Non-reductive Realization and the Powers-based Subset Strategy[*]

Introduction

0.1 The pretheoretic appearances

Pretheoretically, so to speak, "higher-level" special-science particulars and their features (including properties, relations, states, and associated events) appear to be dependent on, yet to some extent autonomous from, "lower-level," presumably physical, particulars and their features.[1] More specifically, special-science particulars appear to be materially composed by lower-level particulars, and to have features which are functionally dependent on (in, at a minimum, supervening with at least nomological necessity on) features of their composing entities. Yet special-science particulars also appear to be to some extent ontologically and causally autonomous from—that is, *distinct from* and *distinctively causally efficacious as compared to*—the lower-level entities upon which they depend: as per their governing laws, they have seemingly distinctive features and enter into seemingly distinctive causal interactions.[2]

What metaphysical dependence relations between higher- and lower-level entities underlie these appearances? Though physicalists often disagree about details, they agree that any such relations conform to *Physicalism*:

> *Physicalism*: All broadly scientific entities are nothing over and above physical entities.

Here the "physical" entities are members of a restricted set, usually associated with fundamental (or relatively fundamental) physics.[3] When some entities are (understood to be) "nothing over and above" physical entities, one way or another, I will say that the entities are "physically acceptable."

Non-reductive physicalists (NRPists) moreover aim to vindicate the appearance that dependence is compatible with ontological and causal autonomy, as per:

> *Non-Reduction*: Some special-science entities are both distinct from and distinctively causally efficacious with respect to any lower-level physically acceptable entities.

Reflecting the goal of vindicating the appearances, *Non-reduction* is characterized in ontological/metaphysical terms.[4] Making explicit the assumptions (see note 1) concerning which entities count as comparatively lower-level: if special-science entity *S* is composed of physical entities, then the claim that *S* satisfies *Non-reduction* entails that *S* is not identical to any physical entities, nor to any relational entity consisting of physical entities standing in physical relation, nor to any boolean or mereological combination of such relational or non-relational entities.

Summing up: NRPists aim to show how at least some dependent higher-level entities that are physically acceptable, in being, one way or another, "nothing over and above" the lower-level physically acceptable ("base") entities upon which they depend (as per *Physicalism*), are also ontologically and causally autonomous from any such base entities (as per *Non-reduction*).

0.2 Non-reductive realization

Though different dependence relations may be at issue as holding between higher- and lower-level entities, the primary focus of NRPist attention is on cases where certain features of special-science particulars depend upon certain (assumed physically acceptable) features of lower-level relational particulars, as when . . .

- . . . *having a certain temperature* (a feature of a gas) depends on *having a mean molecular kinetic energy* (a physically acceptable feature of a relational entity consisting in certain molecules standing in certain molecular relations)

- . . . *being phototropic* (a feature of a plant) depends on *undergoing certain cellular-wall weakenings and cellular expansions* (a

physically acceptable feature of a relational entity consisting in certain cells of the plant standing in certain cellular relations)

And nearest and dearest to our hearts and minds:

- . . . *being in a certain mental state* (a feature of a person) depends on *being in a certain brain state* (a physically acceptable feature of a relational entity consisting in certain neurons standing in certain neuronal relations).

Call the "nothing over and above" relation the physicalist takes to be at issue in such cases "realization."[5] And call the "nothing over and above" relation the non-reductive physicalist takes to be at issue in the target cases, which relation is supposed to accommodate the ontological and causal autonomy of the special-science entities at issue, "non-reductive realization."

0.3 The topic

How should non-reductive realization be understood? I will argue that an adequate account of non-reductive realization must guarantee satisfaction of a certain condition on the token causal powers associated with (instances of) realized and realizing features, which I call *Subset Condition on Causal Powers*. The condition requires that the token powers associated with ("of," "had by") a realized feature on a given occasion be a proper subset of the token powers associated with its realizing feature on that occasion. Accounts of non-reductive realization conforming to this condition implement what I call *the powers-based subset strategy* (henceforth, usually just "the powers-based strategy").

I will focus on the case involving mental and brain states; the results will generalize as appropriate. Unless qualified or implied (by, e.g., talk of necessitation), reference to a "state" is to be understood as reference to a token of a state type. In §1, I will motivate the strategy by attention to the problem of mental causation; I will make the case, in schematic terms, that implementation of the strategy makes room (contra Kim 1989, Pereboom 2002, and others) for mental states to be ontologically and causally autonomous from their realizing physical states, without inducing problematic causal overdetermination and compatible with both

Physicalism and *Non-reduction*; and I will argue that several accounts of non-reductive realization implement the strategy. As we'll see, implementation of the powers-based strategy does not require endorsement of any particular accounts of properties or causation—indeed, a categoricalist contingentist Humean can implement the strategy. The schematic location of the strategy in the space of available responses to the problem of mental (more generally, higher-level) causation, as well as the fact that the schemata may be metaphysically instantiated, strongly suggests that the strategy is sufficient and necessary for non-reductive realization. In §2 and §3, I defend the sufficiency and necessity claims, considering, along the way, how the powers-based strategy fares against competing accounts of (purportedly) non- reductive realization in terms of supervenience, token identity, and constitution.

1. The Powers-Based Subset Strategy

1.1 The problem of mental causation

The problem of mental causation is directed at our target case, and at NRPist hopes for treating this case in line with the pretheoretic appearances. One starts with the question: How can mental states be causally efficacious, as they seem to be, given their strong dependence on brain states? The problem is then that certain plausible premises about mental states and causation together give rise to an unsatisfactory answer.

The premises about mental states are:

1. Mental states depend on lower-level physically acceptable relational states (henceforth: "base states"), in that, at a minimum, mental states (at least nomologically) require and are (at least nomologically) necessitated by base states.

2. Mental states and base states are real.[6]

3. Mental states are causally efficacious *vis-à-vis* other mental states.[7]

4. Mental states are distinct from base states.

The premises about causation are:

5. Every physically acceptable effect has a purely physically acceptable cause.

6. In general, effects are not causally overdetermined.

Now for the problem. Let mental state M depend, on a given occasion, on base state P (as per 1), and let M cause mental state M^* on a given occasion (as per 3). M^* depends on some base state P^* (by 1), which necessitates M^* with at least nomological necessity. Moreover, P^* has a purely lower-level physically acceptable cause (by 5)—plausibly, and without loss of generality, P. If P causes P^*, and P^* (at least nomologically) necessitates M^*, then it is plausible that P causes M^*, by causing P^*. So, it appears, both P and M cause M^*, and given that P and M are both real and distinct (by 2 and 4), M^* is causally overdetermined, contra (6).

Standard responses avoid overdetermination by rejecting one or other premise:

- *Substance dualism*. Deny (1): deny that M and M^* depend on base entities.

- *Eliminativism*. Deny (2): deny that either M or M^* is real.

- *Epiphenomenalism*. Deny (3): deny that M is efficacious.

- *Reductive Physicalism*. Deny (4): deny that M is distinct from P.

- *Robust emergentism*. Deny (5): deny that every physically acceptable effect has a purely physically acceptable cause.

And finally, the NRPist's response:

- *Non-reductive Physicalism*. Deny (or disambiguate) (6): allow that the case involves overdetermination, but deny that it is problematic.

In motivating their response, NRPists typically offer up some specific metaphysical account of the non-reductive realization relation (holding either between states or associated types[8]), illustrating how this might be, including:

- Functional realization (Putnam 1967, Fodor 1974, Papineau 1993, Antony and Levine 1997, Melnyk 2003[9]). Mental state types are functional state types implemented by physically acceptable state types.

- Mereological realization (Shoemaker 2001, Clapp 2001). Mental states/state types are parts of base states/state types.

- The determinable-determinate relation (Yablo 1992, Wilson 2009 [10]). Mental states/state types are determinables of base states/state types.

