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In Defense Of A Realization Formulation Of Physicalism

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Let physicalism be understood as a comprehensive view of the world which accords to physics and the physical a certain descriptive and metaphysical primacy among the many sciences and their domains (Melnyk 2003, Chs. 1 and 2; Melnyk 2014). Any formulation of physicalism—unless the physicalism is eliminative—must do at least two things. First, it must characterize a relatively narrow class of physical entities that are, as it were, physical in their own right; call these entities *narrowly* physical. Second, it must specify a relation R such that, necessarily, if an entity which *isn't* narrowly physical (e.g., a zebra or a mental state) stands in R to an entity which *is* narrowly physical, then the former entity is *nothing over and above* the narrowly physical entity in the intuitive sense required for physicalism; call such an entity *broadly* physical.

In earlier work, I proposed and defended a formulation of physicalism that was distinctive in two ways. First, it took the narrowly physical entities to be those expressible with the proprietary vocabulary of more or less current physics (Melnyk 2003, 11-20; 223-237). Second, it took the key relation R to be neither identity nor supervenience but instead a carefully-defined relation of *physical realization*. To a first approximation, then, I proposed to formulate physicalism as the view that every entity (better: entity-token) is either narrowly physical or else is *physically realized* by some or other narrowly physical entity (Melnyk 2003, 6-11; 20-32).¹ But various objections have been made to the second distinctive feature of my proposed formulation of physicalism, i.e., to its appeal to a relation of

¹ “To a first approximation” only, because the formulation leaves various questions unanswered. For example, should the entities quantified over include abstracta? Or necessary existents? To what categories should the entities belong—states, events, properties, objects, facts, truths? See Melnyk 2003, 6-11; 20-32.

physical realization. In the present paper, I aim to show that these objections can be overcome.

1. Physical Realization

First, however, I need to spell out what I mean by—i.e., how I stipulatively define—the term, “physical realization”. For the sake of concreteness, let me define the physical realization of a mental state by a narrowly physical state. (Hereafter, by “physical” I shall mean “narrowly physical”.) So let “ p ” name a particular actual physical state-token, and “ m ” a particular actual mental state-token. Then p physically realizes m (in my intended sense) only if

i) m is a token of a mental state-type M with a certain *higher-order essence*: for a token of M to exist *just is* for there to exist a token of some or other (lower-order) state-type such that tokens of that (lower-order) state-type play role R_M , the role distinctive of M ;

ii) p is a token of a physical state-type P such that, (logically) necessarily, given the physical laws and (perhaps²) physical circumstances C , tokens of P play role R_M ; and

iii) the laws of physics hold and physical circumstances C obtain.

Claims i) through iii) are *necessary* but *not sufficient* conditions of p 's physically realizing m . They jointly entail that *some* token of mental state-type M exists. But they do *not* entail that this token of mental state-type M is one and the same as the particular token of mental state-type M that we have called “ m ”. Hence, claims i) through iii) do not jointly entail that p physically realizes (not just any old token of M but) m in particular. However, if claims i) through iii) are conjoined with the further mental-to-mental (*not* mental-to-physical) identity claim that

iv) the token of mental state-type M whose existence is entailed by claims i) through iii) = m ,

then all four claims together *do* entail that p physically realizes m . Thus, p physically realizes m (in my intended sense) if and only if claims i) through iv) are true. As I use the term “physical realization”, the holding of the relation of physical realization between physical

² E.g., in the case of wide mental states.

state-token p and mental state-token m *just is* the holding of the four conditions described by claims i) through iv).

At least four glosses on claims i) through iv) are required to make my intended meaning clear. First, the identity claim implicit in claim i)—that mental state type $M =$ so-and-so higher-order state-type—should be taken as metaphysically necessary and, in almost all cases, a posteriori. Second, the expression “(logically) necessarily” in claim ii) is meant to express the idea that the claim that tokens of P play role R_M is in principle *derivable* from statements of the laws of physics plus the claim that physical circumstances C obtain. Third, claim i) speaks of *playing a role* only for the sake of role-playing’s familiarity, and not because realization actually requires role-playing. To capture the full generality of realization, it would be better to speak, more broadly, of *meeting a condition*, where meeting a condition could indeed be playing a causal role, but could also be, e.g., standing in a certain spatio-temporal relation to something, or exhibiting a certain internal structure, or having a certain history, or having a certain bio-function (Melnyk 2003, 37-42). Finally, claim i) uses the term “higher-order” instead of the term “functional”, which is, of course, the term familiar from the canonical literature on functionalism. This is partly because the connotations of “functional” in philosophy of mind are unnecessarily narrow (as I have just pointed out), but mostly because “higher-order” draws attention to the metaphysical heart of physical realization and its associated formulation of physicalism. That heart is its construal of all actual non-physical state types as higher-order types of some or other kind. To claim that a mental state-token is realized by a physical state-token is to commit oneself to a particular view about the *nature* of the mental state-type of which the mental state-token is a token—specifically, to the view that the mental state-type has what I have called a higher-order essence.

A formulation of physicalism in terms of physical realization can claim several virtues: it keeps faith with certain intuitions about the content of physicalism; it entails, and arguably explains, the supervenience of the broadly physical on the narrowly physical and the (closely-related) necessitation of the broadly physical by the narrowly physical; and it helps to solve the various problems of (generalized) mental causation (Melnyk 2003, 33; 59-60; 49-70; 123-174, esp. 134-139 and 159-164). I shall not dilate on these virtues here.

