Determination, realization and mental causation

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Abstract   How can mental properties bring about physical effects, as they seem to do, given that the physical realizers of the mental goings-on are already sufficient to cause these effects? This question gives rise to the problem of mental causation (MC) and its associated threats of causal overdetermination, mental causal exclusion, and mental causal irrelevance. Some (e.g., Cynthia and Graham Macdonald, and Stephen Yablo) have suggested that understanding mental-physical realization in terms of the determinable/determinate relation (henceforth, 'determination') provides the key to solving the problem of MC: if mental properties are determinables of their physical realizers, then (since determinables and determinates are distinct, yet don't causally compete) all three threats may be avoided. Not everyone agrees that determination can do this good work, however. Some (e.g., Douglas Ehring, Eric Funkhauser, and Sven Walter) object that mental-physical realization can't be determination, since such realization lacks one or other characteristic feature of determination. I argue that on a proper understanding of the features of determination key to solving the problem of MC these arguments can be resisted.

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How can mental goings-on bring about physical effects, as they seem to do, given that the physical realizers of the mental goings-on are already sufficient to cause these effects? This question gives rise to the problem of mental causation (MC),

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reflecting a triple threat difficulty in providing an answer.[1] First is a threat of causal overdetermination: overdetermination makes sense in, e.g., firing squad cases, but this isn't the right model for mental causation. Second is a threat of mental causal exclusion: overdetermination is avoided if mental goings-on are causally excluded by their physical realizers; but we want mental goings-on to be causally efficacious. Third is a threat of mental causal irrelevance: overdetermination and exclusion are avoided if mental goings-on are identical with physical goings-on; but we want mental goings-on to be efficacious *qua* mental (that is, *distinctively* efficacious).[2] Such relevance seems to require that mental goings-on be causally autonomous *vis-á-vis* the effects in question—hence reintroducing the first and second threats.[3]

Physicalists aim to solve the problem of MC by appeal to some intimate relation holding between mental Xs and their realizing physical Ys, suited to avoid the threats. But identifying a suitable relation has been difficult. Narrowing our focus in what follows to the case of properties, and developing the previous point a bit: taking mental and physical properties to be type identical avoids overdetermination and exclusion, but seems not to accommodate the desired causal autonomy of the mental (hence the third threat remains); additionally, type identity seems at odds with the multiple realizability of mental properties.

Some (MacDonald and MacDonald 1986; Yablo 1992) have rather suggested that the determinable/determinate relation (henceforth, 'determination') provides the key to a better solution. More specifically, the suggestion is that mental properties[4] are determinables of their physical realizers.[5] The appeal to determination reflects certain features plausibly characteristic of this relation, to wit: determinables and determinates are not causal competitors; determinables typically may be multiply determined; determinables and determinates are type-distinct (and also, some think, token-distinct), hence may be distinctively causally efficacious. If mental properties are determinables of their physical realizers, these virtues are inherited: as causal non-competitors, overdetermination and exclusion are avoided, while accommodating mental multiple realizability, compatible with the causal relevance of mental properties. (I'll expand on these lines of thought shortly.)

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[1] The problem and associated threats may be arrived at without assuming that the effect in question is physical. Such a presentation of the problem requires more setup, however, so for present purposes I focus on the problem as it more obviously attaches to physical effects purportedly caused by mental entities.

[2] As implied, I understand causal relevance (a.k.a. causal autonomy) of a property *vis-á-vis* an effect in terms of the property's being distinctively causal efficacious *vis-á-vis* that effect.

[3] See Kim (1993) for discussion of the first and second threats; see Horgan (1989) for discussion of the third.

[4] Or (as per Yablo) events, assuming that determination may hold between particulars as well as properties. Here I focus on properties in order to avoid complications with extending the determination relation to particulars, though I agree with Yablo that this can be done; see Wilson (in progress) for an extension to the case of tropes.

[5] MacDonald and MacDonald (1986) more weakly maintain that the mental-physical relation is analogous to, though not the same as, the relation at issue in (paradigm cases of) determination. As we'll see, this weaker suggestion is broadly compatible with the schematic understanding of determination at issue in this paper, which preserves the relevant respects of analogy.

More generally, some (Shoemaker 1999; Clapp 2001) suggest that realization may be more generally understood along lines of determination. If so, determination is a basis not just for an attractive physicalist solution to the problem of MC, but also for a general physicalist account of an important class of synchronic dependency relations between properties (and events; see footnote 4) in the layered hierarchy of broadly scientific entities.

Not everyone agrees that determination can do this good work, however. Some (Ehring 1996; Funkhouser 2006; Walter 2006) object that it doesn't make sense to take mental properties to be determinables of their physical realizers, via arguments of the following form:

1. Determination has characteristic feature X.
2. Mental-physical (MP) realization does not have feature X.

   ∴. MP-realization is not determination.

Such opponents conclude that determination doesn't provide a basis for solving the problem of MC, and that, more generally, realization isn't determination.

I aim to show how these arguments can be resisted.

1 Determination and the problem of MC

The characteristic features of paradigm cases of determination (see Johnson 1922; Prior 1949; Ehring 1996; Funkhouser 2006) include:

- *increased specificity* (for something to be scarlet is for it to be red, in a specific way);
- *asymmetrical dependence* (anything scarlet must be red, but something red might not be scarlet);
- *necessary determination of determinables* (anything red must be a specific shade of red);
- *necessary exclusion of determinates* [anything red can only be one specific shade of red (all over)];
- *comparability of same-level determinates* (shades of red can be ordered or compared);
- *irreflexivity, asymmetry, and transitivity* (increases in specificity are irreflexive, asymmetric, and transitive);
- *no causal competition* (determinables and determinates do not causally compete).

And others.

Ehring (1996) argues that MP-realization lacks several of these features. Not all these arguments are of clear relevance, however. For one thing, some of these features may be only typical, not necessary, of determination.

More importantly, even if MP-realization lacks some features necessary of paradigm cases of determination, it is enough to vindicate a determination-based approach that MP-realization have (1) all "core" features of determination; (2) all

features of determination key to solving the problem of MC. Nothing deep turns on whether MP-realization is *exactly* like the relation between, e.g., determinable and determinate colors. Perhaps MP-realization and e.g., color-determination are themselves determinates of a more general determination relation.