The NRPist then argues that were their favored relation to hold between mental and base states, problematic overdetermination would be avoided, compatible with both *Physicalism* and *Non-reduction*.

1.2 Subset Condition on Causal Powers (SCCP)

There is much to say about each candidate non-reductive realization relation, and about whether it makes sense as applied to the mental/ ment-physical case. For present purposes I want to call attention to a more abstract, though still properly metaphysical, condition that each relation arguably satisfies, and which underlies its promise of entering into an account of non-reductive realization. I will first state the condition and show, in schematic terms, how its satisfaction avoids problematic causal overde-termination in the target case, compatible with *Physicalism* and *Non-reduction*. I will then argue that each of the above realization relations satisfies the condition.

1.2.1 Causal powers

The condition is a condition on causal powers (henceforth: just "powers"). What is a power? To start, recall the truism that what a particular can do (cause) depends on how it is—that is, on what features it has: it is in virtue of being massy, not magnetic, that a magnet falls to earth; in virtue of being magnetic, not massy, that a magnet attracts steel; and so on. Reflecting that the actual or potential production of certain effects depends on the possession of certain features, we may say that the latter are asso-ciated with ('have', 'bestow') manifested or unmanifested powers to produce the effects. Additionally, a given feature will typically be associated with powers to produce a variety of effects, depending on the circumstances of its instantiation. Hence (to use Shoemaker's example) *being knife-shaped* has the power to cut butter when co-instanced with *being wood*, and has the power to cut wood when co-instanced with *being steel*.

Philosophers differ over the nature of powers, their role in causation, and whether they are essential to the features that have them. More specifically, they differ over whether powers are dispositions, categorical features, posits following upon "best system" regularities, and so on; over whether powers are had intrinsically or extrinsically; over whether the powers of a feature contingently vary with the laws of nature. No commitment on any of these issues is required in order to implement the powers-based strategy to follow. This neutrality reflects that all participants need to be able to track the actual and potential causal contributions associated with features of broadly scientific entities ("manifested" or "unmanifested" "powers") one way or another, and so long as the operative account of powers can make sense of one (token) contribution's being identical with another, it will do the trick. As we will see, even a contingentist categoricalist Humean can implement the powers-based strategy.

1.2.2 Condition on Causal Powers (CCP)

To start, each of the aforementioned NRPist realization relations (functional, mereological, or determinable/determinate) arguably guarantees satisfaction of:

> *Condition on Causal Powers* (CCP): Every token power of a realized mental state M on a given occasion is numerically identical with a token power of the (lower-level relational, physically acceptable) base state P realizing M on that occasion.

As per the rejection of epiphenomenalism, CCP is assumed to be non-vacuously satisfied. Note that reductive physicalist accounts also guarantee satisfaction of CCP; for example, if mental state types are identical to physical state types, then mental states are identical to physical states, and CCP is satisfied.

1.2.3 Subset Condition on Causal Powers (SCCP)

Each of the aforementioned relations moreover arguably takes CCP to be satisfied in such a way that the set of powers had by a realized state on a given occasion is a *proper subset* of that had by its realizing state on that occasion:

Subset Condition on Causal Powers (SCCP): The token powers of a realized mental state M on a given occasion are a non-empty proper subset of the token powers of the (lower-level relational, physically acceptable) base state P realizing M on that occasion.[11]

Let's see, in schematic terms, how satisfaction of SCCP in our target case, involving mental state M and base state P, avoids overdetermination while satisfying both *Physicalism* and *Non-reduction*.

To start, a realization relation satisfying SCCP avoids problematic over-determination. If the relation between M and P satisfies SCCP, then every token power of M is numerically identical to a token power of P, on a given occasion. Hence for any effect produced by both M and P on a given occasion, only one power is manifested. There is only one causing, not two.

Next, a realization relation satisfying SCCP satisfies *Physicalism*. The main concern about M's physical acceptability turns on the possibility that M might be robustly emergent. But recall that the robust emergentist avoids overdetermination by denying that P causes E, or that P causes E in the same (direct) way as M. In terms of powers, the emergentist maintains either (a) that P does not have the power to cause E, or (b) that while P does have such a power, it is not identical with M's power (it is manifested differently, or in different conditions; perhaps P causes M, which more directly causes E). Either way, SCCP fails to be satisfied.

Satisfaction of SCCP also blocks the other live routes to physical un-acceptability, associated with M's being non-natural (see Moore 1903) or supernatural (à la Malebranchean occasionalism). Moore used the term 'non-natural' as indicative of epistemological irreducibility (more specifi-cally: indefinability), which is arguably compatible with *Physicalism* (see Wilson 2002). In any case, if M's being epistemologically irreducible is deemed physically problematic, this must be because such irreducibility indicates that M's existence involves something metaphysically new relative to ("over and above") P.[12] On the NRPist's operative assumption that M is efficacious, the problematic addition in question would presum-ably either be or entail M's having of a non-natural or supernatural causal power, not had by physically acceptable P. But the having of such a power is ruled out if SCCP is satisfied.

Now, remaining broadly neutral on the metaphysics of states, satis-faction of SCCP is compatible with M's having a non-causal aspect not

had by P—e.g., a non-causal quiddity or categorical aspect. But, as is also reflected in the dispute between robust emergentists and physicalists, any non-causal aspects of M are irrelevant to broadly scientific goings-on, since scientific truths involving broadly scientific features do not depend on or otherwise track whether such features have non-causal aspects (much less track how non-causal aspects of seemingly distinct features are related). Hence that M and/or P have such aspects, shared or not, cannot undermine M's physical acceptability, given P's physical acceptability.[13] The general pattern, guaranteeing M's physical acceptability, is as follows: if P is physically acceptable, and every token power of M is identical with a token power of P, then M's causal aspects are guaranteed to be physically acceptable; M's non-causal aspects are irrelevant to M's physical acceptability; hence a realization relation satisfying SCCP guarantees M's conformity to *Physicalism*.[14]

Finally, a realization relation satisfying SCCP satisfies *Non-reduction*. To start, if M is associated with only a proper subset of P's powers, then M is ontologically autonomous (distinct) from P, by Leibniz's law.

Might M also be causally autonomous—distinctively causally efficacious *vis-à-vis* an effect that P also (by CCP) causes? Yes, supposing that a feature may be distinctively efficacious in virtue of having a distinctive set of causal powers, or *distinctive power profile*. The underlying basis for the powers-based strategy is the claim that M's causal autonomy does not require that M have a distinctive power: it is enough that M have a distinctive set (collection, plurality) of powers.

One case for taking distinctive power profiles to suffice for causal autonomy appeals to difference-making or "proportionality" considerations, in cases where M (or M's type) is multiply realizable. Suppose M is a state of feeling thirsty, which causes a desire for a glass of water (effect E). Now suppose that M (or another instance of M's type) were realized by P' rather than P, in circumstances relevantly similar to those in which M caused E. Would E (or another instance of E's type) have still occurred? Intuitively, yes, since the only powers that matter for the production of E are the powers associated with M; powers differing between P and P' (e.g., to produce different readings on a neuron detector) are irrelevant for E's production. That M's distinctive power profile contains just those powers relevant or "proportional" to E's production provides a principled reason for taking M's efficacy *vis-à-vis* E to be distinctively different from P's.[15]

Another case for causal autonomy reflects that distinctive power profiles are typically associated with distinctive systems of laws (for example, the special-science-treating entities of M's type). Plausibly, systems of laws track causal joints in nature. Correspondingly, M's distinctive power profile indicates such a distinctive causal joint. Causal joints may overlap—both in respect of a given power (as per CCP) and in respect of the associated effect E.[16] Still, if the joints as a whole are different, this provides a principled reason for taking M to be distinctively efficacious *vis-à-vis* E, in that M produces E as part of a different system of laws (causal joint) than P. This is, I think, what Macdonald and Macdonald (1995) have in mind when they say, in arguing that mental properties may be causally autonomous ("relevant"), that "any instance of a cause-effect relation can be an instance of more than one pattern" (71). And it is, I think, what Antony and Levine (1997) have in mind when they say that for causal autonomy of functional properties, "What we really need is a 'realization-indifferent' regularity: a contingent regularity that essentially involves the second-order property, and that applies to any instance of the property, no matter the form of realization." And it is what I have in mind in Wilson 2010*a*, §5.2.1.

