally (Sect. 3), we draw the sceptical conclusion that it remains unclear whether non-reductive physicalists can plausibly respond to the exclusion argument by appealing to considerations of grounding.

Before proceeding, a quick caveat. Discussing interactions between grounding and causation is awkward, as grounding is often treated as holding between facts, whereas causation is often treated as holding between events. Kroedel and Schulz simplify their discussion by identifying events with property instances at a time, and allowing property instances to enter into the grounding relation (2016: p. 1912). We follow them in making these assumptions. We will also sometimes speak of mental and physical states, which we also construe as property instances. To minimise terminological jarring, we will tend to use event talk when discussing causation and fact talk when discussing grounding.³

1 Grounding physicalism and the exclusion problem

Grounding physicalism, as per Kroedel and Schulz, claims that mental events are *grounded* in physical events—that is, mental events non-causally and non-reductively depend on their physical bases. More specifically, grounding physicalism is the conjunction of

Non-Reduction	Mental properties are distinct from physical properties, and mental property instances are distinct from physical property instances ⁴
Grounding	Necessarily, all mental property instances are grounded in physical property instances ⁵

¹ See Kim (1989, 1993) and Malcolm (1968); for an overview of the debate, see Heil and Robb (2014: § 6.2).

² For the charge that grounding is not theoretically fruitful, see Koslicki (2015) and Wilson (2014).

³ Thanks to an anonymous referee for helpful discussion of this point.

⁴ We have reformulated Non-Reduction, as well as the other key principles of Kroedel and Schulz’s discussion, in terms of property instances. Given our (and their) usage, this does not alter the content of these principles. Thanks to an anonymous referee for this suggestion.

⁵ Note that Grounding could be weakened by dropping the necessity operator; however, we’ll set this complication aside here.

The former articulates grounding physicalism's non-reductive element as the denial of mental–physical event identities; the latter captures the widespread (among physicalists, anyway) idea that the mental is less fundamental than and dependent upon the physical. Hence Grounding is a natural extension of

Supervenience Mental properties supervene on physical properties

which Kroedel and Schulz claim (rightly, we believe) is characteristic of non-reductive physicalist positions in general. In this way, grounding physicalism is a member of the larger family of non-reductive physicalist positions, distinguished by its appeal to the explanatory relation of metaphysical grounding to explicate the relationship between the mental and the physical.

According to Kroedel and Schulz, the non-reductive physicalist 'gains a lot of explanatory potential' by adopting grounding physicalism (2016: p. 1910), as doing so resolves the infamous exclusion problem for mental causation.

Generating the problem requires the addition of a few more assumptions. First, to rule out epiphenomenalism about the mental, assume:

Efficacious Some mental property instances are causes of physical property instances

This assumption is motivated by seemingly plausible claims of mental causation, for example, that some combination of desires and beliefs caused Jojo to fill up her kettle.

Second, taking a cue from the natural sciences, assume

Closure All physical property instances which have a cause, *c*, have a physical cause that is simultaneous with *c*

The problem is that the conjunction of non-reduction, efficacious and closure—each, arguably, important components of any plausible version of non-reductive physicalism—seems to conflict with

Exclusion Not all physical effects of mental property instances are overdetermined

To see the problem, suppose, in accordance with Efficacious, that mental event *m* causes physical effect *e*. By Non-Reduction, *m* is distinct from any physical events. But by Closure, *e* has a physical cause *p* that is simultaneous with *m*. So *m* is distinct from *p*, and both *p* and *m* cause *e*. It seems then that *m* and *p* overdetermine *e*; and because the reasoning here is entirely general, it conflicts with Exclusion.⁶

Exclusion enjoys wide support in the literature, being a manifestation of a general scepticism that many philosophers have regarding systematic overdetermination. One natural—though not mandatory—way to motivate Exclusion is via considerations of parsimony. Say that *c*1 is *superfluous* with respect to a class of events *K* iff for any *e* in *K*,