So, what are the core features of determination, common to any relation worthy of the name? There's really only one, though as we'll see there is room to differ about precisely how to understand this feature. This is:

> *Increased specificity*: Property *P* determines property *Q* only if for something to be *P* is for it to be *Q*, *in a specific way*.

As Yablo ([1992](#)) puts it, this is the "core idea" of determination; as Funkhouser ([2006](#)) puts it, this is the "most central" aspect or "key idea" of determination. Core to this core feature is that this increase in specificity is distinctive, contrasting with that at issue in the conjunct/conjunction and disjunction/disjunct relations.[6] More specifically, the increase in specificity at issue in determination must satisfy:

> *Appropriate contrast*: property *P* determines property *Q* only if: (i) the having of *P* does not consist in the having of a conjunctive property consisting of *Q* and some property *P'* wholly distinct from *Q* as conjuncts, and (ii) the having of *Q* does not consist in the having of a disjunctive property consisting of *P* and some property *P'* wholly distinct from *P* as disjuncts.[7]

I'll assume that satisfaction of *Increased specificity* incorporates the *Appropriate contrast* constraint.[8]

Next, what are the features of determination key to solving the problem of MC? What is wanted in a (best case) physicalist solution is an account of MP-realization that avoids all three of the afore-mentioned threats, while accommodating the possibility of multiple realizability. The features of determination supposed to allow such a solution are:

1. Determinables and determinates aren't causal competitors.
2. Determinables typically have multiple determinates.
3. Determinables and determinates are distinct (at the type and perhaps also token levels).

On the proposed account, (1) avoids the first two threats (of overdetermination and exclusion); (2) accommodates the multiple realizability of the mental; (3) avoids,

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[6] Determination is also supposed to contrast with the genus/species relation, but the desired contrast may be subsumed under the conjunct/conjunction head, since the having of a given species property is standardly understood in conjunctive terms as involving the having of both a genus property and a differentia property. So, for toy example, to have the species property *being human* is to have both the genus property *being animal* and the differentia property *being rational*.

[7] The notion of 'whole distinctness' as applied to properties is tricky, but for present purposes the following necessary condition will do: property *P* is wholly distinct from property *Q* only if neither *P* nor its instances are at all constituted by *Q* (or its instances).

[8] As we'll see in Sect. [2.1](#), there is a case to be made for a further constraint on *Increased specificity*; when both constraints are in place I am inclined to see *Increased specificity* as sufficient as well as necessary for determination (reflecting, as I'll argue, that certain features traditionally associated with determination plausibly flow from *Increased specificity*).

at least potentially, the third threat (of mental causal irrelevance). Conveniently, as I'll now argue, each of these key features plausibly flows from the core feature, *Increased specificity*; along the way we'll see in somewhat more detail how determination is suited to avoid the three threats while accommodating multiple realizability.

First, consider (1), according to which determinables and determinates aren't causal competitors. Intuitively, *Increased specificity* characterizes a relation between properties that is sufficiently intimate to prevent overdetermination of the firing squad variety, in which case causal exclusion of either property is unmotivated. Different accounts of determination might differently explain how the threats of overdetermination and exclusion are avoided. If, for example, determinables are (something like) parts of their determinates, the explanation might appeal to the claim that parts typically do not causally compete with wholes, as when both I, and my eye, cause a wink.[9] Alternatively, on a powers-based account (which we'll discuss in more detail down the line) it might be suggested that the causal powers (henceforth, just 'powers') of determinable and determinate properties are related in such a way that every power of a determinable property instance on a given occasion is numerically identical with a power of the property instance(s) that determines it on that occasion (see Wilson 1999; expanding on Yablo 1992).[10] If so, then overdetermination of determinate effects by determinable causes is explicitly ruled out: in any given case of determinable efficacy, there is only one causing—one manifestation of a power in the circumstances—not two. And this avoidance of overdetermination is accomplished without causally excluding the determinable.

Next, consider (2), according to which determinables are typically multiply determined. On the face of it, this key feature of determination reflects *Asymmetrical dependence* (initially motivated by paradigm cases: anything scarlet must be red, but something red might not be scarlet):

> *Asymmetric dependence*: P determines Q only if: (i) anything that is P must be Q; but (ii) something that is Q might not be P.

In particular, (2) reflects clause (ii) of *Asymmetrical dependence*, according to which determinables may be determined by different determinates. Plausibly, this aspect of *Asymmetrical dependence* flows from *Increased specificity*, for typically (in particular, in the paradigm cases) there are multiple specific ways for something to have a given determinable.[11] Again, different accounts may accommodate multiple specificity, hence multiple realizability, differently. If determinables are

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[9] See Wilson in progress for the sketch of a "logical parts"-based account of determination, applying certain insights of Paul's (2002) account of realization.

[10] As I understand powers here and elsewhere in this paper, these track the contributions a property makes to the production of effects of a certain type, when instanced in circumstances of a certain type. Philosophers disagree about the metaphysical status of powers (and properties). Here I am neutral on this status; insofar as all parties recognize the need to make sense of causal contributions (however understood) of broadly scientific properties (however understood), philosophers can translate into their preferred idiom.

[11] It is not obvious that such multiplicity is necessary to determination; perhaps some determinables have only a single determinate (there is only one way for the determinable to be more specific). Hence in my view clause (ii) of *Asymmetric dependence* is best seen a typical correlate of, rather than a core thesis on a par with, *Increased specificity*.

(something like) parts of their determinates, then, perhaps, just as an entity may be part of different wholes, so may a determinable be multiply determined in virtue of its instances being part of different, more determinate, wholes. If the powers of a determinable property are those in the intersection of powers of its determinates (as per Shoemaker 1999), then, perhaps, just as a subset may be contained in different super-sets, so may a determinable be multiply determined in virtue of its instances having powers that are subsets of different, more determinate, supersets of powers, associated with different determinate instances.