The suggestion here is that there are two ways for a higher-level feature to be distinctively efficacious as compared to the lower-level feature(s) upon which it depends. One way—emphasized by Kim and others—is for the higher-level feature to be associated with a new power to produce the effect; here the distinctive efficacy reflects facts that are broadly intrinsic to the effect's production. Another way—that at issue in the powers-based strategy —is for the higher-level property to be associated, either nomologically or essentially, with a collection of powers that are relevantly proportional to the effect, in the ways indicated by difference-making considerations and special-science laws; here the distinctive efficacy reflects, in part, facts (concerning what power profiles are associated with what properties) that are broadly extrinsic to the effect's production.

1.3 NRP accounts satisfying SCCP

I'll now argue that each of the aforementioned accounts of non-reductive realization guarantees satisfaction of SCCP in our target case.[17]

First consider functionalist accounts, according to which realized types are second-order types associated with causal roles that, on a given

occasion, are played by tokens of realizer types. A causal role is just a collection of powers. Hence if M is of a functional type, then, on any given occasion, every token power of M will be numerically identical with a token power of the base state P that plays M's causal role on that occasion. Functionalist accounts of realization thus satisfy CCP.

Do such accounts also satisfy SCCP? One might think not, on grounds that a functionally realized feature inherits *all* of the token powers of its realizing feature:

> A functional reduction of pain has the following causal and ontological implications: Each occurrence of pain has the causal powers of its neural realizer [. . .] In general, if M occurs by being realized by N on a given occasion, the M-instance has the causal powers of the N-instance. (Kim 2006, 554)

But in cases of multiple realizability, a functionally realized state arguably has only a proper subset of the token powers of its realizing state. Recall the hardware/software analogy motivating functionalism (Putnam 1967). The realizing systems are similar with respect to powers needed to implement a given software program, but different with respect to powers associated with their distinctive hardware. More generally, when a functionally characterized feature is multiply realizable, its realizing types will each have all the powers associated with the functional role, and more besides. Hence the powers of the realized type will be a proper subset of those of each of its realizing types. And this type-level relation between powers will plausibly hold between token powers of the instantiated types, as per SCCP.

Second, consider broadly mereological accounts of realization, according to which realized tokens (Shoemaker) or types (Clapp) are proper parts of base tokens/types. Proper parthood appears to satisfy the NRP desiderata: proper parts are distinct from and yet in a sense nothing over and above wholes, and may be efficacious without inducing overdetermination, as when both I, and my eye, cause a wink. As Clapp (2001) says,

> [M]ultiply realized mental properties, though real and causally efficacious, are better thought of as parts of their physical realizers. [. . .] Just as there is no causal and/or explanatory competition between a whole and its parts, so there is no causal and/or explanatory competition between instances of mental properties and instances of their physical realizers.

Both Shoemaker and Clapp suppose that mereological accounts satisfy SCCP; indeed, both see satisfaction of SCCP as core to non-reductive realization, with the appeal to mereology serving mainly to illustrate one concrete way to satisfy the condition. Hence Shoemaker (2001) first presents a CCP-based account of realization:

> Property *X* realizes property *Y* just in case the conditional powers bestowed by *Y* are a subset of the conditional powers bestowed by *X* (and *X* is not a conjunctive property having *Y* as a conjunct). (78)

He then claims that multiply realized features satisfy SCCP:

> Where the realized property is multiply realizable, the conditional powers bestowed by it will be a proper subset of the sets bestowed by each of the realizer properties. (78–79)

Shoemaker supports this claim by appeal to considerations similar to those canvassed for functional realization, with the main difference being that he takes all broadly scientific properties to be characterized by distinctive sets of powers. When such a feature is multiply realized, its realizing types will share all the powers of the realized type, but will differ from each other in respect of further powers. This type-level subset relation between powers will plausibly hold between token powers of the instantiated types; hence a feature realized as per a powers-based account satisfies SCCP. Supposing, following Shoemaker 1980, that powers are exhaustively individuated by their powers, satisfaction of SCCP is naturally interpreted as involving a parthood relation between token features:

> Likewise, the instantiation of a realizer property entails, and might naturally be said to include as a part, the instantiation of the functional property realized. (Shoemaker 2001, 81)

Alternatively, we can "backwards-engineer" the need to satisfy SCCP from a mereological approach. If features have non-causal aspects, the fact that a realized state properly overlaps a realizing state need not indicate that the realized state has any powers at all, much less that it is distinctively efficacious. Hence if proper overlap is to provide a basis for distinctive higher-level efficacy, the overlap must be specifically in respect of powers, as per SCCP.

Importantly, and notwithstanding that Shoemaker and Clapp each take a powers-based, broadly mereological account of realization to naturally

flow from a causal view of properties (as per Shoemaker 1980, Ellis 2001, and others), such an account of realization is independent of this or related views. As previously, non-causal aspects of features are irrelevant to issues of physical realization. For similar reasons, the possibility that a broadly scientific feature might have different powers in worlds with different laws is irrelevant to whether and how such features are physically realized in worlds governed by the same laws as ours—the only worlds of interest, or so it seems to me, when issues of dependence between broadly scientific entities are at stake. And indeed, not just a contingentist but even a Humean categoricalist may endorse a powers-based account of realization and associated subset strategy: here the (manifested) powers will be contingently given by regularities among the categorical features, and the proper subset relation between collections of token powers will be grounded in instances of one regularity's being part of instances of another.

Finally, consider accounts of non-reductive realization in terms of the determinable/determinate relation, the relation of increased specificity paradigmatically holding between colors and their shades. Yablo (1992) suggests that taking mental features to be determinables of physical determinates avoids problematic overdetermination:

> [W]e know that [determinables and determinates] are not causal rivals. This kind of position is of course familiar from other contexts. Take for example the claim that a space completely filled by one object can contain no other. Then are even the object's parts crowded out? No. In this competition wholes and parts are not on opposing teams [. . .]. Determinables and their determinates, like objects and their parts, are guaranteed to be on the same team. (259)

As Yablo's claim suggests, and as is developed in Wilson (1999 and 2009), the determinable-determinate relation satisfies CCP. Consider a patch that is red, and more specifically scarlet. Sophie the pigeon, trained to peck at any red patch, is presented with the patch, and she pecks. The patch's being red caused Sophie to peck—after all, she was trained to peck at red patches. But the patch's being scarlet also caused Sophie to peck—after all, to be scarlet just is to be red, in a specific way. Nonetheless, Sophie's pecking was not problematically overdetermined. Plausibly, this is because each token power of the determinable red instance is numerically identical to a token power of its determining scarlet instance. Similarly, the proponent of this account of realization maintains, for the

case of *M* and *P*, in which case the determinable/determinate relation satisfies CCP.

Again, one might doubt that the relation moreover satisfies SCCP, on grounds that determinable and determinate instances are identical (MacDonald and MacDonald 1986, Ehring 1996), such that a determinable token inherits *all* of the token powers of its realizing determinate token. But again, the powers of a determinable instance are arguably only a proper subset of those of its determining instance. Given Sophie's training, she would have pecked even if the patch had been a different shade of red (burgundy, say); but not so for Sophie's cousin Alice, trained to peck only at scarlet patches. Such cases suggest that the determinable type red has fewer powers than its determinate types. More generally, since broadly scientific determinables are associated with distinctive sets of powers, and are typically "multiply determinable," the powers of determinable types will typically be a proper subset of those of their determinate types. This relation will plausibly hold between token powers of determinable and determinate instances; hence a determinable/determinate account of realization satisfies SCCP.

