REALIZATION AND THE METAPHYSICS OF MIND

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Abstract

According to the received view in philosophy of mind, mental states or properties are *realized* by brain states or properties but are not identical to them. This view is often called *realization physicalism*. Carl Gillett has recently defended a detailed formulation of the realization relation. However, Gillett's formulation cannot be the relation that realization physicalists have in mind. I argue that Gillett's "dimensioned" view of realization fails to apply to a textbook case of realization. I also argue Gillett counts as realization some cases that should not count if realization physicalism is to be distinguished from its competitors in the usual ways. I conclude that the relation described by Gillett cannot be realization.

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1. Introduction

According to the received view in philosophy of mind, mental states or properties are *realized* by brain states or properties but are not identical to them. This view is often called *realization physicalism* (RP). Both the formulation of RP and its defense by way of familiar multiple realizability arguments have proceeded almost entirely without discussion of the realization relation itself. Once in awhile it is noticed that realization is in need of scrutiny, but almost invariably that is left as a project for another day (Horgan 1993, Kim 1996, 1998). At last that day has come, and several philosophers have examined the realization relation (Wilson 2001; Gillett 2002, 2003; Shoemaker 2001, 2003; AUTHOR 2004).

In particular, Carl Gillett has defended a detailed formulation of realization, and argued that it has ramifications for the cogency of multiple realizability arguments. However, I argue, Gillett's "dimensioned" view of realization fails to apply to some textbook cases of realization. And it counts as examples of realization some cases that should not count if RP is to be distinguished from alternative versions of physicalism in the usual ways. I conclude that the relation described by Gillett cannot be realization.

2. Realization: From Flat to Dimensioned

Gillett formulates his account of realization as a relationship among properties. In his framework, individuals instantiate properties whereas properties realize other properties.[1] Specifically, Gillett proposes:

> Property/relation instance(s) F1-Fn realize an instance of a property G, in an individual *s*, *if and only if s* has powers that are individuative of an instance of G in virtue of the powers contributed by F1-Fn to *s* or *s*'s constituent(s), but not vice versa. (2002: 322)

The "powers" in question here are causal powers, as the account is framed in terms of the causal theory of properties. On Gillett's view, a thing T instantiates a certain property G when it or its parts contribute the causal powers that individuate G. That is, the causal powers individuative of G may belong to it's bearer T, or to the parts of T. The second disjunct, allowing realization of G by properties of an object's constituents, is Gillett's innovation. Permitting realization to span mereological levels is the basis for dubbing this the "dimensioned" view. Formulations that lack this feature, specifically those of Kim (1998) and Shoemaker (2001), construe realization as a "flat" intra-level relation. They thereby fail to accommodate some important cases of realization by the parts of a thing rather than the thing itself, according to Gillett.

The flat view is easy enough to understand. A certain individual W realizes a certain property, e.g., being President of the United States, if and only if W has all the properties which are individuative of [the property of] being President. W occupies the role of President. Similarly, we can say that a fuel injector realizes or occupies the role *air-fuel mixer* in my car. That is, it—that very thing—has the properties which are individuative of that functional

[1] I mention this in part because "instantiate" is sometimes used as a synonym for "realize" among realization physicalists; also, "implement" and "occupy [the role of]" seem to be used interchangeably with "realize" by many philosophers.

component of my car. The flat view earns its name because realized and realizer properties must be instantiated in the same individual.

The problem, Gillett argues, is that the flat view neglects the possibility that realized and realizer properties might be instantiated in different individuals. Specifically, it may be that some property is instantiated in an object in virtue of the instantiation of other properties not in that very same object but instead in the parts of that object. Hence the second disjunct of Gillett's formulation; and hence the "dimensioned" view of realization in contrast to the old "flat" view. Gillett's main example in support of the dimensioned view is the realization of the property of hardness in a diamond. He argues that hardness should be understood as a property of one individual, viz., the diamond, which is realized in it in virtue of the properties of many different individuals, viz., the carbon atoms that compose the diamond. Thus realizer and realized properties need not be instantiated in the same individual. We will return to diamonds shortly. For the moment we need only notice that the dimensioned view endorses all the cases of realization counted by the flat view, and adds more.

