Comment on David Papineau, Can any sciences be special?

Michael Esfeld

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David Papineau, Jerry Fodor and many others wonder how the conjunction of the following three positions can be true:

1) *Special science laws*: There are lawlike generalizations in the special sciences. These sciences trade in kinds that are such that statements about salient, reliable correlations that are projectible and that support counterfactuals apply to the tokens coming under these kinds.
2) *Non-reductionism*: The laws of some of the special sciences cannot be reduced to physical laws.
3) *Physicalism*: Everything there is in the world supervenes on the physical, that is, is fixed by the distribution of the physical properties in the world.

The obvious problem is that (3) implies that the similarities among tokens in the world, accounting for the kinds in which the special sciences trade, and the correlations among such tokens, accounting for the laws of the special sciences, are fixed by the distribution of the physical properties. By contrast, (2) implies that some of the laws seizing such correlations are not reducible to physical laws. By using the term "token", I mean a particular instantiating a property.

Papineau's proposal to reconcile these three positions is to account for (2) in terms of selection (pp. 6-9): There can be laws in the special sciences that are not reducible to physical laws if and only if these laws focus on effects that are selected for in a given context independently of the mechanisms by which they are brought about. Thus, the fact of there being such laws and their non-reducibility to physics do not contradict physicalism (3). The drawback is that the kinds that figure in such laws cannot enter into a rich network of laws
199 and that nothing can be causally efficacious insofar as it is a member of such a kind.

In these comments, I shall try to push Papineau further in the direction of a reductive physicalism, thus solving the problem by simply abandoning (2). The obvious gain of such a move is that the scientific quality of the special sciences is vindicated by being systematically linked to physics and the spectre of epiphenomenalism thus banned.[1] The *prima facie* argument for reductionism goes like this: For every single case of a correlation among tokens that comes under a law of a special science, there is a physical explanation available why that correlation obtains. If tokens coming under different physical kinds all give rise to correlations covered by the same law of a special science, then there is in principle a physical explanation available why all these tokens are similar in that respect, on pain of violating global supervenience. So when it comes to laws of the special sciences that can be accounted for in terms of selection for specific effects, why should such laws be in principle irreducible to physics?

Biology is a paradigmatic case of a special science focusing on selection. Take classical genetics as a theory describing lawlike correlations between genes and phenotypes, whereby

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[1] I would like to thank Christian Sachse for discussions about the content of this comment and allowing me to integrate material resulting from common work; the example from genetics is his.

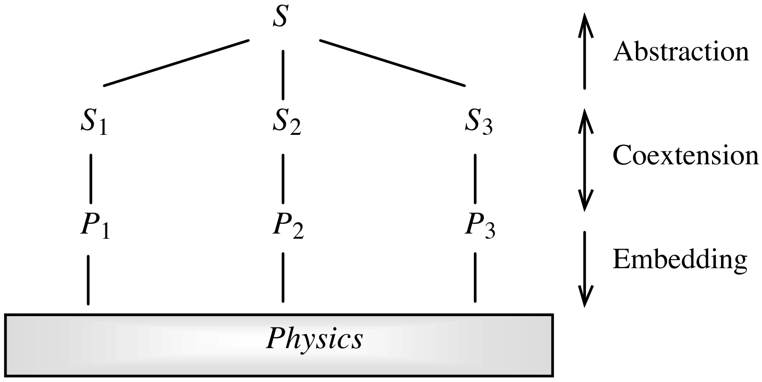
these correlations are brought about in different physical manners. For instance, there are certain kinds of genes of *Escherichia coli*, a well-known bacterium in genetic research, coding for the production of proteins that play a predominant role in the flagella, the capsule, or the cell wall. Certain sequences of DNA bring about the proteins in question provided that there are enough resources for the protein synthesis. These sequences can be of different molecular kinds. Consequently, there are different physical mechanisms to produce the proteins in question. However, these different manners to produce the proteins for which the genes of *E. coli* code are systematically linked with side effects such as the speed or the accuracy of the protein production (see Bulmer 1991).

For any such difference in side effects, there is a physical environment possible in which that difference is pertinent to selection. Oversimplifying, under certain conditions, an accurate and fast production of cell protecting proteins may be important for the survival of the bacterium in question. Classical genetics has the means to consider these fitness differences. For any kind S of a gene of *E. coli*, it is possible to conceive within classical genetics sub-kinds S_1, S_2, S_3, etc. taking into account these side effects of the speed and accuracy of the protein production by means of considering the resulting measurable fitness differences. Thus, S_1 may be about the gene tokens defined by the effect to produce the protein in question (like all gene tokens coming under S) *and* the consideration of a certain time index of the protein production or the corresponding fitness value (in order to distinguish the gene tokens in question from the gene tokens coming under the other sub-kinds S_2, S_3, etc.). This more precise sub-kind S_1 may be something like "S and production of the protein PR in t_1" or "S and 200 fitness contribution c_1", while the sub-kind S_2 may be something like "S and production of the protein PR in t_2" or "S and fitness contribution c_2".

The point just made generalizes. Let S stand for any kind of the special sciences that can be multiply realized by tokens coming under different physical kinds P_1, P_2, P_3, etc. Since the issue is about selection, we can assume that S is defined in terms of certain salient effects that can be brought about in physically different manners, these manners being expressed in terms of P_1, P_2, P_3, etc. However, if the relevant difference between tokens coming under P_1 and tokens coming under P_2 consists in different manners to bring about the effects that define S, then although all these manners coincide in producing a salient effect of the same kind, they are distinguished by certain side effects linked with the production of the main effect. These different manners can be conceptualized in terms of the special science in question, thus leading to the conception of sub-kinds S_1, S_2, S_3, etc. of S. These sub-kinds are no longer multiply realizable. They are nomologically coextensive with the physical kinds P_1, P_2, P_3, etc., although the meaning (primary intension) of the concepts "S_1", "S_2", "S_3", etc. is different from the meaning of the concepts "P_1", "P_2", "P_3", etc. (as the meaning of "water" is different from the meaning of "H_2O").