Finally, consider (3), according to which determinables and determinates are ontologically distinct, at the type and perhaps also token levels. Again, this feature plausibly flows from *Increased specificity*. That determinate properties are more specific than determinable properties guarantees that determinables and determinates are not type identical; depending on how this increase in specificity is understood they may also fail to be token identical (see Yablo 1992; Wilson 1999).[12] This ontological distinctness plausibly makes room for determinable properties (and perhaps also their instances/associated events) to be distinctively causally efficacious (that is, causally relevant). How so, one may wonder, given the assumed lack of overdetermination of a determinable's effects?

Again, different accounts may answer differently, but for illustration consider a powers-based account, where, as previously, determinables are associated with a proper subset of the powers associated with their determinates (namely, those in the intersection of powers of their determinates), and where, on a given occasion, every power of a determinable property instance is numerically identical to a power of the determinate(s) instanced on that occasion. That determinables and their determinates are associated with different sets of powers makes room for the determinable's being causally relevant *vis-á-vis* an effect that its determinate also causes, if such relevance can be, as it plausibly is, sensitive to the *entire set* of the powers associated with (in other words, the *power profile* of) the determinable. Consider Sophie the pigeon, trained to peck at any red patch. On a given occasion, Sophie is presented with a scarlet patch, and she pecks. Even though the token power of the instance of *being red* whose manifestation was efficacious in Sophie's pecking was (as per a powers-based account) numerically identical to a token power of the determinate instance of *being red*, we can still ask: was *being red* causally relevant (causally autonomous; *distinctively* causally efficacious) to the pecking? Supposing that Sophie would have equally pecked if the patch had been any other shade of red (burgundy, say), there is a case to be made for a positive answer, on grounds that it was only the powers in the power profile of *being red* that made a difference to the pecking (again, see Wilson 1999, situating Yablo's 1992 case in a powers-based framework).[13]

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[12] Here we depart from the MacDonalds' understanding, according to which determinable and determinate instances are token identical.

[13] Was *being scarlet* also causally relevant to Sophie's pecking? The above case for the causal relevance of *being* red to this effect appeals to difference-making; and if difference-making is crucial to establishing such relevance then it would seem that *being scarlet* isn't so relevant (though this property would still be causally efficacious *vis-á-vis* the pecking, in virtue of having a power manifested on that occasion, compatible with the causal closure of the physical). My own view is that there are ways of establishing

To be sure, more could be said to establish that determination has features (1)–(3). But intuitively, paradigm cases of determination do have these features; and (as already anticipated) I will later offer an account of determination that accommodates both paradigm cases and features. In any case, my primary concern here is with the question: supposing that determination has these key features, might MP-realization be determination?

More also could be said to establish that features (1)–(3) flow from *Increased specificity*. Again, the "flow" claim seems plausible and serves to conveniently focus discussion; but even supposing this is incorrect, nothing in what follows will thereby be swept under the rug; for as we'll now see, those objecting to MP-realization's being determination (for short: MP-determination) do not argue against the key features per se, but rather target *Increased specificity* directly.

2 The arguments against MP-determination

Notwithstanding determination's promise as a relation suited to solving the problem of MC, Ehring (1996), Funkhouser (2006), and Walter (2006) (henceforth, EF&W) all argue that a closer look at *Increased specificity* indicates that it doesn't make sense to think that mental properties are determinables of their physical realizers.

2.1 The qua principle

As noted, one constraint on *Increased specificity* is *Appropriate contrast*: the increase in specificity associated with a determinate must contrast with the conjunct/conjunction and disjunction/disjunct relations. Additionally, EF&W maintain that the relevant increase in specificity must be "in respect of its determinable". Here they follow Prior (1949):

> Determinates under the same determinable have the common relational property […] of characterising whatever they do characterise in a certain respect. Redness, blueness, etc., all characterise objects, as we say, "in respect of their colour"; triangularity, squareness, etc., "in respect of their shape". And this is surely quite fundamental to the notion of being a determinate under a determinable. (p. 14)

This suggests the following additional constraint on *Increased specificity*:

The qua principle: A determinate *P* specifies its determinable *Q* only in respect of *Q*.

Funkhouser (2006, p. 550) more precisely observes: "Determinates specify their determinables with respect to only a limited number of features". (As per Funkhouser's favored example, to which we will later return: the determinates of *being colored* specify this property with respect only to hue, saturation, and brilliance.) Call these features the "determination dimensions" of the determinable. We can then write *The qua principle* as follows:

The qua principle: A determinate *P* specifies a determinable *Q* only along the determination dimensions of *Q*.

Let's now turn to the two main arguments against MP-determination. As we'll see, each draws upon *The qua principle*. To prefigure: I will eventually argue that the proponent of MP-determination can respond to these arguments, even while accepting the principle (as they should).

2.2 The argument from mental multiple realizability

The first argument (Ehring 1996, p. 471; Funkhouser 2006, p. 26; Walter 2006, p. 230) begins by extracting another principle from *The qua principle*:

The difference principle: Distinct same-level determinates of a determinable *Q* differ with respect to *Q*.

In terms of determination dimensions, we can write:

The difference principle: Distinct same-level determinates of a determinable *Q* differ along at least one of the determination dimensions of *Q*.