⁶ This sketch, of course, simplifies the problem. For one thing, it does not specify necessary or sufficient conditions for overdetermination. Kroedel and Schulz distinguish two concepts of overdetermination (2016: pp. 1918–19): *c*1 and *c*2 *strongly overdetermine* event *e* iff *c*1 and *c*1 are (1) distinct, (2) both causes of *e*, (3) causally independent, and (4) metaphysically independent. Meanwhile, *c*1 and *c*2 *weakly overdetermine* *e* iff *c*1 and *c*2 are (1) distinct, (2) both causes of *e*, and (3) causally independent. Arguably, both concepts require a clause to the effect that *c*1 and *c*2 are events of the same type; see e.g. Dretske (1988: p. 42ff) and Jaworski (2016: p. 280 ff). Thanks to an anonymous referee here.

if c_1 causes e then there is a distinct event c_2 , such that c_1 and c_2 overdetermine e . Non-reductive physicalists seem committed to saying that mental events are superfluous with respect to the physical, since any causal work done by any mental event m with respect to the physical will also be done by distinct physical events. And if mental events are superfluous with respect to the physical, we've good reason to deny that mental events cause physical effects at all. By definition, we can excise any claim of mental to physical causation from our theory without increasing our commitment to causally unexplained physical events. It is then hard to resist the thought that we *should* so excise claims of mental to physical causation. At least, we need to tell a story as to why our theory would not be better—more parsimonious and no less explanatory—without them.⁷

Simplifying a little, Kroedel and Schulz offer non-reductive physicalists a way to bolster a rejection of Exclusion.⁸ Their central claim is that the Grounding thesis is helpful, and perhaps indispensable, for implementing this strategy. Grounding physicalism thus emerges from their discussion as admirably equipped for resisting the exclusion problem.

So, how is grounding physicalism meant to help? One initially tempting line of reasoning starts from the thought that grounding is a necessary and explanatory relationship that expresses a special form of non-causal dependence between the grounded and the ground. Given that the grounding relation is so intimate, it may seem that commitment to *this* kind of mental–physical overdetermination is no more problematic than commitment to water-involving events and H₂O-involving events, or bachelor-involving events and unmarried-man-involving events, ‘overdetermining’ their effects. In other words, the causal overdetermination identified in the problem is harmless, the mental being an ‘ontologically innocent’ addition to the underlying physical grounds.

However, on its own, this won't do. For one, the grounding relation, intimate as it is, is not the identity relation (or the relation of conceptual analysis), and it remains unclear whether the claim that X is grounded by Y renders X ‘ontologically innocent’ in a relevant sense (for a sceptical voice on the matter, see Audi 2012: p. 708).

Furthermore, even if mental events are ontologically innocent, this is not enough to secure the ontological innocence of the causal relations into which those mental events enter. Even if mental events are grounded in physical events, it doesn't automatically

⁷ Kroedel and Schulz suggest that Exclusion is a plausible generalisation, deriving

its initial plausibility from the observation that cases of overdetermination do not seem to abound in other areas of the physical world, which strongly suggests that they do not abound where there is mental causation either (2016: p. 1916).

We doubt that this is the source of Exclusion's plausibility. Belief in composite objects arguably brings commitment to systematic overdetermination by these and their parts, and an analogue to the exclusion problem arises in this context (see Merricks 2001). Since this composition-overdetermination debate is on going, it is premature to claim that cases of overdetermination aren't abundant in other areas. Moreover, since Exclusion and its analogue in the composition debate are of a piece, it is implausible that the former borrows its plausibility from the latter. Both principles stand in need of independent motivation; perhaps the parsimony considerations we sketch in the text can play this role.

