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Comment on J. Kim's "Supervenience, Emergence and Realization in the Philosophy of Mind"

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Let me first state that I like Professor Kim's paper very much. In order to explain why, I would like to introduce a distinction about how to deal with a problem. The distinction is between *schwarzkopfing* a problem and *kimming* it. In our case, the problem involved is the mind-body problem. If one schwarzkopfs the mind-body problem in the way physicalist reductionists or Cartesian dualists do, one ends up with a fairly clear solution, but with a few loose ends that, contrary to your expectations, will cause ongoing, substantial trouble later on. But if one kims the mind-body problem, then one gets some innovative steps with a clear and fair overview of the battle field, including an exposition of the main yet unsolved problems.

In this brief comment, I would like to take up three topics. The first concerns the concept of supervenience, the second the concept of reduction, and the third the concept of emergence.

I

My first topic concerns Kim's proposal that the supervenience relation, by itself, is incapable of articulating a theory of the mind-body relation. Rather, according to Kim, the acceptance of mind-body supervenience should be seen as a necessary, but not sufficient condition on physicalism, or as a definition of minimal physicalism. Let me begin by emphasizing where I fully agree with Kim in this area. The first area of agreement concerns the two substantial gaps between the intuitive idea of supervenience and the formal definitions given in the literature. Whereas it is an essential part of the intuitive idea of supervenience that it denotes a relation of dependence or determination, the current formal definitions of supervenience do not catch this component of the intuitive idea. The formal definitions of supervenience only articulate different forms of covariance. The difference between supervenience (in the full sense) and covariance can be clearly seen when one considers that the former is necessarily asymmetrical whereas the latter is not. The second gap between the intuitive idea of supervenience and its formal definitions concerns the relation of supervenience to reduction. Whereas it is, or at least was, an essential part of the intuitive idea of supervenience that it prohibits the possibility of reduction, for some of the formal definitions of supervenience (or rather of covariance) it is controversial whether that holds for them. But the philosophical attractiveness of the supervenience concept strongly depends on the inclusion of determination with the exclusion of reduction.

The second point of agreement concerns the relative weakness of the supervenience concept. Mind-body supervenience by itself is *not sufficient* for the articulation of a theory of the mind-body relation. But it is, according to Kim, *necessary* for a mind-body theory that is basically physicalistic. It is here that our views begin to diverge, though what I am going to say on this topic will be rather tentative. I think that supervenience is a necessary condition on physicalistic mind-body theories only if the term "physicalistic" is understood in the sense of classical physics. The situation is different, and I think it is different in an interesting sense, if effects from quantum physics play a role. Now let us assume for the sake of argument that the brain is a physical system in which quantum effects do play a role, and furthermore, that mentality is entirely a product of the brain. This is a physicalistic position, or more precisely, a quantum-physicalistic position. Does it imply mind-body supervenience?

I want to stress that the assumption that quantum effects play a role in the brain does not, by itself, imply that there will be some indeterminacy in the system. This is because quantum systems that are fully governed by the time dependent Schrödinger equation obey a *deterministic dynamical equation*; hence, no indeterminacy is involved. However, according to common wisdom, the situation changes dramatically when processes play a role in quantum systems that *are not governed by Schrödinger's equation*. This is the case when some measurement is done on the system. In this case, the state of the system described by a wave function may change in a way that is neither governed by Schrödinger's equation nor entirely deterministic. But who measures the brain in order to bring about the typical quantum-mechanical indeterminacy that might show that mind-body supervenience is not even a necessary condition on all basically physicalistic positions?

What we must bring in at this point is a feature of the mind that seems much underrated in current philosophy of mind. Predominantly, mental phenomena are described, as Kim puts it, by "two broad categories ..., the intentional and the phenomenal" (p. 291). What is not explicit in this sort of description is the fact that the human mind has the capacity of self-awareness. This feature of the mind was emphasized by Kant and Hegel. As Kant puts it in the *Critique of Pure Reason*: "It must be possible for the 'I think' to accompany all my representations."[1] Or as Hegel puts it in the Introduction to the *Phenomenology of Spirit*: "Consciousness simultaneously distinguishes *itself* from something and at the same time relates *itself* to it."[2] More recently, for instance Keith Lehrer has emphasized the mind's potential to self-awareness: "What is special about human mentality is our capacity for metamental ascent and the conceptually explosive consequences thereof."[3] Now in our quantum-physicalistic scenario, this potential self-awareness of the mind must be produced by the brain. But this self-awareness has the same characteristics as the consciousness that is posited by many theoreticians as a key ingredient in the quantum mechanical measurement process which produces those changes of the wave function that do not result from the Schrödinger equation. Thus, we have an analogy between the self-observation of the mind with the

[1] I. Kant, *Critique of Pure Reason*, B 131, translated by N. K. Kemp-Smith, London: Macmillan 1989.

[2] G. W. F. Hegel, *Phenomenology of Spirit*, translated by A. V. Miller, Oxford: Clarendon, 1979, § 82, p. 52; original emphasis deleted, my emphasis added.