The difference principle follows from, or perhaps is presupposed by, *The qua principle*, insofar as the notion of "in respect of" (or, in Funkhouser's terms, of determination dimensions) at issue in the latter thesis reflects the ways in which same-level determinates can differ from each other.[14] As Walter puts it:

Distinct determinates of a determinable *F* cannot be exactly the same with respect to *F*-ness. For instance, being crimson and being scarlet are distinct determinates of being red precisely because they differ with respect to redness. […] This idea is expressed by the […] *Principle of Difference*. (2006, p. 229)

And as Funkhouser puts it:

Redness, like any color, can only be determined with respect to hue, brightness, and saturation. These are the minimally sufficient criteria according to which all colors can be distinguished from one another. Colors differ to the extent, and only to the extent, that they differ in hue, brightness, or saturation. As such, these are the three variables along which colors can be

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14 Here I take *The qua principle* as primary, but nothing in what follows hangs on the precise direction of entailment between the *qua* and *difference* principles; they clearly go hand-in-hand.

determined. […] How do we discover the determination dimensions of a given determinable, X? The easiest way is simply to inquire after the ways in which determinates under the determinable X can differ from one another with regard to their X-ness. (2006, p. 551)

The argument from mental multiple realizability is intended to show that the physical realizers of a mental property don't satisfy *The difference principle*. Ehring (1996, p. 474) claims that "[T]he physical realizers of the mental will not differ mentally at all, as they should if they are determinates of the requisite mental states"; similarly, Walter claims:

Mental properties are said to be multiply realizable precisely because distinct physical realizers can be exactly the same with respect to the mental property they realize […]. Hence, while it is nonsense to say that distinct determinates are exactly the same with respect to a given determinable of them, distinct physical properties are exactly the same with respect to the mental property realized by them. (2006, pp. 219–220)

Walter presses the problem by considering a sorting test. He suggests that, when presented with six patches of distinct shades of red, and asked to sort the patches with respect to their redness, one would understand the task. However, when presented with six distinct physical realizers $P_1, \ldots, P_6$ of the property *believing that Iowa is west of Indiana*, and asked to sort the realizers with respect to that property, one would be justified in claiming not to understand the task: "What could it mean that, say, P_3 is more similar to P_5 than to P_2 with respect to the property of *believing that Iowa is west of Indiana*, given that $P_1, \ldots, P_6$ realize *believing that Iowa is west of Indiana* precisely because they are exactly alike with regard to that property?" (2006, p. 230).

Better: you *could* understand the latter task, as compatible with your putting all the realizers in the same category. But then it won't be appropriate to see the realizers as determinates of the property *believing that Iowa is west of Indiana*, since then the realizers won't satisfy *The difference principle*.

We can sum up the argument from multiple realizability as follows:

1. If MP-realization is determination, then distinct physical realizers of a mental property M must differ in respect of M.
2. Distinct physical realizers of a mental property M do not differ in respect of M.

   $\therefore$ MP-realization is not determination.

   Hence, more generally, realization is not determination.

2.3 The argument from mental super-determinates

Let a "super-determinate" property be a maximally determinate property—that is, one that cannot be further determined *qua* its determinable. Ehring (1996, p. 473) and Funkhouser (2006, pp. 22–25) argue that attention to super-determinate mental

properties indicates that mental properties are not determined by physical properties. Ehring's argument from mental super-determinates is as follows:

1. There can be a mental super-determinate M (e.g., a property of being in a precise state of searing pain such that "there is no room for further specification of this mental [property] *qua* pain").
2. M has a physical realizer.
3. If MP-realization is determination, M can be further specified *qua* pain.

∴ MP-realization is not determination.

The concern more generally indicates that realization is not determination: "having multiple, disparate physical realizers does not entail any lack of determinateness on the part of that which they realize" (1996, p. 474); when a realized property is super-determinate, it makes no sense to suppose that its physical realizers further determine it.

Ehring's argument again appeals to *The qua principle* ("there is no room for further specification of this mental [property] *qua* pain"). But what, exactly, does the "*qua*" locution come to? Funkhouser appeals to his notion of determination dimensions to fill in this locution, resulting in a more developed argument from mental super-determinates.[15]

Let's start by getting clearer on the notion of determination dimensions. First, some M & E. What determination dimensions does a determinable X have? As per *The difference principle*: these are ways in which determinates of X can differ from each other in respect of X-ness. How can we find out what these dimensions are? According to Funkhouser (2006, pp. 551–552): for broadly scientific properties, look at the relevant laws (perhaps "folk"; perhaps scientific) that same-level determinates enter into; these will encode the relevant respects in which determinates can differ.

Next, let's consider Funkhouser's main case study (2006, p. 554). What are the determination dimensions of *being colored*? (What are the ways in which determinates of *being colored* differ in respect of color?) Apply the methodology: look to color science. Color science tells us that different colors differ only in respect of hue, saturation, and brilliance. *All you need* in order to specify a color is values, or ranges of values, of these features. In particular, specifying what color something is doesn't require specifying its material constitution, etc. So, the determination dimensions of *being colored* are hue, saturation and brilliance; and that's all.

Finally, let's note the role determination dimensions play in Funkhouser's illuminating framework for thinking about determination. On this framework, determination dimensions are thought of as "axes" in a property space. The space associated with the full range of a determinable's determination dimensions is the determinable's property space. Determinates of the determinable are associated with restricted ranges of values of these dimensions; correspondingly, the property spaces of determinates are proper subspaces of the determinable property space. Super-determinates of a determinable are associated with specific values of the

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[15] As we'll see (Sect. 4.1.1) there are other ways of filling in the locution.

determination dimensions; their property spaces are correspondingly points in the determinable property space. I'll briefly revisit Funkhouser's framework in Sect. 4.7. The main point (pun intended) for purposes of appreciating Funkhouser's argument is that what counts as a "super-determinate" of a determinable is going to depend on the determination dimensions of the determinable. Once you get down to maximally precise values of the determination dimensions, there's no "room" to further determine the determinable.

The notion of determination dimensions in hand, let's return to the case of mental properties. What are the determination dimensions of mental properties? Again, we must appeal to *The difference principle*: "[T]o discover the determination dimensions for [mental properties] we need to discover the ways in which pains can differ from one another in their pain-ness, beliefs can differ from one another in their belief-ness, and so on for other mental properties" (2006, p. 563) Relatedly: we need to figure out what it takes for mental properties to exactly resemble. For simplicity, focus on beliefs; now apply the methodology.

Funkhouser argues that both common sense and science treat beliefs as differing only along the determination dimensions of content and confidence:

> Plausibly, two people who believe the same content with the same confidence level do not differ with regard to that belief. [...] Content and confidence are the only determination dimensions for believing that *P*. This is supported by the fact that folk psychological laws (and/or the laws of cognitive science and/or decision theory) care only about these two dimensions of beliefs. (2006, p. 563)

It follows that beliefs do not have explicitly physical determination dimensions. As with color, specifying what belief someone has doesn't require specifying anything about the physical hardware realizing the belief: "The laws of intentional psychology are blind to the physical hardware that implements these beliefs. [...] These [physical] differences are simply irrelevant as far as our psychological generalizations go" (2006, p. 564). Explicitly physical features of the realizers of beliefs are thus not determination dimensions of beliefs. Hence, Funkhouser concludes: content and confidence are the only determination dimensions of beliefs.