1.4 The main objection diagnosed, and the necessity and sufficiency claims

The main objection to NRP, due to Kim (1989, 1993*a*, and 1998), is that NRP cannot avoid problematic overdetermination in target cases of realization without collapsing either into reductive physicalism (contra *Non-reduction*) or expanding into robust emergentism (contra *Physicalism*). But, I have argued, SCCP provides a schematic basis for avoiding problematic overdetermination compatible with both *Physicalism* and *Non-reduction*; moreover, several contemporary accounts of non-reductive realization guarantee satisfaction of SCCP, and so are appropriately seen as implementing the powers-based subset strategy. I will shortly consider various objections to the strategy, but first I want to highlight the core presupposition giving rise to Kim's dilemma, the denial of which makes room for the strategy.

The first horn turns on the need for the NRPist to endorse CCP (Kim's "causal inheritance principle"), which is indeed plausibly required for *Physicalism*. In early discussions of the dilemma, Kim supposes that realized instances inherit *every* power of their realizing instances. So, for

example, in his (1993*a*) he assumes that any higher-level property that is both efficacious and irreducible must have irreducible powers. But this supposition neglects the viability of locating irreducibility—both onto-logical and causal—in the having of a distinctive power profile. More recently, Kim allows that CCP may be satisfied via SCCP, but still fails to consider reasons for thinking that SCCP suffices for ontological and causal autonomy.

Pereboom's (1991, 2002) similarly fails to consider these reasons, in assessing SCCP-based versions of NRP. He says, concerning our target case, that if a "token-identity thesis for these causal powers" is held,

> . . . then the causal powers to which the psychological explanation refers would in the last analysis, in fact, be microphysical. Psychological explana-tions might then presume a classification that clusters microphysical causal powers in a way distinct from how microphysics sorts them, but this would not compromise the microphysical status of those causal powers. (2002, 500)

And he concludes that accounts requiring token identity of powers are in-compatible with "robust non-reductive materialism" (502). But such remarks describe, rather than argue against, the powers-based strategy. Why, then, do Kim and Pereboom, among others, think that higher-level features cannot be genuinely (physically) non-reductive if they satisfy CCP—even if, as per the proper subset strategy, they moreover satisfy SCCP?

The reason, I speculate, is that these philosophers assume that there is only a single form of causal efficacy: that associated with the having and manifestation of a power. Consequently, they recognize only a single way for a higher-level feature to be *distinctively* efficacious; namely, in virtue of having a distinctive power. If either CCP or SCCP is satisfied, then this route to the distinctive efficacy of higher-level features is precluded, in which case NRP's viability will seem dim indeed. Moreover, if distinctive powers are required for distinctive efficacy, it is easy to see how the NRPist gets pushed to the "robust emergentist" horn of Kim's dilemma, since new powers are the hallmark of such emergence.

As above, however, there is another route to distinctive causal efficacy, associated not with distinctive powers, but with distinctive *collections* of powers. Again, this alternative conception may be grounded in propor-tionality or difference-making considerations, or in distinctive systems of laws or causal joints; at a more abstract level, the alternative conception

locates efficacy in facts about collections of powers that are partly extrinsic to facts about the individual powers manifested in the production of a given effect. Given this alternative, the dilemma dissolves.

So stands my diagnosis of the ultimately nonfatal grounds of the main objection to NRP. Now for my positive claims.

It is, to be sure, a further question whether a given relation satisfying SCCP is in fact suited to relate mental and physical states. So, for example, some deny that mental states are appropriately seen as determinables of physical determinates (but see Wilson 2009). Supposing a given relation is so suited in principle, however, then satisfaction of SCCP—implementation of the powers-based strategy—is, I have argued, sufficient for its being a relation of non-reductive realization.

I moreover claim that implementation of the powers-based strategy is necessary for an adequate NRPist account of realization. My reasons for thinking this reflect that, of the schematic options for resolving the problem of mental causation, only one avoids both horns of Kim's dilemma, combining an endorsement of CCP (thus ensuring *Physicalism*) with an endorsement of SCCP (thus ensuring *Non-reduction*). As such, there is really only one route to non-reductive realization, though one may travel it in diverse ways.

I turn now to defending the sufficiency and necessity claims.

2. Objections and Responses to the Sufficiency Claim

I have seen four objections to the sufficiency claim: the objections from eliminativism, reductionism, non-interactionist dualism, and token multiple realizability.

2.1 The objection from eliminativism

The powers-based strategy aims to accommodate the pretheoretic appearances, according to which some higher-level entities are both onto-logically and causally autonomous from base entities. The eliminativist does not object to the strategy *per se*, but maintains that it is mistakenly imple-mented: higher-level entities are not to be taken ontologically seriously, and any appearances to the contrary are to be explained away, in pragmatic or other terms.[18]

The response proceeds by recalling the present dialectic. Absent good reason for rejecting the higher-level appearances as genuine, the burden

on NRPists is only to show how these may be metaphysically accommo-dated. Indeed, good reasons for eliminativism are in short supply. Ockham's razor alone does not support eliminating all seemingly higher-level features, for this would be seriously revisionary, entailing that special-science claims are typically either false, meaningless, or incor-rectly understood. Nor is there a case that there is no good metaphysical sense to be made of higher-level entities; on the contrary, the powers-based strategy identifies the basis for a properly metaphysical reading of higher-level features, as located in distinctive power profiles (without, I reiterate, requiring commitment to anything like a causal account of prop-erties). Less revisionary would be a selective eliminativism, allowing that some higher-level features exist—the ontologically reducible ones—but eliminating any irreducible such features. So far even this much remains to be motivated, however. The best reason for eliminating non-reduced entities would, it seems, appeal to Kim-style arguments that one cannot have one's *Physicalism* and one's *Non-reduction*, too; and that in any case one must have one's *Physicalism*. But the powers-based strategy undercuts such arguments; hence modulo attempts to resurrect them (which I will next argue are unpromising), even a moderate eliminativism is unmotivated. Of course, eliminativists may continue to reject the reality of (reduced or, more plausibly, unreduced) higher-level entities. But no matter: given the present dialectic the NRPist need not knock the eliminativist off their horse; they need only to stay on their own.

2.2 The objection from reductionism

The second objection grants the reality of *M*, but presents a challenge: if *M* satisfies SCCP, why isn't *M* appropriately deemed physi-cally acceptable?[19]

To start, the objection must be refined. As stated, the NRPist may respond simply by agreeing that higher-level features, like all features by their lights, are physically acceptable. What the NRPist more specifically claims is that *M* is irreducible to any *lower-level* physically acceptable feature. And what this means, as previously, is that *M* is not identical to any feature of individual physically acceptable entities, nor to any rela-tional feature consisting in lower-level entities standing in lower-level relations, nor to any feature consisting in a boolean or mereological com-bination of such relational or non-relational lower-level features. Call the

latter lower-level features "reduction base features." More precisely, then, the challenge is: given that (as per SCCP) every token power of M, on a given occasion, is identical with a token power of some base feature P, why isn't M identical to some or other reduction base feature?

There are two ways to respond. The first appeals to "strong" multiple realizability considerations to argue that no such identification is in the offing.[20] Here the NRPist points out that, notwithstanding their supposition that M is actually physically realized, it is metaphysically *possible* that M be realized by a physically unacceptable entity. As such, any identification of M with a reduction base feature must incorporate, somehow or other, reference to M's possible physically unacceptable realizers. Since reductive base features do not incorporate such reference, M is not identical to any such feature.

The second strategy may be implemented even if M has only a single (actual, physically acceptable) realizer. The strategy proceeds by arguing that no reduction base feature has the same powers as M; hence by Leibniz's law, M is not identical with any reductive base feature. The full implementation of this strategy is somewhat intricate (see Wilson 2010a); here I sketch the approach.