3. Does Not Compute

When textbooks and professors explain RP they invariably appeal to computing devices, and usually to Turing machines. After all, this is how functionalism—the most prominent form of RP—is introduced into the literature.[2] In framing his functionalist hypothesis Hilary Putnam explicates functional states in terms of probabilistic automata (1967). The basic idea of functionalism is that mental states are in some sense states of brains, but are not identical to brain states—just as machine program states are implemented by but not identical to the states of a

[2] I take it that all variations of functionalism are versions of RP. Whether there are non-functionalist versions of RP is less clear to me.

physical device. Putnam introduced the term *realization* for this relation. According to functionalism, realization is the relation between software and hardware and also between minds and brains. Brains realize or implement minds just as physical devices realize or implement programs. Indeed this analogy exhausts what was said about realization for many years.

I am not going to say anything about the attributes or failings of functionalism, much less the probabilistic automata formulation.[3] What seems clear is that any account of realization that is supposed be relevant to RP is going to have to make sense of realization of functional states, and including realization of computational states. But Gillett's dimensioned view focuses only on a subset of realization relations and thereby neglect the archetypal case of realization of a program or computation.[4]

Consider the familiar case of a Turing machine that implements the addition function. What must be the case for a physical system to realize addition? The physical system must have states whose causal relations to one another somehow "correspond" or "map" onto the mathematical relations characterized by addition.[5] As Robert Van Gulick puts it: " Instantiation of such a formal machine description requires roughly that there be some mapping from the formal states, inputs, and outputs of the abstract machine table onto physical states, inputs, and outputs of the instantiating system, such that under that mapping the relations of temporal sequence among those physical items are isomorphic to the relations of formal succession among the machine table items" (1988: 80). Of course the formal relations are not themselves causal powers, so their realization cannot be in virtue of the physical system (or its parts) contributing the causal powers that are individuative of them. Abstract and mathematical functions and formal

[3] See AUTHOR 2003.
[4] The causally construed "flat" views may fare no better on this count. So much the worse for them.
[5] There is a well-known ambiguity in familiar explications of Turing machines, between abstract and physical machines (Lycan 1974). Here I am focusing on abstract computational functions, as will be clear from my examples.

relations are simply not individuated causally, and so they are not even candidates for realization on Gillett's view.

Among realization physicalists, the observation that I am raising as a problem for Gillett's account is widely recognized. For example, Robert Cummins writes:

> We may think of the button-pressing sequences as arguments to a function *g* that gives display states as values. An adding machine *satisfies g*; that is, the arguments and values of *g* are literally states of the physical system. Addition, as was remarked above, relates numbers, not physical states of some machine, so a physical system cannot literally satisfy the plus function. What an adding machine does is *instantiate* the plus function. It *instantiates* addition by *satisfying* the function *g* whose arguments and values represent arguments and values of the addition function, or in other words, have those arguments and values as interpretations. (1989: 89)

In Cummins' terminology, the dimensioned and flat views seem to be accounts of the satisfaction relation, rather than realization (instantiation) itself. Realization of abstract algorithms and computations plainly cannot be a matter or having the causal powers individuative of them.

At this point, several retorts may seem attractive, so we'd best get them out of the way before going forward. First, one might object that this old idea of realizing abstract or computational functions is passé and therefore can be justifiably ignored. If nobody holds this view of realization anymore then perhaps it doesn't have to be accommodated by a proper account of realization. For better or for worse, however, the computationally inspired view of realization seems to be commonly held. Consider, for example, David Marr's theory of vision.

Marr's theory famously invokes a notion of realization that accommodates the realization of algorithms. For example, Marr writes: "In order that a [computational] process shall actually run, however, one has to *realize* it in some way and therefore choose a representation for the entities that the process manipulates.… The choice, then, may depend on the type of hardware or machinery in which the algorithm is to be *embodied* physically. This brings us to the third level, that of the device in which the process is to be *realized* physically" (Marr 1982: 23-24, emphasis added). Marr's picture raises some questions about realization that are beyond the scope of the current discussion.[6] For the moment the salient feature is that Marr assumes that algorithms can be embodied or realized by physical systems. These algorithms will often be abstract or mathematical, not themselves formulated in causal terms. For example, Marr and Hildreth (1980) propose that the algorithm for accomplishing visual edge detection is the Laplacian of the Gaussian ($\nabla^2 G$). They argue that this algorithm is implemented or realized by retinal ganglion and X-cells in human beings; but it could be realized by other hardware or wetware.