We can now give Funkhouser's more developed argument from mental super-determinates:

1. The determination dimensions of beliefs are content and confidence.
2. It suffices for a belief to be super-determinate that it be fully specified along these dimensions.
3. If beliefs are determined by their physical realizers, then it does not suffice for a belief to be super-determinate that it be fully specified along these dimensions.

∴. Beliefs are not determined by their physical realizers.
∴. MP-realization is not determination.

Hence, more generally, realization is not determination.

2.4 The role of *The qua principle*

Both the argument from mental multiple realizability and the argument from mental super-determinates turn on *The qua principle*. *The qua principle* motivates *The difference principle*, according to which same-level determinates must differ *qua* determinable, such that it makes no sense to suppose that physical realizers that do not differ *qua* some mental property determine that mental property. And *The qua principle* motivates thinking that mental properties can be super-determinate *qua* mental (as exhausting their psychological determination dimensions), such that it makes no sense to suppose that physical realizers further determine (super-determinate) mental properties.

Correspondingly, defenders of MP-determination have two available strategies of response to each argument. The first strategy is to deny *The qua principle* (compatible with granting that MP-realization fails to satisfy it, along with *The difference principle*). Second is to accept *The qua principle* and argue that, contrary to EF&W, MP-realization satisfies it, along with *The difference principle*.

I want to briefly consider Strategy 1, mainly to put it aside; the remainder of the paper will be devoted to implementing Strategy 2. Denying *The qua principle* is perhaps not as ad hoc as it might first appear. As noted, making sense of MP-determination doesn't require that every characteristic feature—even every necessary characteristic feature—of paradigm cases of determination be satisfied in cases of MP-realization.

Nonetheless, it isn't advisable for proponents of MP-determination to deny *The qua principle*, for two reasons.

First, *The qua principle* (along with the *The difference principle*) is the positive "flip side" of the *Appropriate contrast* constraint, where the latter negatively characterizes the increased specificity at issue in determination as not involving either the conjunct/conjunction or disjunction/disjunct relations. It is hard to see how else, besides *The qua principle*, to positively characterize the distinctive increase in specificity at issue; hence acceptance of the *Appropriate contrast* constraint appears to require acceptance of *The qua principle*; then, insofar as the former is plausibly core to the notion of determination, then so must be the latter. This explains, perhaps, Walter's claim (with which I am inclined to agree), that "The principle of difference does indeed express a necessary condition on determination. I would even claim that it expresses a conceptual constraint on determination, so that someone who holds that distinct determinates of a determinable *F* can be exactly the same with respect to *F*-ness does not understand the very concept of a determinable" (2006, p. 230).

Second, issues of what is core to determination aside, in any case rejecting *The qua principle* will not serve the purposes of the proponent of MP-determination, if this also involves rejecting the *Appropriate contrast* constraint. For if the increase in specificity at issue in determination is compatible with that at issue in either the disjunction/disjunct or conjunct/conjunction relations, then the claim that MP-realization is determination will not represent a solution to the problem of MC that is clearly capable of avoiding all three associated threats. In particular, while conjunctions are more specific than their conjuncts, this sort of increase in

specificity does not rule out causal overdetermination, as when something is red, not *simpliciter*, but in a specific way, by being instantiated in a context where an interfering god brings about, by an independent causal chain, any effects brought about by *being red*. And while disjuncts are more specific than disjunctions, it is plausible that instances of disjunctions are identical with instances of their disjuncts. Though some maintain that it is sufficient to avoid the threat of causal irrelevance that properties be type distinct, even if token identical, I am inclined to disagree. After all, in the first instance causal interactions occur at the level of tokens, not types; hence though we speak of the efficacy of properties this must—or so it seems to me—ultimately be a matter of the efficacy of their instances. Similarly, the distinctive efficacy of a property *vis-à-vis* an effect must ultimately be a matter of the distinctive efficacy of an instance of the property. These considerations indicate, at least, that the threat of causal irrelevance is not *clearly* avoided if determinable and determinate instances are token identical (as they might well be if the *Appropriate contrast* constraint is rejected, consequent on rejection of *The qua principle*).

Dialectically, then, it behooves proponents of MP-determination to implement Strategy 2, if they can.

3 Blocking the arguments: two metameric morals

Implementing Strategy 2 requires establishing that, contrary to appearances, MP-realization satisfies *The qua principle*, along with *The difference principle*. How can this be done?

Let's start by locating some wiggle room in what it is for determination to occur "in respect of a determinable". I'm going to look at a case, extract two morals, and show, both schematically (in this section) and in some detail (Sect. 4), how these morals provide a basis for implementing Strategy 2.

3.1 Revisiting the case of colors

Recall that Funkhouser claims that colors are completely specified by hue, saturation and brilliance, such that entities having the same values of these features exactly resemble in respect of color. This is disputable, however, for there is a case to be made that colors of the same hue, saturation and brilliance can differ in respect of color.

Appeals to hue, saturation, and brilliance are typically taken to characterize colors understood as visual perceptual properties, tracking how things look colorwise, in normal light conditions, to normal creatures like us. Interestingly, however, things that appear to be the same color under normal light conditions may appear to be different colors under different light conditions. The explanation for this phenomenon, called 'metamerism', has to do with broadly physical features of the objects and light at issue.[16] Most notably, what color we perceive an object to be

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[16] See, e.g., Wandell (1993).

will be a function of the spectral power distribution (SPD) of the light hitting the retina, specifying the power of the light at each wavelength in the visible spectrum; this SPD is itself is a function of the SPD of the light incident on the object's surface, and the surface reflectance properties of the object. Different SPDs of light hitting the retina may give rise to the same "tristimulus values" (e.g., hue, saturation, and brilliance); hence it is that the samples that appear the same in normal light conditions may appear different in other conditions, or that samples that appear different in normal light conditions may appear the same in different light conditions. Let a 'metamer' be a color appearance property that is individuated, in part, by the relevant broadly physical features—let's assume these are the retinal SPDs—needed to accommodate the phenomenon of metamerism, such that color appearance properties not distinguished by hue, saturation, and brilliance are distinguished by the relevant broadly physical features.