⁸ Strictly speaking, they offer non-reductive physicalists a choice: either reject Exclusion or reject the claim that there is genuine overdetermination between the mental and the physical. Their central claim is that Grounding is helpful, and perhaps indispensable, for implementing either strategy.

follow that mental causation is. If mental event m is grounded in physical event p , it doesn't automatically follow that m 's causing some event, e , is physically grounded, nor does it follow that m 's causing e doesn't require the addition of something ontologically significant. Worries about parsimony apply not only to events, but also to the causal relations into which they enter. Consequently, non-reductive physicalists have to tell us why mental causation is ontologically innocent, why it adds nothing ontologically significant.⁹

To fill the gap, Kroedel and Schulz start with a *general grounding thesis* that a grounded layer of reality is the way it is because its grounds are the way they are. Applied to the current situation, this amounts to the idea that mental events have the properties they do because of the more fundamental physical events that ground them. But we still need to be told what the physical ground of a particular mental causal event is (and, relatedly, how this means the mental causation is 'innocent'). This general thesis is a bit like being given a promissory note saying, 'IOU one physical ground for that instance of mental causation'.

But the general thesis hints at the stronger *inheritance thesis*, according to which the grounded inherits (most of) its properties from its grounds. In other words, non-fundamental events have (most of) their properties because the more fundamental events that ground them have those properties too. Importantly, this inheritance thesis is downward looking, in the sense that it says we can trace the properties of a derivative event 'down' to similar properties of that event's ground; it remains neutral about whether grounds pass (most of) their properties upwards to the grounded.

Building off the inheritance idea, Kroedel and Schulz claim that 'mental events have their causal properties because the physical events that ground them have those causal properties' (2016: p. 1914). This allows them to formulate the *causal grounding principle* ('CG'):

CG Let m be a mental property instance, and let e be a physical effect of m . Then there is a physical property instance p such that p grounds m and m 's causing e is fully grounded in p 's causing e

CG tells us that any instance of mental-to-physical causation is grounded by an instance of physical causation. More particularly, it tells us something about *which* instances of physical causation ground a given instance of mental causation. To find a physical ground for m 's causing e , we can look to m 's physical grounds. Some of these will also cause e , and their causing e will ground m 's causing e . In this way, CG

expresses the idea that causation between physical events is more fundamental than causation of physical events by mental events and that mental events that have physical effects inherit the corresponding causal properties from their physical grounds. Thus, mental causation turns out to be a non-fundamental phenomenon (Kroedel and Schulz 2016: p. 1914)

⁹ Thanks to an anonymous referee for help in clarifying this paragraph.

So understood, the causal ‘overdetermination’ of overlapping mental-to-physical and physical-to-physical causation events turns out to be unproblematic, as the former is fully grounded in—and hence fully explicable in terms of—the latter.¹⁰

2 Against CG

Kroedel and Schulz’s response to the exclusion problem—and hence their case for grounding physicalism—turns on CG. Our contention is that CG is at best under-motivated, and, at worst, false.

First, note the (parenthetical) ‘most of’ in the inheritance thesis. This is necessary because, as Kroedel and Schulz admit, it is not plausible that *all* of a derivative event’s properties and relations are grounded by those of its grounds. They mention ‘certain highly unspecific properties such as being self-identical’ (2016: fn. 15) which, arguably, won’t be inherited. But these unspecific (logical) properties aren’t the only exceptions to the inheritance claim. Other likely exceptions include properties that ascribe propositional attitudes—e.g. if the glass’s shattering is my favourite event and I am ignorant of this event’s grounds, it is implausible that my preference for this event can be explained by something about the grounds of the glass’s brittleness. The same goes for *kind* properties—two-thingers about constitution will certainly deny that Statue inherits being a statue from Lump’s being one, and most would be loath to claim that Cicero is human because his parts are human.¹¹ Finally, *modal* properties are not always inherited: for example, that either Socrates is wise or it is not the case that Socrates is wise clearly doesn’t inherit its necessity from Socrates’s being wise,¹² and it is far from obvious that the glass’s being possibly tough is grounded by anything about e.g. the glass’s parts.¹³ This last observation is particularly relevant to the topic at hand, if we accept that causation is itself a modal phenomenon (see, e.g., Lewis 1973 for an account of causation in counterfactual terms).