These days the details of Marr's theory of vision are not widely accepted, so one might think that we can do away with its commitments to realization of abstract computations. But even if the particulars of Marr's theory are dismissed, his general theoretical framework and his ideas about realization have been widely influential. Terence Horgan and John Tienson take it that Marr's account represents a standard view of realization, writing, "[t]he relationship between state types at Marr's middle (algorithm) level and state types at the lowest (implementation) level, and *also* the relationship between state types at Marr's top (cognitive-transition) level and state types at his middle level, is the relation that philosophers call *realization* and cognitive scientists call *implementation"* (1996: 23). Indeed, Marr's work is often cited as evidence of the

[6] See AUTHOR forthcoming.

convergence of RP in philosophy of mind and empirical cognitive psychology; and this convergence is taken as evidence of their respective successes. So even if it turns out that noone currently advocates a theory of minds that relies on realization of abstract computations, it seems that the possibility of such realization is nevertheless part of our understanding of the realization relation itself.

This brings us to a second objection. Perhaps it is not just theories of cognition that rely on abstract computational functions that have been rejected, but also the very idea of abstract realization itself. After all, recent work on RP—specifically, development of the flat view in Kim's and Shoemaker's metaphysics of mind—relies on realization of causally individuated states or properties, not abstract or computational states or properties. Didn't we simply learn that the realization relation involves causal relations, and therefore that we need not accommodate realization of abstract computational algorithms?

Among realization physicalists about the mind, attention has shifted to realization of causally individuated states. But this is a change in the theory of what is realized, not in the realization relation. The realization relation itself is usually taken to have the same characteristics as realization of abstract machine states. As Putnam notes, "[w]hen it became clear that the formal properties of [computational] states are quite unlike the formal properties of psychological states, the original idea of functionalism quickly was replaced by an appeal to the notion of an ideal 'psychological theory.' But this ideal psychological theory was conceived of as having just the properties that formalisms for computation theory possess" (1999: 34). The realization of computing machine states may have been be abandoned as a theory of minds, but that does not mean that machines do not realize computational processes.

We must distinguish between the realization relation and its applications. Perhaps philosophers have come to see that realization of causal (rather than abstract) properties or states provides a better version of RP, e.g., about the mind. But it is one thing to learn that realization of computational kinds doesn't make for a good ontology, and quite another to learn that realization is not the relation between hardware and software after all. Realization physicalists need not hold the view that mental states are abstract machine states; but they should not deny that abstract machine states can be realized by physical systems.[7]

This brings us to the third response to my objection. One might assert that so-called realization of abstract computing machines or algorithms just isn't genuine realization after all. (If Putnam or Marr or anyone else thought otherwise, so much the worse for them.) After all, we're not trying to give an old-fashioned philosophical analysis of the term 'realization' or the concept *realization*. Why should we be beholden to historical versions of realization? In fact I think that this is Gillett's position. And I suppose that if Gillett wants to stipulate the scope of realizations in this way there is little to stop him. But I urge that we not accept this stipulation.

One reason, already mentioned, is that the analogy of minds and computing machines was a significant motivation for developing RP in the first place. The fundamental idea of RP is that the relationship between brains and mental states is the same as the relationship between physical devices and computational states. Gillett will have trouble making any sense of this fundamental analogy or how it leads to current versions of the theory, because on his view the brain-mind relation is not the same as the hardware-software relation.

Another reason to resist the stipulation is that it seems to be motivated by the mistake noted above, viz., that of confusing the realization relation with its applications. It may be that

[7] See footnote 4.

realization of abstract states or properties doesn't support metaphysical theories of mental states—the cases that mainly concern Kim, Shoemaker and Gillett. That is a good reason for rejecting the abstract state theory for minds. But we should not absorb the demands of one application of realization into the relation itself. The realization relation is used in theories and explanations that do not implicate metaphysical claims and their idiosyncrasies. For example, realization sometimes figures in theories of intentional and semantic content, and in explanations of computing machines.