Are metamers specific kinds of colors? Funkhouser's methodology seems to indicate so. First, metamers are, at least colloquially, spoken of this way.[17] Second, metamers are part of color science. Color science is not concerned only with colors as individuated by hue, saturation, and brilliance.[18] On the contrary, considerable (perhaps most) color research is aimed at understanding colors as individuated by retinal SPDs, as relevant to digital photography, screen displays, car interiors, etc.[19] Third, the role that retinal SPDs play in this research appears to be compatible with taking colors to be partly constituted by these features. After all, as above, colors are understood as visual perceptual properties; and retinal SPDs are clearly part of the process of visual color perception—in particular, retinal SPDs are input into the color-sensitive cones, which then output the tristimulus values. Whether or not the input/output function here is causal or rather 'filter-like', in any case there seems to be no in-principle barrier to characterizing (specific kinds of) colors in terms of the broader process of visual perception—especially since the broader process and associated features are required to *fully* characterize color appearances (in particular, metamerism).[20]

Fourth (and adding metaphysical theorizing to Funkhouser's methodology for identifying determination dimensions), that metamers are specific kinds of colors has a unifying explanatory value. The pretheoretic conception of colors as 'appearance properties' is notoriously metaphysically ambiguous as regards the 'internal' versus 'external' contributions of the environment to color experience; relatedly, there is no philosophical consensus on whether, in experiencing colors, we are experiencing something in the head, something outside the head, or something in between (presumably, some relational state of affairs). If metamers are specific kinds of colors, at least some of these options need not be seen as exclusive, and

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[17] From a recent Wikipedia entry on color: "Colors that have the same visual appearance (= the same "tristimulus values"), but different spectral composition, are called metameric"; from a recent Wikipedia entry on metamerism: "In colorimetry, metamerism is the matching of apparent color of objects with different spectral power distributions. Colors that match this way are called metamers".

[18] See, e.g., Wyszecki and Styles (1982).

[19] See, e.g., Judd and Wyszecki (1975).

[20] If certain theses about perception are true—notably, direct realism—then there is moreover no barrier to taking colors to be partly constituted by broad as well as relatively 'narrow' physical features—say, by the surface reflectance properties of veridically perceived objects.

hence that different philosophers reasonably maintain their preferred option is explained: at a certain general level of grain, colors are individuated in broadly psychological terms (not explicitly making reference to the physical features of color), in terms of hue, saturation, and brilliance; at a finer level of grain, colors admit of further specification in broadly physical terms.

The above considerations collectively make a case for metamers' being specific kinds of colors. More specifically: given that colors are paradigmatic determinables, and applying Funkhouser's methodology for assessing the determination dimensions of a determinable, we may reasonably conclude that colors of the same hue, saturation and brilliance can differ in respect of color.[21]

We can draw two morals from the case of metamers. The first is:

> *Metameric moral 1*: Psychological determinables may have explicitly physical determination dimensions.

Colors, individuated by hue, saturation, and brilliance, are (we are assuming) psychological determinables; and metamers are (plausibly) specific kinds of colors, that are partly explicitly physically characterized. The second is:

> *Metameric moral 2*: Different sciences may treat the same determinable as having different determination dimensions.

Relative to normal appearance color science, *being colored* has determination dimensions of hue, saturation and brilliance. Relative to metameric color science, *being colored* has further determination dimensions. In other words: determination dimensions may be science-relative. Note that there's nothing mysterious about the science-relativity (more generally: context-relativity) of determination dimensions, from a physicalist perspective. That different sciences may treat the same determinable as having different determination dimensions reflects that different sciences and their associated laws may treat the same phenomena at different levels of metaphysical grain.

I will later fill in the metameric morals—first (in detail) against the backdrop of both a powers-based account of determination, and second (somewhat more sketchily) against the backdrop of Funkhouser's account. Let's start, however, by observing how the metameric morals, however filled in, block the arguments against MP-realization being determination.

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[21] One may wonder (as did Eric Funkhouser and Jill North) whether this conclusion might be blocked by supposing that 'color' as used in metameric color science marks out a type bearing no specificity relation to that marked by 'color' as used in normal color science. While this strategy is in-principle available, it is (as yet) unmotivated; in particular, taking metamers to be specific kinds of colors provides a simpler and more unified account of the scientific practice and terminology than otherwise. Alternatively, one may wonder (as did Laurie Paul) whether, even granting that metamers are specific kinds of colors, this specificity might be understood in conjunctive terms (such that, e.g., the property of being a metamer might be a conjunctive property consisting in *being a (non-metameric) color* and *being caused by a certain retinal SPD* as conjuncts. Again, while this strategy is in-principle available, it is (as yet) unmotivated, insofar as there is no reason to think that *being caused by a certain retinal SPD* tracks a natural kind; hence any broadly scientific property. In any case, absent reason to think that we must understand metamers in conjunctive fashion, there is no barrier to taking metamers to be determinates of normal science colors; and this is enough to motivate the morals that I will now draw.

3.2 Blocking the argument from mental multiple realizability

The first and second metameric morals together block the argument from mental multiple realizability.

The first metameric moral indicates that there is no in-principle problem with mental properties' having explicitly physical determination dimensions. Moreover, this possibility is arguably actually realized, since some sciences treat mental properties at a level of grain sensitive to explicitly physical determination dimensions: neuroscience, cognitive science, psychopharmacology, human and animal physiology, etc. So, for example, in psychopharmacology different forms of depression depend on whether the depression results from disorders in seratonin-based neuronal circuits or in dopamine-based neuronal circuits; depending on which transmitter is involved, different drugs are likely to produce a beneficial effect.[22] So physical realizers of mental properties can, and arguably do, differ in respect of these properties.