In short, there is a large body of exceptions to the inheritance thesis. And once we start to see the variety of exceptions, it becomes clear that further argument is required to support the claim that *causal* properties are similarly inherited: CG is in need of further motivation.¹⁴

¹⁰ More precisely, because *m* is not metaphysically independent of *p*, *m* and *p* do not strongly overdetermine *e*. Meanwhile, though *m* and *p* weakly overdetermine *e*, the grounding connection between *m*’s causing *e* and *p*’s causing *e* allows us to ‘give a principled explanation of why the physical effects of mental events are weakly overdetermined’ meaning grounding physicalism can ‘dispel the worry that the overdetermination of the physical effects of mental causes is a surprising coincidence’ (Kroedel and Schulz 2016: p. 1920).

¹¹ For further discussion about material constitution, see e.g. Paul (2010), Bennett (2004) and Koslicki (2004, 2008).

¹² Though see Wildman (ms) for discussion of this point.

¹³ This point is closely related to the grounding puzzle. For further discussion, see Zimmerman (1995), Bennett (2004), and Simons (1987).

¹⁴ Interestingly, Kroedel and Schulz claim that CG ‘merely says that if a mental event possesses properties of causing such-and-such physical events, then they are due to a physical event that grounds the mental event’ (2016: p. 1914). But this wouldn’t be CG—rather, it would be the weaker

WCG Let *m* be a mental event, and let *e* be a physical effect of *m*. Then there is a physical event *p* such that *p*’s existence grounds *m*’s existence and *m*’s causing *e* is grounded in something about *p*

This is enough to call into question Kroedel and Schulz’s solution to the exclusion problem. But we also want to make the stronger claim that there is positive reason to deny CG. More specifically, we contend that there are plausible counterexamples that undermine the principle and, by extension, the case Kroedel and Schulz make for Grounding Physicalism.

2.1 Factive mental states

Some mental states are *externalist*, in the sense that they are not fully grounded by goings on ‘in our heads’ but also require certain external factors to be included in their full grounds. And some externalist mental states are *factive*, in the sense that they are partially grounded by the facts that they are about. Knowledge states are paradigmatic factive mental states. My knowledge that there is cheese on the plate is not fully grounded by facts about my brain—to count as knowledge the belief must be true, so any ground of [I know there is cheese on the plate] must either contain, or ground, [There is cheese on the plate].¹⁵

Arguably, some factive mental states will be partly grounded in things that are causally inefficacious, or spatiotemporally distant from the mental state’s bearer. Consider my knowledge that the number 17 is prime. Any full ground for this knowledge fact will either include a fact about an abstract object—namely, [17 is prime]—or it will include some facts that ground 17’s being prime; yet [17 is prime] and its grounds are causally inefficacious.¹⁶ Similarly, any full ground of [I know there exists a star outside of my causal light cone] will either include [There is a star outside my light cone], or some facts that ground this latter fact.

Further, some factive mental states that are partially grounded in causally inefficacious or spatiotemporally distant matters are themselves causally efficacious. For example, my learning that 17 is prime can cause me to say ‘17’ when asked to name a prime. And my coming to know of a star outside my light cone could cause me to boggle in wonder, or break into tears over the majesty of the cosmos.

This causes trouble for CG. Suppose that Bill’s coming to know that there exists a star outside his light cone causes him say ‘Wow!’. This involves a mental event—call it *Star*—causing a certain physical event—call it *Wow*—meaning that, in this case, ‘*Star* causes *Wow*’ is true.¹⁷ Any full grounds for *Star* will include (or ground) various physical properties about Bill’s brain – e.g. that he’s in brain state S—but also that there

Footnote 14 continued

And WCG is just another version of the (effectively worthless) promissory note, as it doesn’t tell us what the relevant physical grounds *are*.

¹⁵ We adopt the convention of using square brackets to denote facts, so that ‘[P]’ is to be read: the fact that P.

¹⁶ We assume that [17 is prime] is not fully grounded by concreta, but this is dispensable for the argument. Even if [17 is prime] is grounded by concreta, it is—to say the least—hard to be confident that these concrete grounds will be causally linked to me in the systematic manner which CG predicts.