2. Francescotti On Realization And Physicalism

In the previous section I defined the *physical* realization of a mental state by a *physical* state. But, you might ask, isn't the double occurrence of "physical" a case of overkill? In fact, it isn't. There is an important difference between merely being *realized* by a physical state, and being *physically realized* by a physical state; and it's only by appeal to the latter that, I have claimed, physicalism can be formulated (Melnik 2003, 22-23). Furthermore, when physicalism is formulated by appeal to physical realization (by a physical state), rather than to mere realization (by a physical state), the realization approach to formulating physicalism can avoid an objection recently made against it by Robert Francescotti—as I shall show in this section (Francescotti 2010).

What makes the definition of the previous section into a definition of physical realization, and not mere realization, by a physical state is one of the requirements in clause (ii):

- ii) p is a token of a physical state-type P such that, (logically) necessarily, given the physical laws and physical circumstances C , tokens of P play role R_M .

All it takes for realization *simpliciter* of a token of M by a physical state is that p be a token of a physical state-type P such that tokens of P play role R_M , the role distinctive of M ; nothing more is required. But clause (ii) adds the further requirement that the fact that tokens of P play role R_M must be derivable, in principle, from the laws of physics plus a physical description of circumstances C . So, for there to be *physical realization* by a physical state, tokens of P must play role R_M solely in virtue of how things are physically—solely in virtue of how things are physically in the sense specified by the "such that..." clause in (ii). By contrast, for there to be realization *simpliciter* by a physical state, tokens of P may play role R_M in any way that takes their fancy.

The more demanding requirements of physical realization (by a physical state) rule out certain possibilities that the less demanding requirements of realization *simpliciter* (by a physical state) allow—and that physicalism should not allow. Realization *simpliciter* (by a physical state) would allow tokens of P to play role R_M in virtue of properties (possessed by tokens of P) incompatible with physicalism, such as the property of being produced by an immaterial spirit. It would also allow role-playing itself to involve components incompatible with physicalism, such as causing changes in immaterial spirits. Possibilities like these are obviously precluded if tokens of P must play

role R_M solely in virtue of how things are physically, in the sense specified by the “such that...” clause in (ii).

Now for Francescotti’s objection; he writes that

Melnyk’s account fails to capture the physicalist belief that mental phenomena obtain in virtue of physical phenomena. For it is shown [in Francescotti’s paper] that with his analysis of realization, not only are the former *realized by* the latter, but they [mental phenomena] also *realize* the latter [physical phenomena]” (Francescotti 2010, 604).

Francescotti’s objection seems to be that *being realized by physical phenomena* can’t be sufficient for *obtaining in virtue of physical phenomena*. For if it were sufficient, then, because *physical phenomena* are also realized by *mental phenomena*, we’d be forced to say—implausibly—that physical phenomena obtain in virtue of mental phenomena.

But Francescotti’s objection is an *ignoratio elenchi*. Realization physicalism does not assume what his objection denies; it does not assume that being realized by physical phenomena *is* sufficient for obtaining in virtue of physical phenomena. What it *does* take to be sufficient for obtaining in virtue of physical phenomena is being *physically realized* by physical phenomena. Thus, it claims that all mental phenomena are *physically realized* by physical phenomena. But if Francescotti’s objection were modified to take this point into account, it would be missing its crucial premise, because it’s patently false that all (or indeed any) *physical phenomena* are *mentally realized*—where a physical state is *mentally realized* only if some mental state-type plays the role distinctive of the relevant physical state-type *solely in virtue of how things are mentally*.

Nor, in fact, do any of Francescotti’s proposed cases of mental phenomena realizing physical phenomena suggest that physical phenomena *are* mentally realized. Here is a representative example of one of Francescotti’s proposed cases:

Take any token x of any one of those mental types, G , and any token y of the corresponding neural type, F . Mental type G meets whatever condition C is characteristic of F —e.g., the property of *sensing redly* meets the condition, *instantiated in such-and-such activity (call it 'V*') in area V4*. Also, the fact that x is a token of a type that meets condition C necessitates that

there is a token of neural type F , which is y itself; e.g., there being a token of a type that meets the condition, *instantiated in activity V^** , necessitates that there is a token of V^* activity. So in this case, a mental token realizes a neural token on Melnyk's account. (Francescotti 2010, 606)

I note in passing that the argument here seems unsound. In order for sensing redly, which is a type, to meet the condition, *instantiated in activity V^** , "instantiated" has to mean something like "sometimes instantiated", because higher-order types are multiply realizable. In that case, type F must have a higher-order essence which entails that F is tokened *if* some or other type is tokened that is sometimes instantiated in activity V^* ; otherwise it wouldn't follow that there's a token of F just because there's a token of some type that is sometimes instantiated in activity V^* . But then type F couldn't be *neural*. For, given its higher-order essence, F is tokened in a possible world in which sensing redly is *ectoplasmically* realized while no neural types at all are tokened; and—trivially—no neural type is tokened in such a world.

But my main point is that, even if the quoted argument turns out to be sound, it shows at best that a neural token is realized *simpliciter* by a mental token; it doesn't show that a neural token is *mentally* realized by a mental token. For the condition that the token of the mental type meets—namely, being instantiated in a particular kind of *neural* activity—is not one that it meets (or could meet) solely in virtue of how things are *mentally*.