Revisiting the sorting test, the first metameric moral provides an answer to Walter's call for explanation: "What could it mean that, say, P_3 is more similar to P_5 than to P_2 with respect to the property of *believing that Iowa is west of Indiana*, given that P_1, …, P_6 realize *believing that Iowa is west of Indiana* precisely because they are exactly alike with regard to that property?" (p. 230). Given that diverse physical realizers of *believing that Iowa is west of Indiana* can and arguably do differ with respect to that property, there is no problem with sorting them in accordance with *The difference principle*.

Still, the concern remains: what about the intuition that diverse physical realizers of a mental property are "exactly alike" with respect to that property? This is where the second metameric moral, concerning the science-relativity of determination dimensions of a determinable, comes in. Relative to "purely" psychological sciences, mental properties may have psychological determination dimensions, while relative to lower-level sciences, these properties may have further, explicitly physical, determination dimensions. Hence relative to psychology, mental properties with diverse physical realizers may be exactly alike, compatible with these properties being different (as per the first moral: *qua* mental), relative to a lower-level science distinguishing these realizers. Such facts accommodate the supposition that diverse physical realizers are exactly alike with respect to what they realize (relative to purely psychological sciences), compatible with these realizers determining mental properties in respect of those properties (relative to lower-level sciences). Hence the argument from mental multiple realizability is blocked.

3.3 Blocking the argument from mental super-determinates

For similar reasons, the metameric morals also block the mental super-determinate argument. Given that (as per the second moral) different sciences may treat a single determinable as having different determination dimensions, mental properties may be super-determinate relative to a purely psychological science, while (as per the first moral) being further determined relative to a lower-level science (treating the

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[22] Thanks to Robert van Gulick for this case.

physical realizers of the mental properties). What is super-determinate relative to one science may not be super-determinate relative to another. Hence the argument from mental super-determination is blocked.

4 Filling in the morals-based responses

Those endorsing MP-determination are typically physicalists, for whom properties at higher levels of the hierarchy of scientific entities are 'nothing over and above' properties at lower levels (in particular, in cases of synchronic necessitation). A promising way of establishing that the requisite nothing over-and-aboveness is in place for the case of properties is via a "powers-based subset strategy", according to which, roughly, the powers associated with higher-level properties (either essentially, or at least in worlds with the same laws of nature) are a proper subset of those associated with their realizing properties. Arguably, a wide variety of apparently diverse non-reductive physicalist accounts are implicitly, if not explicitly, implementing this strategy (see Wilson 1999); hence are more similar than they may superficially appear.[23]

Though many physicalist accounts implement the powers-based subset strategy, the appeal to determination may be crucial if the strategy is to serve as the basis for optimally solving the problem of MC. For example, the mere holding of a proper subset relation between the relevant power profiles is compatible with a realized property's being a conjunct of a conjunctive realize property; but as previously, the conjunct/conjunction relation does not rule out the threat of causal overdetermination. Here it is also worth noting that functionalist accounts of realization, while often clearly aimed at implementing something like a proper subset strategy, do not decisively do so insofar as it is common to give functional properties a disjunctive analysis; but (in addition to the afore-mentioned concern about whether the token identity of disjunctive and disjunct instances avoids the threat of causal irrelevance) disjunctive properties arguably do not have a proper subset of the powers of their disjuncts.[24]

In any case, in service of seeing how the morals-based responses to the mental multiple-realizability and mental superdetermination arguments might be filled in, let's put a powers-based account of determination on the table and see how this

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[23] Indeed, a powers-based understanding of synchronic nothing over and above-ness unifies both reductive and non-reductive accounts, with the main difference being that the former accounts (e.g., type-identity accounts) maintain that the power profiles of higher-level properties are non-proper subsets of the power profiles of the relevant lower-level properties. It is worth noting that what is most crucial to establishing the physical acceptability of a higher-level property is that the powers of any one of its instances, on an occasion, be a subset of the powers of the physically acceptable property instance realizing it on that occasion. Similarly, it is the subset relation as holding between powers of instances that ultimately avoids problematic overdetermination and (when a proper subset is at issue) accommodates higher-level autonomy.

[24] Consider the powers of $P \vee Q$ to produce effects when in circumstances C (restrict attention to these, for simplicity). Since there are two ways for $P \vee Q$ to be instanced, there will in general be two powers associated with C: (1) If in $C \wedge P \wedge \neg Q$, then E_1; and (2) If in $C \wedge Q \wedge \neg P$, then E_2. (There may be others, but that won't matter for making the point.) What powers will P have, in C? It will have at least one of the powers of $P \vee Q$, in C: 1. If in $C \wedge P \wedge \neg Q$, then E_1. (Here the conjunct P is redundant, but no matter.) However, P will not have the following causal power of $P \vee Q$, in C: 2. If in $C \wedge Q \wedge \neg P$, then E_2. P would have such a power only if it could be both instanced and not instanced in C, which it can't. So in this case (and more generally) $P \vee Q$ does not have a proper subset of the powers of P.

account may be used to implement Strategy 2. Afterwards, I'll briefly revisit Funkhouser's framework for understanding determination, and indicate how Strategy 2 can be implemented in this framework.

4.1 A powers-based account of determination

Suppose, then, that properties (at least of the broadly scientific variety) are associated with (perhaps essentially; perhaps only in worlds with the same laws of nature) sets containing all and only the powers they have (bestow). As a first pass, a proponent of MP-determination may then suggest that the increase in specificity at issue in *Increased specificity* reflects a relation between the sets of powers of the properties involved, as follows:

> *Powers-based determination* (first pass): Property P determines property Q iff the set of powers associated with Q is a proper subset of the set associated with P.

Here the idea is that a determinate is more specific than its determinable in being associated with a more specific set of powers (again, see Wilson 1999).

That a determinate has more powers than its determinable rules out that determination is the disjunction/disjunct relation: having a disjunct property is a specific way of having a disjunctive property, but (as per footnote 24) a disjunct property arguably does not have more powers than a disjunctive property.