To start, as per SCCP, M has, on a given occasion, a proper subset of the token powers of its realizing state (feature) P. Hence M is not appropriately identified with P or any other individual realizing feature. Nor will disjoining, conjoining, or fusing any of these lower-level realizers result in a feature that, like M, has only a proper subset of P's token powers on a given occasion. So, for example, consider a disjunction of lower-level realizers—the sort of feature most commonly offered as a candidate for identity with a multiply realized feature. Instances of disjunctive features are identical with instances of whatever disjunct is instanced on the occasion; but any such instance will be a lower-level realizer, and hence, by assumption, such that it has a proper superset of M's token powers. So M cannot be identified with such a disjunctive reduction base feature. Other modes of reductively acceptable combination similarly fail to result in any decrease in specificity of the (complex, relational) feature's powers, when instanced (again, see Wilson 2010a for details). The challenge is thus on the reductionist's side, to show that some feature in the reduction base has token powers that are, like the powers of M, restricted in the way that SCCP requires.

2.3 The objection from non-interactionist dualism

Eric Hiddleston argues (p. c.) that the powers-based strategy is insufficient for NRP, since compatible with a form of "non-interactionist dualism," in which (in our target case) instances of M's type nomologically, but not metaphysically, supervene on instances of a disjunctive base type; and where M has no powers, on a given occasion, beyond those those of its realizers (e.g., P). In such a case, Hiddleston suggests, M would satisfy SCCP; but intuitively, M is over and above the base properties; after all, by assumption M is only nomologically necessitated by those states.

Two responses are available. First, one may deny that, in cases where M's occurance is a matter of law, it has numerically the same powers as the features that lawfully necessitate it. Recall the robust emergentist's treatment: M, they claim, has a new power to produce effect E; and even supposing that M's realizing state P also has a power to produce E, this will not be the *same* power as M's: it will be manifested differently, or in different circumstances (perhaps, e.g., P only indirectly produces E, by producing M, whereas M directly does so). The situation with non-interactionist dualism is similar, but reversed. Here, it is M's realizer P that directly has the power to produce E; and even supposing that M also has a power to produce E, this will not be the *same* power as P's: M only indirectly produces E, thanks to its nomological connection with P, whereas P directly does so.

Second, even granting that, in Hiddleston's case, M's token powers are a proper subset of those of P, the proponent of the powers-based strategy may deny that such an M would be physically unacceptable. Hiddleston assumes that features supervening with only nomological necessity on base features will be physically unacceptable—a common assumption among those attempting to characterize physicalism or physicalist realization by reference to the distinction between metaphysical and nomological necessity. As I'll discuss in §3.1, such attempts are unsuccessful, since even metaphysical supervenience is compatible with robust emergence. But the failure also goes in the other direction: that a feature only nomologically supervenes on base properties doesn't imply that it is physically unacceptable. Since, in Hiddleston's case, M has no nonphysical powers, its supposed unacceptability must lie in its having some non-causal aspect, only nomologically connected to its realizers. But as argued above, any non-causal aspects of broadly scientific features are irrelevant to issues of physical realization, constitution, or truthmaking. These arguments were

neutral on whether these aspects were brought about with metaphysical or rather nomological necessity; consequently they apply here, to show that the NRPist may comfortably countenance M as physically acceptable, so long as M satisfies SCCP, independent of whether M's occurrence is only nomologically necessary.

2.4 The objection from token multiple realizability

Pereboom (2002) argues against CCP, thus indirectly arguing against the sufficiency of SCCP for NRP. He starts by arguing that (token state) M can be multiply realized, and so is not identical with (token base state) P:

> Suppose that M is realized by a complex neural state [P]. It is possible for M to be realized differently only in that a few neural pathways are used that are token distinct from those actually engaged. [. . .] [I]t is evident that this alternative neural realization is itself realized by a microphysical state P' that is token distinct from P. It is therefore possible for M to be realized by a microphysical state not identical with P, and thus M is not identical with P. (503)

He continues:

> [T]his reflection would also undermine a token-identity claim for mental causal powers—should they exist—and their underlying microphysical causal powers. For if the token microphysical realization of M had been different, its token microphysical causal powers would also have been different. We therefore have good reason to suppose that any token mental causal powers of M would not be identical with the token microphysical causal powers of its realization.

A proponent of CCP/SCCP can respond in either of two ways. First, they may deny that M is multiply realizable. What is (fairly) uncontroversially true is that M's type is multiply realizable. Pereboom's case for taking token M to be multiply realizable isn't compelling, and may be rejected. Compare: could that very instance of red, currently realized by an instance of scarlet, have been realized by an instance of burgundy? One might reasonably judge not, and continue to reasonably judge not even supposing the alternative shade to be only "slightly" different from the original. One may similarly reasonably deny that M (as opposed to another instance of M's type) could be realized by a base feature other from P, whether this alternative feature be very different from P, or only different with respect to "a few neural pathways."

Second, the proponent of CCP/SCCP may allow that M is token multiply realizable, but maintain that M's token powers are relativized to realizers/occasions. Pereboom presupposes that M has its token powers essentially; but why think this? As he later observes, "stable tokens [. . .] often retain their identity over certain changes in their constitutions and configurations" (529). One may similarly maintain that M can retain its identity across changes in its realizers and associated token causal powers. CCP requires only that M's token powers *on a given occasion* be numerically identical with the powers of the state realizing it on that occasion; so CCP and SCCP can be satisfied even if M is token multiply realizable.

3. Objections and Responses to the Necessity Claim

Must an adequate account of non-reductive realization implement the powers-based strategy? I will now consider a representative sample of NRPist accounts on which the relation at issue is not guaranteed to satisfy SCCP, associated with supervenience-based accounts, token-id accounts, and Pereboom's "robust nonreductive materialism," respectively. I will argue that supervenience-based accounts and token-id accounts do not guarantee the causal autonomy of a realized state (contra *Non-reduction*), and that supervenience-based accounts and Pereboom's account do not guarantee the physical acceptability of a realized state (contra *Physicalism*). Moreover, these difficulties will each be traced to the account's failure to entail satisfaction of CCP or SCCP. I will conclude that there is considerable inductive support for the necessity claim.

3.1 Supervenience-based accounts

Supervenience is a comparatively abstract relation in which dependence of higher-level entities on lower-level entities, and/or determination of higher-level entities by lower-level entities, is cashed in terms of correlations alone, omitting any specific account of what metaphysical relation(s) might be responsible for the correlations.[21] There is a history of attempts, starting with Davidson and continuing on today, to characterize NRP and non-reductive realization by appeal to one or other variety of supervenience as holding between (families of) the types at issue (such that, e.g., mental properties supervene on physical properties).

Supervenience-based accounts of non-reductive realization are, however, doubly problematic from an NRPist perspective. First, such accounts fail

to guarantee *Non-reduction*. Supervenience of types is compatible with identity of tokens (as on Davidson's anomalous monism); hence, for reasons I will present when assessing token-id approaches in §3.2, do not guarantee ontological or causal autonomy of higher-level features.

Second, supervenience-based accounts fail to guarantee *Physicalism*. Some physicalists have hoped that correlations of sufficient modal strength would transmit physical acceptability from base to supervenient entities. Such hopes are encouraged by the common assumption that whatever relation is at issue in robust emergence would hold with only nomological necessity, whereas paradigm relations preserving physical acceptability (e.g., identity) hold with metaphysical necessity. But these hopes are in vain, for no matter how modally strong the correlations, the supervening feature might be physically unacceptable (see Wilson 2005). For example, mental features might supervene with metaphysical necessity on base features, thanks to a Malebranchean god who acts consistently across worlds. Relatedly, such supervenience is compatible with robust emergentism, given certain live metaphysical and physical theses about powers and laws. For example, if features are essentially individuated by their powers (Shoemaker 1980), if laws of nature are metaphysically necessary (Swoyer 1982, Bird 2007), or if the laws of nature are holistic (as presupposed in attempts to unify fundamental interactions; see Wilson 2002), then any world where the relevant physical states are instanced will be a world where the associated mental states are instanced, even if the latter are partly caused or constituted by a nonphysical fundamental interaction.[22]

Proponents of supervenience-based accounts sometimes resist taking such scenarios to undermine their view, on grounds that these violate Hume's Dictum, according to which there are no metaphysically necessary connections between distinct existences. One problem with this response is that arguments, much less good arguments, for the dictum are in short supply.[22] In any case, an account of non-reductive realization shouldn't rule out live independent physical and metaphysical theses concerning properties and laws, or intuitive Malebranchean possibilities. The deeper point is that we shouldn't expect mere correlations to do the work—of illuminating higher- level dependence, in particular—of a properly metaphysical realization relation.