I am confident that Francescotti would accept this claim, for he acknowledges, albeit late in his paper, the essential points (i) that my formulation of physicalism appeals to physical realization (rather than realization *simpliciter*), and (ii) that, as a result, there is an important asymmetry between mental and physical phenomena: "the totality of mental facts", he says, "certainly does not fix all the physical facts." (Francescotti 2010, 612-613). But he is sanguine about this concession, believing that it leaves his main contention intact:

...it seems that condition (2) [Francescotti's name for the requirement that the playing by tokens of P of role R_M be derivable, in principle, from laws of physics plus a physical description of circumstances C] is not part of the concept of realization itself. One can hold that mentality is realized at the physical level...without believing that the physical facts alone determine the mental facts... Rather than being part of the

notion of realization, (2) expresses a kind of supervenience claim, for saying that the physical facts necessitate the mental facts is equivalent to saying that physically indistinguishable individuals/worlds are mentally indistinguishable. (Francescotti 2010, 613)

I see no particular reason to acquiesce in Francescotti's narrow interpretation of "realized at the physical level" to mean merely that the *role-players* are physical phenomena. But in truth I don't much care whether condition (2) is "part of the concept of realization itself" or not, for giving an account of realization is at least as much a matter of stipulation as it is of description; and in any case I could abandon the word "realization" entirely and still be able to state my position.

Francescotti's final sentence, however, claims that to adopt condition (2) is to fall back on a supervenience formulation of physicalism—a claim which, if correct, would mean that the realization approach ends up making no distinctive contribution to the formulation of physicalism. But the claim is not correct. Condition (2) does not "say[...] that the physical facts necessitate the mental facts", for it does not speak of *mental* facts at all. It says that physical facts in one class—the laws of physics plus circumstances *C*—logically necessitate physical facts in another class—the playing by tokens of *P* of role *R_M*. Because it does not say that the physical facts necessitate the mental facts, it isn't equivalent to the claim that the mental facts supervene on the physical facts. For all that Francescotti has shown, therefore, the role that realization plays in my proposed formulation of physicalism remains indispensable.

3. Stoljar's Dilemma

Daniel Stoljar objects to a realization formulation of physicalism that it must collapse into either type physicalism or physicalism formulated in terms (solely) of supervenience (Stoljar 2010, 13-124). He presents the objection as follows in his entry on "Physicalism" in the *Stanford Encyclopedia of Philosophy*:

...as Melnyk himself notes at one point ([Melnyk] 2003, p. 23), there is an issue here having to do having to do with the definition of a second-order [i.e., higher-order] property, the property of having some property that has a certain causal or theoretical role. What are the properties involved in spelling out these causal or theoretical roles? If physicalism is true at all, it must be true of these properties as much as any other

properties. But then by... realization physicalism, these properties themselves will be either physical or realized by physical properties. If the first option is taken, the...realization physicalist will stand revealed as holding a version of identity physicalism (one level up, as it were), and thus will face the multiple realization objection. If the second option is taken, the...realization physicalist looks committed to an infinite regress, since now we have further properties realized by physical properties and, correlatively, further causal or theoretical roles. To avoid the regress, the realization physicalist might say that these properties supervene on physical properties. But now it hard to see the difference between the realization physicalist and the supervenient physicalist in the first place. (Stoljar 2015, Section 10.1)

Let me begin with a remark on terminology. In this passage, Stoljar speaks of "properties involved in spelling out [the] causal or theoretical roles" in terms of which second-order properties are defined. But from my point of view this way of speaking is less than ideal. Properties can't, strictly speaking, be said to "spell out" anything; moreover, talk of "causal or theoretical roles" is unnecessarily restrictive, as noted in Section 1; finally, it is worth stressing that talk of "definitions" is talk not of verbal but of real definitions, discoverable only a posteriori. For these reasons, instead of using Stoljar's locution, I shall speak of "properties that enter into the essence of a higher-order property". If a higher-order property is the property of having some or other property that meets condition C, then any property included in C enters into the essence of the higher-order property.

Stoljar is quite right to say that, if realization physicalism is to be true, then every property entering into the essence of a higher-order property must be physical or physically realized.³ But he is wrong to think that this implication is problematic for realization physicalism, as I will show in this section.

In introducing his dilemma, Stoljar seems to say that realization physicalists must hold *either* that all the properties that enter into the essences of higher-order properties are physical *or* that all the properties that enter into the essences of higher-order properties are physically realized. It might be, however, that the properties that

³ More precisely, every *instance* of every such property must be physical or physically realized.

enter into the essences of *some* higher-order properties are physical, while those that enter into the essences of *other* higher-order properties are physically realized. Indeed, it might be that a *single* higher-order property has an essence into which *both* physical properties *and* physically realized properties enter. Realization physicalists are therefore within their rights to claim that, most likely, both physical and physically realized properties enter into the essences of higher-order properties.