What about the contrast between determination and the conjunct/conjunction relation? This contrast holds in paradigm cases of determination—and also, it seems, of realization (a mental property is not a conjunct of its physical realizers!). Such cases, in particular, seem to rule out that a determinate is a conjunction, of which a determinable is one of the conjuncts. We may preserve this contrast on a powers-based approach (improving on the proposal in Wilson 1999) by stipulating that the powers in the complement of the sets associated with a determinate and any of its determinates, respectively, do not determine a set that is associated with any property, as per:

> *Powers-based determination* (second pass): Property P determines property Q iff Q is associated with a proper subset of the powers associated with P, and the set of powers had by P but not by Q is not associated with any property.

The second pass account satisfies *Increased specificity*, understood as conforming to the *Appropriate contrast* constraint.

4.1.1 Accommodating The qua principle

Powers-based determination provides a metaphysical basis for accommodating the second, positive, constraint on *Increased specificity*—that is, *The qua principle*—by appeal to the following understanding of determination "in respect of" a determinable:

> *Determination "in respect of" a determinable*: What it is for a determinate P to specify a determinable Q in respect of Q is for P to have all the powers of Q and then some; and for the set of powers of P not had by Q not to be associated with any property.

Proponents of MP-determination can profitably understand what it is to be "determined in respect of a determinable" in terms of such non-conjunctive specification of a determinable's powers. By these lights, satisfaction of *The qua principle* is built into a powers-based account of determination.

4.1.2 Accommodating The difference principle

Relatedly, *Powers-based determination* (and associated understanding of "determination in respect of a determinable") provides a metaphysical basis for satisfaction of *The difference principle*: determinates sharing the powers of their common determinable, but which differ in respect of powers not had by the determinable, will appropriately differ in respect of their determinable.

4.1.3 Accommodating science-relative determination dimensions

Powers-based determination provides a metaphysical basis for accommodating the apparent fact that sciences may differ with respect to the determination dimensions of a determinable.

All determinates of a given determinable must be specified in respect of the determinable—that is, must share the powers had by the determinable (equivalently: must be associated with sets of powers that are supersets of the set associated with the determinable). But different sciences may be sensitive to different levels of metaphysical grain at which the determinable can be specified. The laws of one science (e.g., psychology, normal color science) may be sensitive to relatively small supersets of the set of powers had by the determinable, while the laws of another science (e.g., neuropharmacology, metameric color science) may be sensitive to relatively large supersets of the determinable set.

4.1.4 Accommodating mental multiple realizability

Powers-based determination makes sense of how multiply realized determinates may be "exactly alike" with respect to a determinable, compatible with realization being determination.

Relative to one set of determination dimensions (reflecting sensitivity to powers in certain supersets of the determinable set) diversely realized same-level determinates may be exactly alike. Relative to a finer-grained set of determination dimensions (reflecting sensitivity to powers in larger supersets of the determinable set) diversely realized determinates may not be exactly alike. Hence the argument from mental multiple realizability is blocked.

4.1.5 Accommodating mental super-determination

Powers-based determination makes sense of how multiply realized determinates may be intuitively "super-determinate" with respect to a determinable, compatible with realization being determination.

What counts as a super-determinate depends on what determination dimensions are at issue. Relative to one set of determination dimensions (reflecting sensitivity to powers in certain supersets of the determinable set) a determinate P may be "super-determinate". Relative to a finer-grained set of determination dimensions (reflecting sensitivity to powers in larger supersets of the determinable set) P may not be super-determinate. Hence the argument from mental super-determination is blocked.

4.2 Revisiting Funkhouser's framework

Powers-based determination provides one basis for filling in the morals-based implementation of Strategy 2; I anticipate that there are other such bases (bracketing the question of which framework is best for understanding determination). Indeed, notwithstanding Funkhouser's rejection of MP-determination, his framework for understanding determination (appealing to determination dimensions as defining determinable and determinate property spaces) may be "stretched" to accommodate the metameric morals.

Recall that on this framework, determination dimensions act as axes in a property space, with their associated allowable values defining regions of property space—even unto a single point in a determinable's space, in the case of a super-determinate of that determinable. On such a framework, one can accommodate the metameric moral that determination dimensions are science-relative, by supposing that what looks like a point relative to a particular property space, defined by a specific set of determination dimensions, is (under the effective "magnification" associated with a finer level of metaphysical grain) in fact an extended space, with further (possibly physical) determination dimensions.

The resulting framework of property spaces will be more complex; in particular, will need to address how the science-relativized determination dimensions associated with what is intuitively a single property (say, *being colored*, or *believing that Iowa is west of Indiana*) are related. But this is just as a physicalist would have it; for in the physicalist's view features of higher-level properties are ultimately not isolated from—and indeed, are nothing over and above—features of lower-level, ultimately physical goings-on.

5 Conclusion

The metameric morals, the morals-based responses to the mental multiple realizability and mental super-determinate arguments, and the various ways of filling in these responses (by appeal to one or other account of determination) indicate that there is no problem with supposing, and indeed may well be the case, that MP-realization is determination. Hence there is no problem with implementing the attractive determination-based solution to the problem of MC.

This leaves open whether realization is, in general, determination (here again, of the general variety defined by *Increased specificity* and its associated constraints). Whether this is so remains to be seen. The answer might in part be a matter of terminology, reflecting how 'realization' is or should be used in formulations of

physicalism and the like. If 'realization' is intended to cover any and all physically acceptable synchronic necessitation relations, then it is doubtful that all realization is determination. But if 'realization' is used more specifically, as a physically acceptable relation compatible with the multiple realizability of realized entities, and with the type and even token distinctness of realized and realized entities, then many and perhaps even all cases of realization are determination. After all, it is commonly observed that the problem of MC is just one particularly close-to-the-heart case of the more general problem of higher-order causation, whose instances are ubiquitous. Given the advantages and viability of taking MP-realization to be determination, physicalists are well-advised to treat other instances of the general problem similarly, by taking whatever higher-level property is at issue to be a determinable of its more determinate physical realizers. At a minimum, then, an understanding of realization as determination promises to illuminate an important class of synchronic necessitation relations.

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