Finally, I have thus far been emphasizing what is left out when realization is construed only causally. But there are also problems about what is included. These problems are part of the second main objection that I have for Gillett's account of realization.

4. The Dimensioned View and Realization Physicalism

The example that motivates Gillett's reasoning about realization is the hardness of a diamond. "The sciences," Gillett writes, "have given us a very precise and detailed account of how the hardness [H] of the diamond results from the properties/relations of the individual carbon atoms." Hardness is instantiated in the diamond but not instantiated in the individual atoms. And hardness contributes different powers to the diamond (e.g., class cutting) than the properties of atoms contribute to them. "Given these differences, H cannot be identical to any of the particular properties/relations of the carbon atoms.… the properties/relations of the carbon atoms apparently 'play the causal role' of H, but not vice versa, and, consequently, it is plausible that H is *realized* by the relations/properties of the carbon atoms" (2002: 319).

Gillett's emphasis is that the hardness of the diamond is realized in it because of the properties of its parts, the carbon atoms. Hence, and contrary to the flat view, realized and

realizing properties may occur in different objects. The flat view cannot explain the realization of the properties of an object by the properties of its constituents, and the dimensioned view remedies this failing. But in doing so the dimensioned view assimilates realization into material composition in general. More precisely, Gillett's view seems to be that the carbon atoms *compose* the diamond, and the properties of the carbon atoms *realize* the properties of the diamond. For Gillett, realization and composition go hand in hand.

Yet the motivation for RP is to provide an alternative to the view that mental states are identical to brain states, that mental properties are just like the other macro-properties of brains. Brains instantiate brain properties, just as diamonds instantiate hardness. RP denies that mental states and properties are identical to the states and properties of brains. The claim that mental states/properties are realized by brain states/properties is supposed to be in contrast with the claim that mental states are identical to properties of brain states qua composites of neurons. It is supposed to be an *alternative* to that view.[8] When Gillett offers an account of realization that covers also cases of material composition—when he argues that structural properties are also realized properties (2002: 319, fn.4)—he obliterates the very distinction on which RP depends. As Van Gulick puts the concern: "If physiological properties and other physical properties of many sorts can all be interpreted as functional properties, then the functional nature of psychological states cannot be taken as evidence against the identity thesis. Moreover, the very thesis of functionalism itself is in danger of losing interest, for its appeal lay in picking out some supposedly distinctive characteristic of psychological properties" (1983: 190). The point is quite general. If physiological properties and other physical properties of many sorts can all be interpreted as realized properties, then RP is not a distinct or distinctive doctrine after all. It

[8] At least structural realization is not supposed to exhaust the kinds of realization. It may be that all mereological relations are realization relations; my point is that not all realization relations must be mereological.

seems, therefore, that the realization physicalist should not accept Gillett's account of realization.[9]

5. Conclusion

Gillett protests that advocates of the flat view of realization take the idea of playing or occupying a role too literally. They do, indeed, take it literally. Bill Lycan declares, "Functionalism is the only positive doctrine in all of philosophy that I am prepared (if not licensed) to kill for. And I see the 'role'/'occupant' distinction (some say obsessively) as fundamental to metaphysics" (1987: 37). Realization physicalists have typically contrasted mental states and properties with structural states and properties. The hardness of a diamond is not the sort of example that realization physicalists tend to favor.[10] Perhaps Gillett has the right account of the relationship between the hardness of diamonds and the properties of carbon atoms. Perhaps we ought to think of mental properties and brain properties as having the same relation. But that relation is not realization.

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[9] Notice that Kim's and Shoemaker's flat view, whatever else its flaws, might fare somewhat better on this count. This is precisely because the flat view excludes some cases (like that which Gillett includes) and thereby distinguishes realization from mereological relations.

[10] For one thing, it is not a very good candidate for the kinds of multiple realization that are supposed to be the central features of functionalism (Shapiro 2000, AUTHOR 20002).

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