But does this claim entail an infinite regress of the sort suggested by the second horn of Stoljar's dilemma? It does not. Infinite regress is avoided so long as, if higher-order properties are realized by other higher-order properties, this hierarchy bottoms out, so to speak, in higher-order properties that have essences into which only physical properties enter. And it's quite plausible that this condition is actually met, because the higher-order properties at the bottom of any hierarchy of higher-order properties are presumably either chemical properties (e.g., the property of being an acid) or macro-physical properties (e.g., the property, of a solid, of having a certain temperature).⁴

But what about the first horn of Stoljar's dilemma? He alleges that, if physical properties alone enter into the essences of certain higher-order properties, then, as regards those higher-order properties, "the...realization physicalist will stand revealed as holding a version of identity physicalism (one level up, as it were), and thus will face the multiple realization objection." To assess this two-part allegation, let us first ask whether, if a higher-order property *P* has an essence into which only physical properties enter, it follows that *P* is one and the same as a physical property. It may indeed seem to follow, on the grounds that the property can be specified in purely physical terms. But we shouldn't count a property as physical just because it can be specified in purely physical terms. We are speaking here of a higher-order property; and an instance of a higher-order property owes its reality to the property instance that realizes it. But the *realizing* property doesn't have to be physical just because the *property that it realizes* can be specified in purely physical terms, i.e., has an essence into which only physical properties enter. Suppose, for the sake of a concrete example, that being a mousetrap has a higher-order essence

⁴ This condition (introduced by "so long as") is *sufficient* for avoiding the regress, but it is not *necessary*, because higher-order properties at the bottom of a hierarchy might have essences specifiable in *topic-neutral* terms, which would also avoid the regress; see the text below.

that can be specified in purely physical terms. Plausibly, it is still metaphysically possible for a mousetrap to be realized by a well-organized team of immaterial spirits. But if it *is* possible, then a mousetrap could exist that had no physical parts at all, and it seems wrong to call the property of being a mousetrap physical if there could be a mousetrap that had no physical parts at all. It doesn't follow, then, that *P* is one and the same as a physical property just because it has a higher-order essence into which only physical properties enter, and so the realization physicalist doesn't "stand revealed as holding a version of identity physicalism" (see also Melnyk 2003, 78-80).

But let us ask now whether realization physicalism "will face the multiple realization objection" with regard to those higher-order properties into whose essences only physical properties enter. Perhaps Stoljar is still right about that even if he is wrong to think that realization physicalism collapses into type physicalism.

To claim that a higher-order property is multiply realized is to claim, minimally, that the property is not uniformly realized, i.e., that it is not realized by one property only. And there is no obvious reason to think that higher-order properties into whose essences only physical properties enter can't be realized by more than one property. After all, why shouldn't there be more than one metaphysically possible way, and indeed more than one physically possible way, to skin a physically-specifiable cat? Indeed, there is no obvious reason to think that higher-order properties into whose essences only physical properties enter can't be realized by *numerous* properties. In view of these points, I take Stoljar's objection to be that, if physical properties alone enter into a higher-order property's essence, then there must be *some limit* to the number of properties that can realize the higher-order property. How troubling is this objection?

Certainly, if a higher-order property has an essence into which (any) physical properties enter, there must be some limit to its multiple realizability; it can't be universally realizable. The nature of such a property ensures that it is not instantiated in any possible world in which no physical properties at all are instantiated, or in which physical properties are instantiated but not the right ones or in the right way. But it is a further question whether this undoubted limitation on the multiple realization of such a property is a problem for realization physicalism, rather than just a harmless consequence. If it is a problem, I suggest, then it's a problem because the following argument-schema has at least one sound instance. Consider some non-physical property, *Q*, instantiated in the actual world. Given

realization physicalism, *Q* must be physically realized and hence a higher-order property. Suppose, now, that *Q* is a higher-order property into whose essence (some) physical properties enter. It follows that *Q* can't be realized, and hence can't be instantiated⁵, in a world in which no physical properties at all are instantiated, or in which physical properties are instantiated but not the right ones or in the right way. Let it have been shown on independent grounds, however, that *Q* is instantiated in such worlds. We have arrived at a contradiction. The supposition that *Q* is a higher-order property into whose essence (some) physical properties enter must be rejected.

I object to this argument that in fact it has *not* been shown, at least not by Stoljar in the places cited above, that any candidate for *Q* is instantiated in the possible worlds in question. Someone might try to show it via an inference from the putative conceivability of such instantiations to their genuine metaphysical possibility; but in my view, for reasons given elsewhere, such inferences from conceivability to possibility fail (Melnyk 2001).

I add that, even if the conclusion of an instance of the argument had been established, it still wouldn't entail that realization physicalism is false. Suppose that there is a non-physical property instantiated in the actual world, but that this property can't be a higher-order property into whose essence (any) physical properties enter, precisely because, we somehow know, it is instantiated in some possible world in which no physical properties at all are instantiated. Realization physicalists, I say, can still accommodate this property. They can take it to be a higher-order property with an essence specifiable in entirely *topic-neutral* (as opposed to physical) terms. An example of a higher-order property with a topic-neutral essence would be the property of having some or other properties whose instantiations are isomorphic under some mapping to a certain pattern characterizable in the language of mathematics (Melnyk 2003, pp. 39-40). But higher-order properties with topic-neutral essences can perfectly well be instantiated in possible worlds in which no physical properties at all are instantiated, because the properties that realize them may be of any kind whatever, and hence needn't be physical. I conclude that realization physicalism allows for as much multiple realizability as anyone could justifiably demand.

4. Gillett On Bridging The Gap Between Micro And Macro

⁵ In my terminology, only a higher-order property can be *realized*; but any property at all, even a first-order property, can be *instantiated*.

Carl Gillett has argued that what he terms a “flat” view of realization cannot adequately describe the relationship between, on the one hand, a cut diamond, with its hardness and its causal power to scratch glass, and, on the other hand, the carbon atoms of which the diamond is made, with their respective properties and causal powers (Gillett 2002). What makes a view of realization flat, in Gillett’s sense, is its claiming or entailing (i) that a realized property and the property that realizes it belong to the same individual object, and (ii) that the conditional causal powers bestowed by the realized property on the object that has it form a proper subset of the conditional causal powers bestowed on it by the realizing property. And the trouble with a flat view of realization, according to Gillett, is that, with regard to the diamond, with its hardness and its causal power to scratch glass, neither claim (i) nor claim (ii) is true. Though the realized property of the diamond—its hardness—belongs to the diamond, the realizing properties belong to the carbon atoms; and the causal power of the diamond to scratch glass, bestowed by its hardness, fails to be among the causal powers of the carbon atoms.

