

formed, that is, downwards from constraints on the constituent physical processes of the order found in the attractors that “win” (Campbell 1974).

But the situation is worse. Certain properties hold a system together (called *cohesion* in Collier 1986; 1988; Collier & Hooker 1999; Collier & Muller 1998). Cohesion is the unity relation for a dynamical system (previous references; Collier 2002). The unity relation is the basis of the identity of an entity. If the property of cohesion is nonreducible, then the object is nonreducible (not the *kind* of object; that can vary). It is certainly possible that the cohesion of the mind, if there is such a cohesive thing, is of this sort. Kim’s arguments address ontological deflation (and kinds of objects), not emergence in particular dynamical systems. It is quite possible for an entity to be physical in every respect but not to be reducible in any way that is relevant to complete scientific explanation, even in principle.

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## Supervenience: Not local and not two-way

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**Abstract:** This commentary argues that Ross & Spurrett (R&S) have not shown that supervenience is two-way, but they have shown that all the sciences, including physics, make use of functional and supervenient properties. The entrenched defender of Kim’s position could insist that only fundamental physics describes causal relations directly, but Kim’s microphysical reductionism becomes completely implausible when we consider contemporary physics.

Ross & Spurrett (R&S) point out that the definition of supervenience as (roughly) no change in the supervening properties without a change in the subvening properties, does not imply realizer functionalism (or internalism) unless the relevant subvening change has to occur in the realizer (target article, sect. 2.2). However, they go on to cite Kim (1998), defining supervenience such that if the mental properties of something are to be different, there must be a difference in the physical properties of *that thing*. This appears to rule out externalism, according to which mental properties depend on relations to the environment. If a change in relations does count as a change in the realizer, because relational properties are included in the subvenient base, that reconciles this definition of supervenience with externalism and allows the causal exclusion argument to proceed but with realizer functionalism, not role functionalism, as its target. It seems that Kim’s causal exclusion argument relies on local rather than merely global supervenience, but it also seems that local supervenience is less plausible, and certainly the completeness of physics does not entail local supervenience.

A confusing thing about this article is the notion of multiple supervenience and the role it plays in R&S’s attempt to reconcile the causal closure of physics with the causal efficacy of supervenient and functional properties. R&S argue that there is two-way supervenience, but they do not show that there is a modal rather than merely an epistemic dependence of, say, physical properties on functional ones. Nothing they say defends the implausible claim that there can be no change in physical properties without a change in mental properties. Rather, they argue persuasively for multiple realizability and the indispensability of functional properties in science.

As R&S diagnose it, Kim’s causal exclusion argument threatens to reduce the special sciences other than physics to stamp collecting. To this diagnosis it may be objected that nothing is being taken away from the special sciences by denying that the proper-

ties to which they refer in their theories are causally efficacious. After all, the supervenient properties are realized, and the realizers are causally efficacious. Hence, in any concrete case, someone who uses, say, the language of mental states to talk about behaviour and its causes could be regarded as *referring* to physical tokens of the supervenient types, and there are causal connections between those physical states, albeit ones that are of no salience to us. Therefore, according to this response, in “S’s belief that *p* caused them to do X,” the referent of “S’s belief” is a physical state that really does cause the physical state that tokens S’s doing X. Saying that beliefs cause actions is elliptical for saying that beliefs are tokened by physical states that cause physical states that token actions. Therefore, it may be argued that the special sciences are tracking a rich causal structure, and therefore doing real science and not mere stamp collecting, but that structure is being described indirectly by means of supervenient properties. Psychology, say, may issue predictions and systematise data in a way that would be epistemically inaccessible to physics, but mental causation is really between physical realizers of mental states. However, this need not be instrumentalism because it may be conceded that supervenient properties are real features of the world and not mere constructs, while maintaining that they only have causal power vicariously.

R&S point out that much of physics is not fundamental and describe properties that are supervenient on atomic and subatomic realizers. Suppose that physics does describe the world by means of supervenient functional properties and that temperature and pressure are examples. There is no doubt that describing the macroscopic properties of a gas in these terms allows for reliable predictions in terms of laws. However, someone of Kim’s persuasion could argue that an increase in the pressure of a gas at constant volume does not cause anything; rather, the increase in temperature is a consequence of many microevents that happen to be amenable to a more convenient description than listing them all (and note that there is a physical story to be told about how the universal properties of differently realized macrostates arise). Temperature is a coarse-grained functional property and summarises the statistics of a multitude of microevents. It is a real property but not a causal one. On this view, there is physics, there is stamp collecting, and there is some physics that is stamp collecting.

Which brings us to fundamental physics, which presumably describes the domain where the real causal action is happening in the movements and interactions of microbodies. That quantum phenomena have led to the return of the spectre of action at a distance to physics is well known. This is particularly apposite to metaphysics when local supervenience claims are at issue because arguably what quantum nonlocality requires is not action at a distance *per se*, but the denial of local supervenience. Entangled states of joint systems are just those that violate the principle that the joint state of the whole should supervene on the states of the parts, and, as is well known, Bell’s theorem tells us there is no consistent way of attributing states to the parts from which the properties of the joint system can be recovered (without action at a distance). Furthermore, things only get worse for the advocate of microcausation as the only real causation. Quantum field theory does not apply at arbitrarily short-length scales, and researchers in quantum gravity are exploring theories that dispense with spacetime altogether and then try and recover it as an emergent feature of something else. Kim, or anyone who similarly thinks that the real causal processes are only at the fundamental physical level, would then be faced with claiming that there are no true causes in space and time. At that point, if not before, it is surely right to conclude with R&S that the causal explanations of the special sciences are as genuine as those of even fundamental physics.

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