¹⁷ This involves the simplification that *Star* alone causes *Wow*, when realistically *Star* would only cause *Wow* in conjunction with other mental events; but this does not seem to crucially affect the point of the example.

exists a star outside his light cone. And the inclusion of this fact about the existence of stars outside Bill's causal light cone renders this full ground unsuitable causing the relevant physical effect. Any grounds for the existence of a star outside Bill's light cone will either be, or ground, an instance of the generalisation, and therefore will themselves be outside of Bill's light cone. Thus, any of *Star's* full grounds will include elements that are too spatiotemporally distant from Bill to causally bring about *Star's* effects.¹⁸ Consequently, it isn't true that *Star* causes *Wow* in virtue of *Star's* full grounds causing *Wow*. But this conflicts with CG, which requires that *Star's* causing *Wow* is grounded in *Star's* physical grounds' doing so.

More generally, suppose that *m* is an event involving a causally efficacious factive mental state, and that any full ground for *m* contains causally inefficacious or spatiotemporally distant matters. Consider an instance of mental–physical causation where *m* causes *e*. CG predicts that *m's* causing *e* is grounded in *p's* causing *e*, where *p* is one of *m's* physical grounds. Since *p* contains some causally inefficacious or spatiotemporally distant elements, *p* is unfit for causing *e*. So it's neither the case that *p* causes *e*, nor that *m* causes *e* because *p* causes *e*, even though *p* fully grounds *m*. Consequently, CG is false.

And note that, while appeal to distant and abstract states of affairs helps make the problem vivid, it is not essential: even when a factive mental state concerns local concreta, these concreta will in most cases not be internal to the mental state's bearer, and so there is no reason to expect that these concreta or their grounds will fit neatly into the relevant causal role.

In reply, defenders of CG might bite the bullet by denying that factive mental states are causally efficacious, at least in the problematic cases. On this line, it is not someone's *knowing* about the distant star that gives them goosebumps, but rather their being in an internalist surrogate state for knowledge (*appearing to know* or *believing*). This move might be bolstered by a general thesis to the effect that factive mental states are never causally efficacious. Alternatively, an objector might claim that *some* factive mental states are causally efficacious—i.e. those that do not concern abstract or spatiotemporally distant states of affairs—while denying that those which cause trouble for CG ever are. This second strategy requires a principled reason for denying that the problematic factive mental states are causally efficacious; let us register here that it is unclear whether this denial can be motivated in a principled manner. Moreover, even in this restricted form, the strategy of denying the causal efficacy of externalist states is revisionary, since our causal thought clearly includes claims to the effect that knowledge states like those cited above are causally efficacious. It would be entirely natural and plausible to say that it is my knowing that 17 is prime that (at least partially) causes me to answer that 17 is prime if prompted. So, if the bullet-biting strategy is taken simply to preserve CG, then it will be undermotivated unless this principle is given a more convincing motivation than has so far been provided.¹⁹

¹⁸ This reasoning does not require the dubious claim that we can have *singular* thoughts about stars outside our light cone. It does assume that any ground for an existential generalisation will either be, or will ground, some of its instances; see Fine (2012: p. 65).

¹⁹ It is noteworthy that part of the motivation Kroedel and Schulz cite for their account of mental causation is that it preserves intuitive causal ascriptions; see their fn. 30.

2.2 Externalism about mental content

We appealed to factive mental states to cast doubt on CG because such states are very clearly externalist. But, as many philosophers have argued, it is plausible that other kinds of mental state, including belief states, are sometimes externalist.²⁰ If we allow ourselves some (admittedly contentious) externalist theses about mental content, the problem that we used knowledge-states to illustrate proliferates to such an extent that the bullet-biting defence of CG threatens to undermine a very great deal of our intuitive thought about mental causation.