Gillett considers the plausible objection that what realizes the diamond’s hardness is not the properties of the individual carbon atoms but a property possessed instead by some complex *structure* of carbon atoms. His reply is that this objection merely relocates the problem, since now something must be said about the relation between this complex structure and its properties, on the one hand, and, on the other, the fundamental physical particles, e.g., electrons, with their properties, that make it up; and yet this relation, though it would appear to be one of realization, cannot be *flat* realization, because, just as before, neither claim (i) nor claim (ii) is true. Gillett concludes that we need a new—what he calls “dimensioned”—account of realization which makes realization a relation between a single realized entity (in our example, the diamond) and multiple realizers (in our example, the carbon atoms).

The account of physical realization I gave in Section 1 is not committed to either claim (i) or claim (ii), the claims definitive of a flat view of realization. For it does not require that realized and realizing properties should belong to a single individual; nor is it committed to treating realized state-types as having higher-order essences that are *causal* (though it certainly *allows* them). But it would be an unconvincing defense of my account of realization to leave it at that, since what Gillett says naturally suggests a challenge that my formulation of physicalism must still meet even though it is not

committed to claim (i) or claim (ii). For if, in accordance with the account of physical realization in Section 1, a physical state-token physically realizes a state-token which is macro, then the realizing physical state-token can hardly fail to be macro too; but in that case I must still say *something* about how this realizing *macro*-physical state-token is related to *micro*-physical happenings. The challenge is to say something without *either* appealing to a further and potentially problematic metaphysical relation—of composition, say—in addition to realization *or* adopting Gillett’s dimensioned account of realization in place of my own. The former danger is illustrated by the views of Jaegwon Kim and Sydney Shoemaker. Kim characterizes the property of being a molecule of H₂O in the following way:

...it is the property of having two hydrogen atoms and one oxygen in a such-and-such bonding relationship. (Kim 1998, 84)

The word “having” refers to a relation of composition distinct from that of realization—as is clear from the explicit mention of decomposability in his general account of what he calls “micro-based properties”, of which being a molecule of H₂O is one example:

P is a *micro-based property* just in case *P* is the property of being completely decomposable into nonoverlapping proper parts, a_1, a_2, \dots, a_n , such that $P_1(a_1), P_2(a_2), \dots, P_n(a_n)$, and $R(a_1, \dots, a_n)$. (Kim 1998, 84).

Sydney Shoemaker also appeals to composition to explain something very similar:

Such a [micro-structural] property will be the property of being composed of particles with such and such micro-manifest causal powers and related in such and such a way. (Shoemaker 2007, 74)

Neither Kim nor Shoemaker give an analysis of composition.⁶

To Gillett’s challenge I wish to reply that I have no need either of a new and potentially problematic metaphysical relation to *supplement* physical realization as I understand it or of Gillett’s dimensioned realization to *replace* physical realization as I understand it. The physical realizer of a diamond, I say, is a physical system at the same

⁶ I am grateful to Gillett for conversations which helped me see the deeper nature of his challenge to flat realization.

(i.e., macro) scale as the diamond itself, something fully characterizable in the language of physics alone. And this language, of course, includes terms for physical relations. For example, physical chemistry (see, e.g., Atkins and de Paula 2009) fully characterizes atoms in terms of electrons, protons, and neutrons, the distances between them, and the electrostatic forces holding between them. It fully characterizes molecules in terms of atoms, the distances between them, the chemical bonds between them, and the angles between the bonds. It fully characterizes larger structures, e.g., polymers and solids, in terms of molecules, distances, intermolecular forces, and angles. No other relations beyond those expressed by the vocabulary of physics itself need to be mentioned. True, the textbooks contain informal talk of the “composition” (and so forth) of such physical systems as atoms, molecules, and polymers; but nothing suggests that such talk plays a theoretically indispensable role in characterizing physical systems larger than electrons, protons, and neutrons; such talk is a convenient shorthand only.⁷

So what exactly is this physical system, at the same scale as a diamond, that can be the physical realizer of a particular diamond? We can easily see how God could *make* such a system by following a procedure that could be specified by invoking none but physical relations—given a large enough supply of carbon atoms and a miraculous ability to make physical relations hold between physical items. He would start by covalently bonding to a single carbon atom each of four other carbon atoms which are 1.544×10^{-10} meters away, taking care in doing so to ensure that every C-C-C bond angle is 109.5 degrees; next he would covalently bond each of *these* four carbon atoms to each of four *further* carbon atoms at a distance of 1.544×10^{-10} meters, taking care again to ensure that every C-C-C bond angle is 109.5 degrees; and he could draw upon his supply of carbon atoms to repeat this procedure over and over again, though not, of course, indefinitely, since the size of every diamond is finite (Rossi 2007).⁸ But how is the macro-scale physical system that God could thereby have made related to the carbon atoms that he would have used as

⁷ I am aware that, according to current physics, protons and neutrons are not fundamental particles, but I am trying to keep the exposition digestible. I am aware, too, that current physics seems not to treat *any* particles as fundamental; but this more troublesome point raises issues that I cannot discuss here; sufficient unto the day is the evil thereof.