Finally, it is worth noting that attempts to beef up supervenience to ensure transmission of physical acceptability succeed just to the extent

that the resulting "supervenience" relation guarantees satisfaction of CCP. For example, Horgan's (1993) account of "superdupervenience" requiring that supervenient entities be robustly ontologically explainable doesn't do the trick, since causal explanation is robustly ontological, but is compatible with non-identity of token powers of supervenient and base entities (effects typically have powers their causes don't have), hence with robust emergentism (see Wilson 1999). By way of contrast, Chalmers's (1996) account of "broadly logical" supervenience does guarantee physical acceptability of supervenient entities, precisely because the requisite conceptual connections establish that the supervenient entity is of a functional type whose distinctive causal role may be played by the base entity—such that, as argued in §1.3, SCCP is satisfied.

3.2 Token identity accounts

A properly metaphysical strategy for avoiding overdetermination in our target case is to identify states M and P (see, e.g., Davidson 1970, Macdonald and Macdonald 1995, Ehring 2003, and Robb 1997). On such an approach, the realization relation satisfies CCP, but not SCCP. Above, I characterized such realization as reductive; and indeed, reductive physicalists typically suppose that realized and realized features are token-identical. But a token-id account leaves open whether, in particular, M's type is identical with P's type (or to the type of another reductive base entity), and so the account might be non-reductive at least at the level of types.

The token-id approach avoids token-level overdetermination between M and P. It doesn't gain M's ontological autonomy, but one might think that this isn't as important as gaining M's reality and efficacy. It remains, however, that causal autonomy requires not just that M be efficacious, but distinctively so.[24]

How might M be distinctively efficacious, on a token-id account? It cannot be so in virtue of its distinctive powers, or in virtue of having a distinctive cluster of powers. The remaining option (see MacDonald and MacDonald, Ehring), is that M be distinctively efficacious in virtue of falling under a distinctive type.[25]

The appeal to non-identical types as the ground of the causal autonomy of M, as compared to P, reintroduces a (or the) threat of causal overdetermination, and associated threat of exclusion. As Ehring (2003) puts it: "Since mental types are not identical to physical types (because of

multiple realizability) even if mental tokens are identical to physical tokens, there are no causes of physical effects that are efficacious in virtue of mental property types" (364). To gain M's autonomy, the token-id theorist must provide an account of the relation between M and P's associated types, and show that the associated means of gaining autonomy does not reintroduce problematic overdetermination.[26]

Ehring provides an account of the relation between types aiming to show that this threat is avoided. As a trope theorist, Ehring understands M and P as tropes, and associated types as collections of resembling tropes; he then argues that M's and P's types are related as part to whole. Here the order of the part/whole relation is reversed from Clapp's understanding: for Clapp, a realized type is part of each of its realizing types; for Ehring, a realized type is a whole, having the subclasses (of resembling tropes) of its realizing types as parts.

What is interesting for present purposes is that Ehring takes appeal to a type-level powers-based strategy as required to establish the requisite autonomy without inducing problematic overdetermination. He first motivates the view for the type *red* and associated shade types:

> It seems clear that for the class of red tropes as a whole, the type "red," has certain causal powers. [. . .] [W]e are still left with the question of how the causal powers of this class as a whole are related to the causal powers of the subclasses of each determinate shade of red. I believe the answer is that the causal powers of the type "red" are those exactly similar causal powers shared by each of these subclasses. [. . .] For any causal power of a shade of red not matched by an exactly similar causal power belonging to each of the other shades of red, "red" lacks any such power. (374)

In other words, the powers of the type *red* are a proper subset of those of its constituent determinate types. Ehring takes similar considerations to indicate that the powers of mental types are a proper subset of the powers of their realizing physical types. Macdonald and Macdonald (1995) also plausibly implement a powers-based strategy at the level of types, for they take mental state types to be relevantly analogous to determinables, and as previously (§1.3) determinable types arguably have a proper subset of the powers of their realizing determinate types.

Such hybrid approaches are problematic, however. To start, shouldn't the subset relation between powers at the level of types be mirrored at the level of states? As Shoemaker (2001) notes:

> [I]t seems doubtful that we should identify the mental property instance with the instance of the physical property that realizes it—or that we should identify the instance of red and the instance of scarlet. If we think of the instantiation of a property as the conferring on something of the conditional powers associated with that property, then when properties confer different sets of conditional powers, the instantiation of one of them is not identical with the instantiation of the other. (28)

A related but more serious concern is as follows. On the hybrid view, *M*'s type does not have powers that differ between its realizer types; but *M* (being identical with *P*) can have such powers. Hence *M* can have powers that *M*'s type doesn't have; and that seems wrong. It arguably makes sense for a token state to have *fewer* powers than its state type, reflecting restrictions associated with circumstances in which the state occurs (see Clarke 1999). But it makes no sense for a token feature to have *more* powers than its type, at least if types are supposed to track similarities among associated tokens. If a token feature has more powers than a given type, that is, or so it seems to me, compelling reason to think that the feature is not of that type.[27]

Avoiding this difficulty requires that the subset strategy hold at the level of tokens as well as types. More precisely, it requires imposing SCCP if the account is to be a version of NRP—alternatively, the proponent of token-id could go reductive at both token and type levels, or else go robust emergentist at the type level. At the end of the day, token identity accounts of non-reductive realization either do not establish autonomy of states, contra *Non-reduction*; or else impose SCCP and so are not really token identity accounts.

3.3 Pereboom's account of non-reductive realization

On Pereboom's (2002) account of "robust" NRP, *M* is neither type nor token identical with *P*; and contra both CCP and SCCP, *M*'s token powers are "irreducible to" powers of *P*: "robust non-reductive physicalism affirms various token-diversity claims for mental causal powers." Such a view will clearly make sense of *M*'s ontological and causal autonomy. But how are *M*'s irreducible powers supposed to avoid problematic overdetermination while retaining compatibility with *Physicalism*?