[3] K. Lehrer (1989), "Metamental Ascent: Beyond Belief and Desire," *Proceedings and Addresses of The American Philosophical Association* 63 (3): 19-30; p. 19.

quantum-mechanical measurement process. If this analogy holds, then in our quantum physicalistic scenario, we must assume that the brain is a quantum mechanical system that may, by itself, exhibit some sort of indeterministic behavior. This indeterminacy concerns the time evolution of the brain, or put another way, the brain's wave function as a function of time. Given these presuppositions, we must conclude that the deterministic force of the brain is not strong enough strictly to determine its own time evolution, which contradicts what we assume of isolated classical systems.

But if the determinative force of the brain is not strict with respect to its own time evolution, then there can be some doubt about the brain's determinative force with respect to the mind. Remember that in our scenario the mind brings about the indeterminacy of the time behavior of the brain through its self-awareness. In other words, the mind weakens the determinative force of the brain on its own time evolution. Put in colorful terms, the brain emancipates itself from determinism by means of the mind it produces. This opens up various possibilities for the mind not to be completely determined by the brain. One abstract argument would be that if the mind, by being a mind, is capable of influencing the brain's time evolution, then it simply cannot be fully determined by the brain. The relationship between mind and brain would then be one of mutual determination, not a one way street.

I do not claim, to be sure, that what I have said is definitive about quantum mechanics or about the brain, nor have I *disproved* Kim's proposal that mind-body supervenience defines minimal physicalism. But I hope to have made his proposal look a little less persuasive, if one takes quantum mechanics into account.

II

My second topic is reductionism. Kim has developed an alternative to the standard Nagelian model of reduction in science. The standard model is, according to Kim, "incorrect" (fn. 4), or at least "extremely rare in the sciences—especially, in the case of microreductions" (p. 285). Kim's main criticism of Nagel's model is that the biconditional bridge laws which it uses are themselves unexplained, which results in a derivation of the laws to be reduced without their being explained. Thus, the purpose for which the reduction was designed in the first place is not fulfilled. In Kim's model of reduction, the properties or phenomena to be reduced must first be functionalized, that is their nomic connections to other properties and phenomena must be established (p. 284). Then, one has to find properties or mechanisms at the micro-level that satisfy these nomic specifications (p. 284). If this is possible, then the reduction is successful. Multiple realizability is no longer a counter-argument against reduction, but a common concomitant of it. I note only in passing that this model has some parallels to what William Wimsatt called "explanatory reductionism" or "reductive explanation."[4]

I share the feeling that substantial parts of the discussion of reduction, including the so-called "antireductionist consensus," are artifacts because they are based on inappropriate notions of reduction. The situation would look a great deal different if more appropriate concepts of reduction were applied. I cannot provide a general discussion of Kim's model of reduction here, nor can I address whether it is really a replacement of the traditional model or an addition to it, nor whether its claim to generality in most cases of inter-level reduction is really justified. But I will confront it with a concrete example of a reduction to determine how well it fares.

The example comes from natural product chemistry.[5] This branch of chemistry analyzes natural products with respect to their chemical structure, and then tries to synthesize them and their derivatives. The enterprise is clearly reductionist in the sense that it aims at characterizing substances and elucidating their function by analyzing their parts and their structural composition. The specific class of natural substances I will consider

[4]See W. C. Wimsatt (1976), "Reductive Explanation: A Functional Account," in E. Sober (ed.), *Conceptual Issues in Evolutionary Biology. An Anthology*. Cambridge, MA: MIT Press (1984), pp. 477–508.

[5]My main sources for the following are G. Habermehl and P. E. Hamman, *Naturstoffchemie. Eine Einführung*. Berlin: Springer (1992), pp. 643–658; P. Nuhn, *Naturstoffchemie. Mikrobielle, pflanzliche und tierische Naturstoffe*. Stuttgart: Hirzel (1990), pp. 456–458; K. B. G. Torssell, *Natural Product Chemistry. A Mechanistic and Biosynthetic Approach to Secondary Metabolism*. Chichester: John Wiley (1983), p. 7.

are the pheromones. Pheromones are substances that mediate a specific form of communication between individual members of a species. For instance, the female silk moth, *Bombyx mori*, emits a sex-attractant substance that has an enormous signaling power on male silk moths. The chemical structure of this substance was only given in 1959 after more than 20 years of work on its isolation. Let me now compare this example both to Kim's model of reduction and the older model.

First, Kim posits that the properties to be reduced must be functionalized. This posit is trivially fulfilled in the case of pheromones because they are functionally defined from the beginning. To be a pheromone is to be a chemical substance with certain functions, namely, specific signaling functions in a particular species.