⁸ My account here is no doubt very rough, but there is no reason to think that greater scientific accuracy would imperil my philosophical contentions.

ingredients? That is, how can Gillett's challenge be met with regard to this macro-scale physical system?

I suggest that it can be met by means of a claim to the effect that one thing just is (i.e., is identical with) certain other things, *taken together*. The claim that Hutton's rock collection just is this rock, that rock, and a third rock, taken together, might be an example. Such claims are not self-evidently coherent; but their coherence has been skillfully defended against a variety of objections by Megan Wallace, and I direct readers to her discussion (Wallace 2011). In the case at hand, a natural first suggestion is that the macro-scale physical system that realizes our diamond just is C_1, \dots, C_n —where (i) " C_1, \dots, C_n " are singular terms that refer respectively to each of the n particular carbon atoms that we imagined God using to make the system, (ii) the expression formed by concatenating these singular terms with commas is a *plural* term that refers collectively to those carbon atoms taken together, and (iii) "just is" is understood as a "hybrid identity predicate", as Wallace calls it, that can be flanked by any combination of singular *or plural* terms (Wallace 2011, 810). Alas, this first suggestion fails to specify the intended physical system. The intended physical system exists only when the carbon atoms in question are related to one another in the physical ways specified by the procedure that God would follow in making the system, whereas the carbon atoms that (taken together) the plural term on the right hand side of the identity predicate picks out will for most of their lifetimes *not* be physically related to one another in these ways.

But this defect in the first suggestion can be remedied. Let us suppose that the particular carbon atoms in question—the very ones that God would have used—stand in the relevant physical relations to one another for a certain period of time, a period we can specify by noting that it lasts from a certain time t_1 to a later time t_2 . We can then specify the macro-scale physical system that realizes our diamond by saying it just is (not the atoms in the set $\{C_1, \dots, C_n\}$ themselves, taken jointly, but rather) the t_1 -to- t_2 *time-slices* of the atoms in the set $\{C_1, \dots, C_n\}$, these *time-slices* taken jointly.⁹ And in principle, I presume, a comparable specification could be given of any physical system that we might want to say is the realizer of a macro-scale object. Crucially, however, the only relations that such a specification would invoke are (i) identity and (ii) certain physical

⁹ When singular terms are concatenated with commas *inside* braces, I mean them to be taken in the usual way, and *not* as forming a plural term that refers collectively to the referents of the singular terms.

relations. No need arises either to posit any potentially problematic metaphysical relation distinct from realization or to adopt Gillett's dimensioned account of realization.

Now Wallace's defense of the coherence of claiming that one thing just is certain other things (taken together) forms part of her defense of the highly controversial thesis that "composition is identity". I am not committed to this thesis, however, because I have neither claimed nor committed myself to claiming anything at all about *composition*. I have appealed only to the claim that it's possible for something to be identical with several things taken jointly—which just amounts, perhaps, to the claim that there's such a thing as several things taken jointly. And the "something" needn't even be a commonsense continuant, say, a chair; it need only be a physical system fit to serve as the *realizer* of a chair.¹⁰

Although the way I have suggested of specifying a physical system fit to serve as the realizer of a particular diamond does not appeal to composition as such, I want now to suggest that it still allows us to make sense of what is (I grant) very natural talk of physical systems as having atoms (say) as *parts*. For we can speak of the macro-scale physical system that realizes a particular diamond as having a certain carbon atom as a part so long as all we mean is that (i) the physical system just is the t_1 -to- t_2 time-slices of the carbon atoms in the set $\{C_1, \dots, C_n\}$, these time-slices taken jointly, and (ii) the carbon atom in question is *one* of the carbon atoms in the set $\{C_1, \dots, C_n\}$. And likewise, of course, for other cases. At the same time, I note that, if this definition articulates a genuine kind of parthood at all—and it may instead articulate an *alternative* relation to parthood—it is not *spatio-temporal* parthood. For though the carbon atoms in the set $\{C_1, \dots, C_n\}$ do stand in certain spatio-temporal relations to one another from t_1 to t_2 , and are in *some* sense spatially located entities, the way in which I have proposed giving sense to talk

¹⁰ That the "one thing" which my claim concerns need not be a commonsense continuant means that my claim sidesteps a major objection to composition as identity that Wallace calls "MODAL" (Wallace 2011, 817): if the physical system that realizes the chair can be numerically distinct from the chair, then the physical system and the chair needn't have the same modal properties. I don't deny, though, that it remains to be explained how the modal properties of the chair, and those of other commonsense continuants, can be physically realized by physical systems that lack them.

of parts does not require that the entities in the relevant set be spatio-temporally related or even spatially located.¹¹

Now the macro-scale physical system that realizes our diamond presumably does so by having certain causal powers, causal powers such that the existence of a diamond just is the existence of an object—some object or other—that has those causal powers (objects, too, can have higher-order essences). And among the macro-scale physical system's causal powers, I claim, is the causal power to scratch glass.¹² To meet Gillett's challenge completely, therefore, I must give an account of the relationship between (i) this causal power of the macro-scale physical system to scratch glass and (ii) the relevant causal powers of the micro-scale carbon-atom time-slices that are—in the possibly neologistic sense given above—the realizing macro-scale system's parts. My account also appeals to a claim to the effect that one thing just is (i.e., is identical with) certain other things, taken together. I suggest that the macro-scale physical system's causal power to scratch glass just is certain of the causal powers of the t_1 -to- t_2 time-slices of the atoms in the set $\{C1, \dots, Cn\}$, these causal powers taken jointly—where "certain of the causal powers" refers to causal powers of the same type for each t_1 -to- t_2 time-slice of a carbon atom. Because the atoms in the set $\{C1, \dots, Cn\}$ are in fact related to one another from t_1 to t_2 in the physical ways specified by the procedure that God would follow in making the macro-scale system, my suggestion takes due account of the fact that the causal powers (of a time-slice) of a carbon atom that stands in certain physical relations to (time-slices of) other carbon atoms are not the same as the causal powers (of a time-slice) of a free carbon atom, but are instead modified, in accordance with physical laws, by its standing in those relations.