According to Pereboom, this is because *M*'s powers are "constituted" by *P*'s powers, in a way piggybacking on the notion of token feature constitution:

Token causal power constitution: The causal powers of a token of
kind *F* are constituted by the causal powers of a token of kind *G* just
in case the token of kind *F* has the causal powers it does in virtue of
its being constituted by a token of kind *G*.[28]

The notion of constitution of one token feature by another is broadly
primitive, but is (as per Pereboom in progress), to be grasped as relevantly
analogous to the "made up of" relation holding between one particular and
another (e.g., a statue and a lump of clay). The account of feature consti-
tution, coupled with *Token causal power constitution*, is intended to
motivate taking the powers of a non-reductively realized feature *M* to be,
while irreducible to, still nothing over above the powers of *P*:

[Though *M*'s token powers are irreducible to *P*'s] there would be a sense in
which the token causal powers of *M* would be "nothing over and above" the
token causal powers of *P* . . . *M*'s causal powers would nevertheless be
"absorbed" or "swallowed up" by *P*'s causal powers. But there are impor-
tantly distinct modes of this sort of absorption: identity and constitution
without identity . . . token mental causal powers are wholly constituted by
token microphysical causal powers. (2002, 503–504)

But such appeals to token feature and power constitution do not
establish that rejection of CCP is compatible with *Physicalism*. "Consti-
tution" is a term of art, applied mainly (as Pereboom notes) to objects.
Where token features are at issue, and where conformity to *Physicalism* is
presumed, "constitution" is usually just another name for "realization."[29]
But as per §1.3, standard cases of non-reductive realization presuppose
satisfaction of CCP. The expression "in virtue of" entering into the account
of token power constitution is also a term of art, compatible with many
underlying relations, from identity and the determinable/determinate relation
(satisfying CCP) to emergence-involving causation (not satisfying CCP,
and contra *Physicalism*).[30]

Pereboom offers further considerations in support of irreducible
mental powers' being compatible with *Physicalism* and with the avoidance
of overdetermination, but these also fail to establish his case. In re com-
patibility with *Physicalism*, he says that "correlated with the possibility of
this sort of constitutional explanation is the fact that the existence and
nature of token higher-level causal powers would be predictable in
principle from their microphysical constituents together with the laws

governing them" (504). But if the powers of *M*, at either the type or token level, are not identical with the powers of *P*, what guarantees that the powers of *M* would be so predictable? Perhaps such predictability could be guaranteed if every power of *M* was type-identical (though token-distinct) with a power of *P*. But this understanding looks to give rise to the worst kind of overdetermination.

Pereboom resists, saying that "no competition arises in the case of mere constitution":

> For if the token of a higher-level causal power is currently wholly constituted by a complex of microphysical causal powers, there are two sets of causal powers at work which are constituted from precisely the same stuff [. . .] and in this sense we might say that they coincide constitutionally. (505)

To the extent that I understand why constitutional coincidence blocks overdetermination, however, this is because (the relevant sort of) coincidence would entail identity of the token powers had by features of the "stuff." Pereboom acknowledges "that they now coincide in this way might tempt one to suppose that these causal powers are token identical, but, as we have just seen, there is a good argument that they are not." Here Pereboom is referring to his argument from the supposed token multiple realizability of *M* to the non-identity of *M*'s token powers with *P*'s powers; but as we saw in §2.4, that argument does not work.

Finally, Pereboom provides an indirect argument that problematic overdetermination can be avoided even if CCP is rejected. He starts by saying, "If identity [of powers] and not just constitutional coincidence were necessary for [. . .] noncompetition, then there would be features required for noncompetition that identity has and current constitutional coincidence lacks" (506). He goes on to say that the features possessed by identity but not constitutional coincidence are coincidence at all other times and worlds; then notes that lack of such features surely could not induce overdetermination. But what identity of powers has and constitutional coincidence of powers lacks, and which is necessary for noncompetition, is not a matter of goings-on at other times or worlds. It is rather simply that identity of powers on an occasion guarantees noncompetition on that occasion, whereas constitutional coincidence on an occasion without identity of powers on that occasion seems not to avoid competition, and indeed to invite it (if *M* and *P* are token distinct, but

type-identical). Summing up: Pereboom never provides reason to think that denying CCP is compatible either with *Physicalism* or with avoiding problematic overdetermination, much less jointly so compatible.

To show that the denial of CCP is so compatible, Pereboom must get more metaphysically specific about what it is for one power to constitute another; but such a strategy is unpromising. One cannot directly implement the powers-based strategy as holding between individual powers, for it is unclear that powers have powers, and even if they do, it's unclear how such higher-order powers are implicated in the production of higher-level effects. Alternatively, Pereboom might attempt to make out that one of the metaphysical relations that, when holding between features, plausibly entails the holding of a proper subset relation between associated token powers, holds between powers themselves. But such relations do not obviously make sense as holding between powers. So, for example, if the token powers of M and P are to stand in the determinable/determinate relation, then P (or perhaps P's associated effects) must manifest, relative to M, the increase in specificity characteristic of the determinable/ determinate relation. This rules out that P produces the same effect as M, which departs from the standard NRPist take. Moreover, what would be the ontological ground for the difference in specificity? In the case of token features, their powers serve as the requisite ground: the determinate feature is more specific than the determinable feature in that the former has more powers than the former. But again, it is unclear that powers have powers, so the usual metaphysical ground for the determinable/deter- minate relation is not available here. Similarly if the token powers of M and P are to stand in the proper parthood relation. In the case of features, the holding of this mereological relation is grounded in the holding of a proper subset relation holding between token powers; but what are the con- stituents of powers, such that one can be a proper part of another in having different numbers or amounts of these constituents? In any case, there is no reason to posit further constituents to powers, since the motivating desider- ata of accommodating the pretheoretic appearances in line with NRP may be accomplished more simply and plausibly without any such further posits, via the (appropriately metaphysically neutral) powers-based strategy.

4. NRP: Alive and Well

In this paper I have argued for three claims pertaining to the powers- based subset strategy. First, contra Kim and others, implementation of this

strategy provides a principled basis for avoiding problematic overdetermination compatible with taking mental and other realized features to be ontologically and causally autonomous (as per *Non-reduction* and physically acceptable (as per *Physicalism*). Second, whether or not they realize it, many NRPists are implementing a powers-based subset strategy, according to which the preferred realization relation satisfies SCCP. Third, implementation of the strategy is not only sufficient but necessary for the viability of a given account of non-reductive realization, insofar as a representative variety of purportedly NRP accounts not implementing the strategy (including accounts based in supervenience, token-identity, and constitution) fail to guarantee satisfaction of one or both core NRP theses. These results collectively indicate that NRP is alive and well, and represents (along with robust emergentism, which remains a live option) an attractive means of accommodating the pretheoretic appearances concerning special-science entities.

Further questions remain, of course, including: What specific relation(s) satisfying SCCP are best suited to non-reductive realization? What other dependence relations hold between special-science and (fundamental or relatively fundamental) physical entities? And last but not least: Is NRP true?

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NOTES

1. Talk of "higher" and "lower" levels here tracks, in a relative way, composed and composing entities, and their associated sciences; e.g., a molecule is "higher-level" relative to its composing atoms, as is molecular physics relative to atomic physics. Also counted as "lower-level" are lower-level relational, conjunctive, disjunctive, or mereological combinations of lower-level entities, even though such complex entities might not be among the proper subject matter of the associated lower-level science; e.g., a relational entity consisting of atoms standing in atomic relation is "lower-level" relative to a molecule. The distinction is *prima facie*: one might argue, for example, that molecules are identical to relational atomic entities (or to disjunctions of such entities, etc.).

2. As Kim (1993a) notes, these appearances motivate a commonly assumed framework involving "a hierarchically stratified structure of 'levels' or 'orders' of entities and their characteristic properties. It is generally thought that there is a bottom level, one consisting of whatever micro-physics is going to tell us are the most basic physical

particles out of which all matter is composed [. . .]. As we ascend to higher levels, we find structures that are made up of entities belonging to the lower levels, and, moreover, the entities at any given level are thought to be characterized by a set of properties distinctive of that level." As with levels, the assumption of this framework is *prima facie* and subject to refinement.

3. Various accounts of the physical are on offer. My preferred account, which conforms to the intentions of most physicalists, takes the physical entities to be the comparatively fundamental entities treated by (appropriately accurate) present or future physics, with the proviso that the physical entities are not fundamentally mental (do not themselves have or bestow mentality); see Wilson 2006.

4. NRP has also been formulated in epistemological terms, as the thesis that some higher-level goings-on are not deducible from or otherwise explainable in terms of lower-level physical goings-on. Modulo an entailment of metaphysical by epistemological non-reduction, such theses are not at issue here.