To flesh this out, let us suppose, with Burge, that “certain relations between an individual and his environment are partly determinative of what it is for the individual to have certain kinds of mental states and events” (Burge 1989: p. 316). We will focus on belief states here, but other kinds of state could be appealed to. To take an example from Burge, consider a person who is familiar with aluminium but who lacks an account of aluminium that would enable him to distinguish it from all other actual or possible metals. He is able to think about aluminium, despite his lack of theoretical knowledge on the matter. For example, his belief that aluminium is lighter than lead concerns aluminium, as opposed to an imaginary superficially identical but chemically different metal twaluminium. This is not because he is able to distinguish the two metals. It is about aluminium because he happens to have encountered aluminium in the world in which he lives; the external fact that he is in a world containing aluminium and not twaluminium partly explains why his beliefs are about aluminium and not twaluminium. In this way, his aluminium beliefs are externalist; moreover, if externalism about aluminium beliefs is warranted, it seems that a very large body of our beliefs about the world will require an externalist treatment as well.

Whatever we say about knowledge states, it seems intuitively clear that many of our beliefs are causally efficacious. Jimbo’s belief that a certain chunk of metal is aluminium might cause him to say “aluminium” if somebody asks him to identify its chemical kind. But if this belief is partly grounded by an expansive portion of Jimbo’s surrounding environment, there is no reason at all to expect that the full grounds of Jimbo’s belief will be hooked up to the effects of Jimbo’s belief in the manner that CG predicts.²¹

Philosophers sometimes contrast *wide content* beliefs, whose content depends on features of the believer’s external environment, with *narrow content* beliefs, whose contents do not so depend. With this distinction in hand, defenders of CG might respond to the present objection by following Fodor (1987) in only taking narrow content beliefs to be causally efficacious. This ensures that the grounds for any given belief will be local to the believer and so will be suitable for slotting into the belief’s causal role (and likewise for other kinds of causally efficacious mental states).

In our view, Burge (1989: pp. 325–7) has persuasively argued that this misidentifies, in many cases, the causally relevant mental states. A narrow content belief in the vicinity of Jimbo’s belief that his chunk is aluminium would be a belief whose

²⁰ Classic defences of externalist accounts of content include Burge (1979) and Putnam (1975).

²¹ Again, the problem can be made more vivid by appealing to beliefs about abstract or distant entities.

content does not vary between aluminium and twaluminium worlds. A narrow content surrogate for Jimbo's aluminium belief might be a belief that the chunk is a grey metal, with such and such relevant additional properties. But, while this narrow content belief may be causally efficacious in its own right, it is no substitute for Jimbo's belief that the chunk is aluminium. For all we have said, Jimbo may not even have the narrow content belief in addition to the wide-content one (for instance, he might lack the concept of greyness). Moreover, aluminium-concerning beliefs seem to have effects that narrow content surrogates lack. If we want to causally explain why Jimbo picked up a piece of aluminium, it is his aluminium-concerning beliefs and desires that we need to cite. Narrow content beliefs and desires, being neutral between aluminium and twaluminium, are not suitable for bringing about the effect that Jimbo picks up a lump of aluminium: in the terminology of Yablo (1992), they are not *proportional* to this effect, since in a twaluminium-infested twin world, these beliefs and desires would result in Jimbo picking up a lump of twaluminium instead. In this sense, the narrow content beliefs are not causally sufficient for the effect in question.

3 Conclusion

We have focussed on CG, a central plank in Kroedel and Schulz's account of mental causation and their response to the exclusion problem. We found it (1) to be under motivated, (2) to be in tension with the intuitively plausible claim that certain factive mental states are causally efficacious, and (3) to be problematic when combined with plausible versions of externalism about mental content. If some strong internalist thesis about mental content, or the claim that only narrow content mental states are causally efficacious, are commitments of Kroedel and Schulz's approach, we think they are substantial theoretical costs. This warrants the interim conclusion that it is unclear whether appealing to grounding will help solve the exclusion problem.

Indeed, the discussion suggests the stronger conclusion that, given the externalist grounds of some mental states, we may have to accept that there are instances of mental causation that are not fully grounded by corresponding instances of physical causation at all. This conclusion would not amount to the denial of Closure; it sharpens the exclusion problem, by showing that grounding physicalists are arguably committed to instances of mental causation that are not only superfluous (in the sense defined above) but also fundamental.

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