Second, Kim posits that we "find properties or mechanisms, often at the micro-level, that fill the specified causal/nomological roles" (p. 284). Now this is a precise description of the procedure of the chemists in our example. The chemists want to give the structural formula of the respective compound. In order to test whether a compound with this structural formula really "fills the specified causal roles," namely the biological signaling function, the compound is synthesized and can then be tested by biologists as to whether is has the same biological effects as the natural product. Notice, however, that for the natural product chemist, the causal role the substance plays is not *analyzed* at the micro-level. That the synthesized substance can play the same biological role as the natural product is simply shown *on the macro-level*, but how the compound manages to play this role is not analyzed in terms of its structural composition. Thus, for the natural product chemist, the reduction is accomplished once the chemical structure is elucidated, the substance is synthesized and then is shown to have the right biological properties on the macro-level. However, this does not preclude that a biochemist might investigate how the compound manages to fulfill its biological function *in terms of its structural formula*. Put another way, a biochemist might want to elucidate the mechanism of action in molecular terms. But this, I think, is a second reductive enterprise on top of natural product chemist's.

Third, this and other related examples shed some light on multiple realization which may or may not obtain. If a pheromone is characterized as a sexual attractant in a particular species, then we may not have multiple realization. When we speak about sexual attractants among insects in general, then of course we have multiple realization. But we may also have multiple realization within a single species. For instance, the substance penicillin is functionally characterized at the macrolevel as a product of penicillin molds which has certain antibacterial properties. It turns out, however, that there is multiple realization of this product: different strains of molds produce chemically different penicillins.[6]

Fourth, the example is interesting regarding the status of biconditional bridge laws in the traditional model. It has been postulated that bridge laws must hold between natural kinds. In other words, the natural kinds of one science are connected to natural kinds of another science.[7] This idea seems to be confirmed in our pheromone case where a biological natural kind, a particular pheromone in a particular biological species, is identified as a natural kind in chemistry, namely a particular chemical compound. Yet, it has turned out that many, if not most pheromones are mixtures of different chemical compounds and that the proportion of these compounds in a particular pheromone is just an optimum for its signaling function. For instance, the sexual pheromone of a particular moth consists of two different compounds, in this case isomers, and their proportion happens to be 7 to 93. Chemically speaking, this is certainly not a natural kind, but biologically it is. This suggests that it is unreasonable to posit that biconditional bridge laws must connect natural kinds of the two sciences. Thus no antireductionist argument results if one finds a case in which a natural kind in one science finds no natural kind counterpart in the putative reducing science.

Fifth and finally, it is often said that those biconditional bridge laws that express identities (which are, therefore, not really laws) need no explanation. Kim also subscribes to this view (p. 287). Although in many cases this seems to be true, as in the case of light which simply is electromagnetic radiation, it is not necessarily the case in our example. For instance, the question why two (or more) substances are mixed in a particular pro-

[6] A. L. Bacharach and B. A. Hems, "Chemistry and Manufacture of Penicillin," pp. 26–27, in A. Fleming (ed.), *Penicillin: Its Practical Application*. London: Butterworth (1946).

[7] J. A. Fodor (1974), "Special Sciences, or The Disunity of Science as a Working Hypothesis," *Synthese* 28: 97–115, pp. 100, 102.

portion in a given pheromone, that is, why the pheromone is identical with just this mixture, can be answered with respect to its optimal signaling effects. Furthermore, the question why a certain compound makes up a particular pheromone may be answered with respect to the evolution of the respective species.

After this test of Kim's model of reduction by a particular example which led to a something like an A, finally I turn to emergence where a very short remark will have to suffice.

III

Towards the end of his paper, Kim conjectures "that if emergentism is correct about anything, it is far more likely that it is correct about qualia than anything else" (p. 292). The qualia he has in mind are "the color of jade" or "the smell of ammonia" (p. 292). The emergence of qualia he refers to is their emergence with respect to their material basis. In a different respect, however, the emergence of some qualia can be conclusively established and—which seems much more important to me—can even be fully understood. I mean the emergence of properties of a whole such that these properties can in no sense be reduced to the properties of the respective parts. As has often been mentioned in the literature, the smell of ammonia is emergent in the sense that the chemical components of ammonia, that is nitrogen and hydrogen, do not smell at all and that therefore, the sum of their smells certainly does not add up to the smell of ammonia. What I would like to add is that this fact presents no mystery whatsoever. There is nothing to be accepted with "natural piety," to use Samuel Alexander's well-known expression. The reason is that the smell of a substance is a secondary quality. This means that it not only depends on the substance, but also on the organism that has the respective sensation, more specifically, on its specific endowment with olfactory receptors. But if an organism has no olfactory receptors for hydrogen and nitrogen, we do not know at all whether it has olfactory receptors for ammonia, a compound of these substances, and what ammonia's smell would be like for it. In the information about the parts, the smells of hydrogen and nitrogen, the information about the whole, the smell of ammonia, is not fully contained because knowing that there are no olfactory receptors for hydrogen and nitrogen leaves open whether there are receptors for ammonia. This holds, of course, even if all the *primary* qualities of ammonia could be predicted from the primary qualities of hydrogen and nitrogen. But since this remark does not really connect with what Kim had to say, I had better stop here.

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