5. The term 'realization' is standardly associated with a physicalistic understanding of the relation ostended in the target cases, which is (multiple dependence or realizability aside) a one-one relation between higher-level and lower-level features. Gillett (2002) maintains that 'realization' should also apply to cases of many-one ("dimensioned") realization, holding between lower-level non-relational goings-on and higher-level goings-on; and he offers an account based in the "in virtue of" relation aimed at covering both cases. I don't find "in virtue of" accounts of dependence to be metaphysically informative, but in any case there is no deep difference between the two cases, for the "one-one" and "many-one" approaches target the same phenomena: the latter considers the nature of the dependence of a higher-level entity on comparatively non-relational lower-level entities given certain allowable combinatorial principles, whereas the former considers the nature of the dependence of a higher-level entity on relational lower-level entities having features allowed by the combinatorial principles.

6. This premise is presumably entailed by 1, 3, and 4; but is worth registering separately since its denial is associated with a distinct position.

7. This assumption reflects that special-science laws appear to express (perhaps among other things) causal relations between treated entities. The assumption that mental states are efficacious *vis-à-vis* lower-level physical states also gives rise to a *prima facie* problem. For simplicity, and also because it is harder to establish distinctive mental efficacy in that case, I restrict focus to higher-level efficacy.

8. Polger and Shapiro (2008) claim that accommodating multiple realizability requires that realization hold between types, on grounds that token features are not multiply realizable; but this is incorrect: attributions of multiple realizability may be grounded in the tokens's being of potentially differently realized types.

9. I include Melnyk as endorsing an account of realization that may, as argued below, accommodate NRP, though Melnyk is neutral on whether his account guarantees distinctness, as required by *Non-reduction*.

10. I am neutral on whether NRPism is the correct view about mental and physical states, since robust emergentism remains a live empirical possibility (see Wilson 2002). Of the NRPist options, however, I find the determinable/determinate relation most promising (see Wilson 2009).

11. Neither CCP nor SCCP requires that the powers of a mental state type be a proper subset of the powers of its realizing types. To be sure, when the proper subset condition holds at the level of types, it will plausibly hold at the level of tokens (compare the case of identity). But the condition might not hold at the level of types, and yet hold at the level

of tokens; see Clarke (1999).

12. Similarly for accounts of robust emergence characterized in terms, e.g. of "in-principle" failure of deducibility. As McLaughlin (1992) notes, "the Emergentists do not maintain that something is an emergent because it is unpredictable. Rather, they maintain that something can be unpredictable because it is an emergent" (73).

13. Hence even if (contra the NRPist's operative assumption) *M* is epiphenomenal, *M* will inherit *P*'s physical acceptability.

14. These considerations indicate, *pace* Melnyk (2006, 141–43), that endorsement of a causal theory of properties, identifying properties with clusters of powers, is not required for satisfaction of SCCP to guarantee physical acceptability of a realized feature. Melnyk supposes that if features have non-causal aspects, then satisfaction of SCCP will not guarantee satisfaction of the "constitution" and "truthmaking" conditions, according to which physically realized entities are constituted by their realizing physical entities, and truths about the former are made true by the latter. However, constitutional and other broadly scientific truths about broadly scientific entities are neutral as regards the presence or absence of non-causal aspects of features; hence satisfaction of SCCP does guarantee satisfaction of the constitution and truthmaking conditions, independent of whether features have non-causal aspects. Nor is endorsement of a causal theory required to guarantee satisfaction of the "necessitation" condition, according to which physical realizers metaphysically necessitate the features they realize: "Why assume that along with possession of power-tokens of certain types there automatically comes possession of a property [. . .] that would have conferred them?" (140). Since non-causal aspects are irrelevant to the individuation of scientific features, whether the necessitation condition holds can only depend on whether the lower-level goings-on entail that there are higher-level laws adverting to the power profile associated with the higher-level feature (compatible with *Non-reduction*, since such entailment does not entail that higher-level features are identical with any lower-level features; see §2.2). That said, the NRPist can resist imposing the necessitation condition; see §2.3.

15. Both Shoemaker (2001, 31) and Yablo (1992, 274) take difference-making and proportionality considerations to indicate not just that *M* may be distinctively causally efficacious but that *M* may be the only cause of E. But since causal autonomy can be gained with distinctive rather than exclusive efficacy, there is no need to deny *P*'s efficacy *vis-à-vis E*.

16. Supposing laws express type-level goings-on, the overlap will be, in the first instance, at the level of types of the states and effect at issue.

17. Satisfaction of SCCP by lights of these and other accounts is most straightforwardly established when the realized type is multiply realizable, but can also be alternatively established, if the realized and realizing types enter into different laws; see Wilson 2010a.

18. As John Heil, David Robb, and Alyssa Ney, among others, suggested. Note that eliminativism here contrasts with reductionism; nominalists offering general ontological reductions of properties do not immediately count as eliminativists.

19. Though Kim has not treated the powers-based subset strategy in detail in print, he registered this as his primary concern with the powers-based strategy in a 2009 Pacific APA panel on Shoemaker's (2007), as did Alyssa Ney in her APA comments on a precursor to this paper (see also Ney 2010). Ranpal Dosanjh, Jim John and Timothy O'Connor each raised a similar objection in conversation or Q&A.

20. The following strategy is due to Ranpal Dosanjh.

21. See Yoshimi (2007) for a useful discussion of the notions of dependence and determination, and of how these enter into standard formulations of supervenience.

22. A nonphysical (physically unacceptable) fundamental interaction is a fundamental interaction that first comes into play at the level of complexity associated with mentality; see Wilson (2006) for discussion.

23. As I have argued, the dictum is neither analytic, nor grounded in intuitions we have no good reason to question, nor motivated as required by the best account of counterfactuals (see Wilson 2005, 2010b, and in progress).

24. This claim reflects what Horgan (1989) calls "the problem of mental 'quausation." As Yablo (1992) puts it, "To reply [to the problem of mental causation] that mental events just are certain physical events, whose causal powers they therefore share, only relocates the problem from the particulars to their universal features. [. . .] Mental events are effective, maybe, but not by way of their mental properties; any causal role that the latter might have hoped to play is occupied already by their physical rivals" (248–49). Shoemaker (2001) agrees: "If what is in fact an instance of a mental property causes something [. . .] but does so in virtue of being an instance of a physical property rather than in virtue of being an instance of a mental property, then the causal efficacy of the mental does not seem to have been adequately vindicated" (28).

25. Davidson cannot implement this strategy, since he supposes that mental events are efficacious only in virtue of falling under physical types; Robb could do so, but does not for reasons discussed in note 26.

26. Robb (1997) denies that an overdetermination problem crops up again at the level of types, on grounds that "A causally relevant property F simply does not have various aspects such that one can legitimately ask whether some but not others are responsible for F's being causally relevant." But the resurrected problem need not take exactly the form of the original. For example, even if tropes do not have tropes, we can ask: is the one mental/physical trope efficacious *qua* member of the set of mental tropes, or *qua* member of the set of physical tropes? In any case, Robb implements a proper subset strategy at the level of trope-theoretic types, and so his account is subject to the concerns about hybrid accounts to be shortly discussed.

27. Robb suggested that this is not problematic, on analogical grounds that one may be admitted to a club due to satisfying some condition, while also satisfying other conditions. But the analogy does not succeed. The club case reflects that a single particular can instantiate many types, thanks to having many features; taking the analogy at face value the suggestion would be that one can make sense of a trope's having more powers that its given type on grounds that the trope can have features not relevant to its being a member of the type. Robb doesn't think that tropes can have features (tropes), but even if they can that would not show how a trope of a given type could have more powers than the type, since the powers had by a trope aren't tropes of the trope; and similarly for properties more generally.

28. See Pereboom and Kornblith (1991) and Pereboom (2002).

29. Kim (1992) says, "talk of 'realization' is not metaphysically neutral [. . .] There is the suggestion that [. . .] the instantiation on a given occasion of an appropriate physical property [. . .] simply counts as, or constitutes, an instantiation of a mental property on that occasion" (4–5).

30. See Melnyk (2008, 1292) for a similar observation.

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