But how on earth, one might ask, can the macro-scale physical system's power to produce a macro-effect like a visible scratch in a piece of glass literally *be* certain powers (taken together) of time-slices of carbon atoms to produce certain micro-effects? How can the causal powers of time-slices of carbon atoms "add up" to the macro-scale

¹¹ Have I *now* committed myself to the thesis of composition as identity? Even if I articulated a genuine parthood relation, I am committed at most to *some* thesis of composition as identity. If there is more than one kind of part, then there is more than one kind of composition; and I am—at most—committed to holding that just *one* kind of composition is identity.

¹² From which it follows, I note, that the causal power of the *diamond* to scratch glass is a member of the set of its *realizer's* causal powers—exactly as the flat view of realization claims

physical system's causal power? The carbon-atom time-slices' micro-powers "add up" to the physical system's macro-power because the *micro-effects* of the exercise of the micro-powers, if these effects are of the right kind and number, "add up" to the *macro-effect* of the exercise of the physical system's macro-power. And the micro-effects "add up" to the macro-effect because the macro-effect—a scratched piece of glass—is realized by a macro-scale physical system whose micro-parts (again, parts in the sense given above) *are* the micro-effects.

We are left with the question of how it comes about that the right kind and number of micro-effects are in fact produced, but the answer lies in the physics. Thus, when a diamond scratches glass, external forces in the direction of the glass are applied to the carbon-atom time-slices on the side of the diamond-realizing macro-scale physical system furthest away from the glass. These forces set in train an enormous number of more or less local interactions among time-slices of carbon atoms. Because of the great strength of the bonds between any two adjacent carbon-atom time-slices, plus their physical configuration, the carbon-atom time-slices respond to the forces by staying more or less where they are in relation to one another, and instead of moving apart from one another apply forces in turn to their neighbors further in the diamond. These neighboring carbon-atom time-slices react in the same way, and the process repeats itself until the carbon-atom time-slices on the surface of the diamond-realizing macro-scale physical system that touches the piece of glass apply forces to the (mostly) silicon-atom and oxygen-atom times-slices on and near the contacted surface of the glass. But, because the (mostly) silicon-atom and oxygen-atom times-slices do not form a regular structure, the bonds between them tend to break in response to these forces, so that the (mostly) silicon-atom and oxygen-atom times-slices on and near the surface of the piece of glass are *rearranged*. In virtue of this rearrangement, the macro-scale physical system realizing the piece of glass now realizes a piece of glass with a scratch of a certain shape and size.

5. Schneider's "Mind Problem" For Non-reductive Physicalism

Susan Schneider has recently argued that non-reductive physicalism faces what she calls "a mind problem": it cannot make any claim to the effect that *minds* (or selves, or persons—whatever the bearers of mental properties are) are physical *objects* (Schneider 2013, 135). She starts from the uncontroversial premise that, according to non-reductive physicalism, minds (or selves, etc.) don't just have

physical properties; they also have mental properties—which, given the irreducibility of mental properties, are non-physical in the sense of not being identical to physical properties. She then argues very ingeniously, by reference to various accounts of what objects (i.e., substances) are, that it follows from her premise that minds are as much non-physical as physical.

Realization physicalism, however, can avoid Schneider’s mind problem. It can do so, of course, by saying that minds are compatible with physicalism because the mental properties of minds, despite being non-physical in the sense of being distinct from *narrowly* physical properties, are nonetheless *broadly* physical in the sense that all their instances are physically realized by instances of physical properties. It is no threat to the physicality of a mind that some of its properties are irreducibly mental (in the relevant sense of type-distinct from physical properties) if these properties are physically realized. Now in fact Schneider considers this realization physicalist response to her challenge, but rejects it on three grounds (Schneider 2013, 144-146). I will argue that none of her objections succeeds.

Her first objection is to my account of the narrowly physical: she claims that it’s problematic to understand the narrowly physical, as I do, in terms of more or less current physics, because it faces what has come to be called Hempel’s Dilemma (Schneider 2013, 145).¹³ The objection, however, is beside the point. The two distinctive features of my formulation of physicalism can come apart. Even if my account of the narrowly physical in terms of more or less current physics is wrong, some rival account of the narrowly physical could be plugged into the realization physicalist response to Schneider’s challenge. For example, we could define the (narrowly) physical in terms of what’s posited by current *neurobiology*, which, one might well think, would be unaffected even by revolutionary changes in fundamental physics, so that the definition would avoid Hempel’s Dilemma. Schneider correctly notes that any approach like mine must say what a *physical* realization is. But she doesn’t say why this is a special problem for *my* approach, or why it can’t be done.

Schneider begins her second objection with the premise that physical realization doesn’t rule out token identity: it doesn’t follow, from the thesis that mental state-token *m* is physically realized by

¹³ Schneider offers no criticism of my answer to Hempel’s Dilemma (Melnyk 2003, 223-237), and indeed seems unaware of it—ironically, given that the term “Hempel’s Dilemma” was introduced in a paper of mine.

physical state-token p , that $m \neq p$. She then argues that, because “the realization relation must be formulated to *exclude* token identity”, “Melnyk’s view cannot provide a solution to the mind problem” (Schneider 2013, 146). The realization relation must be formulated to exclude token identity because, she claims, “otherwise realization threatens to be either covertly reductive or incoherent” (Schneider 2013, 146).

My reply is that Schneider fails to justify her claim that “otherwise realization threatens to be either covertly reductive or incoherent”. Schneider apparently infers her claim from (1) her initial premise that physical realization doesn’t entail that token identity claims are false plus (2) the further premise (which she argues for on independent grounds that need not concern us) that token identity claims are either covertly reductive or incoherent. But in fact this inference is invalid; the general principle on which it is most naturally viewed as depending is false. That principle says that, if the proposition that p has undesirable feature F (e.g., is covertly reductive or incoherent), and if the proposition that q doesn’t entail that not- p , then the proposition that q “threatens” to have F too. But there is no sense in which a proposition “threatens” to have the undesirable features of the propositions that it is merely consistent with. For example, if creationism is silly, and nominalism (about universals) fails to entail the negation of creationism, it doesn’t follow that in some sense nominalism “threatens” to be silly too. Nor does it follow that *something*, at any rate, is wrong with nominalism; no damaging conclusion of any sort about nominalism follows. If token identity claims are either covertly reductive or incoherent, as Schneider argues, and hence to be rejected, realization physicalists can simply reject them; the rejection doesn’t have to *follow* from realization physicalism.

It may be, though she nowhere says it, that Schneider thinks that realization ought to rule out token identity claims because she takes such claims to be reductive, and thinks that a formulation of physicalism is non-reductive only if it *rules out* all reductive claims. But to think that a formulation of physicalism is non-reductive only if it rules out all reductive claims is to set the bar for being non-reductive higher than non-reductive physicalists have in fact set it. Non-reductive physicalists have typically counted a form of physicalism as non-reductive if it *doesn’t entail the truth* of any reductive claims; they haven’t required that it *entail the falsity* of such claims. For example, in what is probably the *locus classicus* of non-reductive physicalism, Jerry Fodor writes:

It will be one of my morals that the truth of reductivism cannot be inferred from the assumption that token physicalism is true. (Fodor 1974, 100)

All that Fodor is saying in this quotation, and in the paper from which it comes, is that token physicalism doesn't entail reductivism. That he wouldn't *also* say that token physicalism entails that reductivism is false is indicated by his paper's closing words:

If physics is to be basic science, then each of these things had better be a physical thing. But it is not further required that the taxonomies which the special sciences employ must themselves reduce to the taxonomy of physics. It is not required, and it is probably not true. (Fodor 1974, 114)

Here Fodor says only that reductivism is *probably* not true. He would not say that if he thought that token physicalism entailed that reductivism is false, for he seems in no doubt that token physicalism is true. And Fodor's caution in rejecting reductivism is appropriate: it would be dogmatic to insist that *not even one* reductive type identity claim will turn out to be true. Why stick one's neck out that far?

Schneider's third and final objection to the realization physicalist solution to the mind problem is that my account of physical realization (by a physical entity) has not been shown to entail that, if an instance of a mental property is physically realized by an instance of a physical property, then it is nothing over and above the way things are physically (Schneider 2013, 146). But in fact I have tried to show precisely this (Melnyk 2003, 33; 59-61), it is in any case plausible upon reflection, and Schneider does nothing to cast doubt on it. True, she mentions her earlier claim, following me, that the relation of constitution that Derk Pereboom appealed to in his 2002 formulation of physicalism (Pereboom 2002) can't do the job, because it might hold between a physical state-token and a mental state-token, and yet—contrary to physicalism—the mental state-token be *emergent* from the physical state-token (Schneider 2013, 144).¹⁴ But the relation of physical realization is superior to Pereboom's relation of constitution in this regard: if the mental state-token is physically realized by a physical state-token, then it cannot be brutally emergent from the physical state-token. For if it were brutally emergent, then there would be a psychophysical law of emergence whereby, whenever a system is

¹⁴ Pereboom significantly modified this formulation in later work (Pereboom 2011; Melnyk 2014).

in a certain physical state, it is simultaneously in a certain mental state; and this law would be fundamental in the sense of having no reductive explanation. But if the mental state-token is physically realized by the physical state-token, then it's certainly a matter of (physical) law that, whenever a system is in the physical state, it is simultaneously in the mental state; but in this case the law has a reductive explanation. To a first approximation, the explanation is as follows:

(1) Whenever a system is in the physical state in question, it's simultaneously in a state that meets condition C.

This holds as a matter of physical law.

(2) Whenever a system is in a state that meets condition C, it's simultaneously in the mental state in question.

This holds as a matter of metaphysical necessity, because it's metaphysically necessary that to be in a state that meets condition C just is to be in the mental state in question; the mental state has a certain higher-order essence. And from (1) and (2) it follows that

(3) Whenever a system is in the physical state in question, it's simultaneously in the mental state in question

—which also holds as a matter of physical law, and is what was to be explained (Melnyk 2003, 31-32).¹⁵

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¹⁵ I am very grateful to Andreas Elpidorou and to an anonymous referee for refreshingly constructive comments on an earlier version of section 4.

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