Given this nomological coextension, it is possible to reduce the special science theory trading in S to physics: (1) Within an encompassing physical theory, one conceives the kinds P_1, P_2, P_3, etc. for the different configurations of physical tokens that all come under the special science kind S. (2) One makes the conceptualization of S more precise by constructing sub-kinds S_1, S_2, S_3 of S, seizing the systematic side effects linked to the different manners of producing the effects that define S. These sub-kinds are nomologically coextensive with the physical kinds P_1, P_2, P_3, etc. (3) One can reduce the theory of S to physics via S_1, S_2, S_3 and P_1, P_2, P_3. Starting from the encompassing physical theory, one constructs the concepts "P_1",

"P_2", "P_3" and then deduces the concepts "S_1", "S_2", "S_3" from "P_1", "P_2", "P_3" given the nomological coextension. One gains "*S*" by abstracting from the conceptualization of the side effects contained in "S_1", "S_2", "S_3" (see Esfeld & Sachse 2007). 201



Any law couched in terms of *S* can be made more precise by being conceived as a law about S_1 without thereby losing its lawlike character. If there are laws about *S*, these are also laws about *S* and fitness contribution c_1, etc. Indeed, as Papineau stresses (pp. 7-9), it is likely that there are much more laws about S_1 than there are about *S* as such, since S_1 is coextensive with the physical kind P_1. From the laws about S_1, etc. one can gain the laws about *S* by abstracting from the conceptualization of the side effects, that is, the particular manner in which the effects characterizing *S* are produced. In other words, what remains when one abstracts from the conceptualization of the production mechanism contained in the laws about S_1 is projectible to all tokens coming under *S*, thus yielding the laws about *S* as such. Hence, the fact that some theories of the special sciences focus on effects that are selected for in a given context without paying attention to the manner in which these effects are brought about does not prevent these theories from being reducible to physics, because the different manners to produce these effects can be relevant to selection and consequently be taken into account in terms of the special sciences.

Note that the sub-kinds S_1, S_2, S_3, etc. are not restricted to particular species. There is no question here of focusing on species-specific realizers and thereby carry out what is known as a local or species-specific reduction (for instance, the concept of pain reduces in one species, say humans, to one physical concept – e.g. "firing of C-fibres" –, it reduces in another species, say octopuses, to another physical concept, etc.). The sub-kinds S_1, S_2, S_3, etc. are not construed in a species-specific manner, but in terms of purely functional differences only. They are distinct only by conceptualizing the different manners in which the effects are produced that define the kind *S*: They are heterogeneous as regards these manners of production, but homogeneous insofar as the effects are concerned that define *S*. The concept "*S*" always has the same substantial meaning in "S_1", "S_2", "S_3", etc. – a meaning that is only further specified by paying heed to the manner in which the effects in question are produced. Therefore, "S_1", "S_2", "S_3", etc. clearly express for the scientist of the special science in question what the referents of these concepts *functionally* have in common and what their *functional* differences are, which may in certain circumstances be of interest for the special science in question – instead of splitting up the homogeneous kind *S* into species-relative kinds, thereby losing the homogeneity of *S* and thus paving the way for its elimination (cf. the so-called new wave reductionism advocated by Bickle 1998).

202 Nonetheless, Papineau is of course right in pointing out that there are laws of the special sciences that are non-physical in the sense that there is no single physical law having

the same extension as any of the laws about *S*. But this is not a deep metaphysical or epistemological fact preventing reduction. It is simply a matter of the division of scientific labour. When talking about complex objects such as e.g. genes, or whole organisms, the physical concepts focus on the composition of these objects. Due to selection there are salient causal similarities among effects that such complex objects produce as a whole although they differ in composition. The concepts seizing these similarities are therefore not considered to be physical concepts, but classified as concepts of the special sciences. However, these concepts can be gained from physical concepts in the way sketched out above by the deduction of concepts for sub-kinds and reaching the kinds in which the special sciences trade by abstracting from the conceptualization of the side effects that distinguish these sub-kinds. Consequently, there is a systematic, deductive way how to get from the physical laws to the laws of the special sciences.

It is obvious why there has to be such a way: The physical laws are about causal correlations among physical tokens, insofar as they explain why there are certain tokens in the world. They cover all the causal correlations among tokens in the world. If the laws of the special sciences offer explanations of why there are certain complex objects having certain specific effects, there has to be a systematic way to get from the physical laws to these laws. It is only that we need specific concepts of the special sciences when it comes to the effects that certain complex objects produce as a whole, since in that case the physical concepts focus on the composition of these objects rather than on the effects they have as a whole.

In sum, the scientific quality of the special sciences consists in offering lawlike generalizations concerning correlations among tokens that are projectible and that support counterfactuals. Although these laws are non-physical in that there are no physical laws that are coextensive with them, they do not come into conflict with the completeness of physics and the supervenience of everything on the physical if and only if there is a systematic, reductive way how to reach them on the basis of the physical laws. Providing for such a way thus vindicates their scientific quality and shows that an eliminativist attitude towards them on the basis of the completeness of physics and global supervenience is unjustified.

The mentioned scheme applies all the way down to fundamental physics. It therefore also paves the way for accounting for the causal efficacy of objects insofar as they come under kinds of the special sciences. The debate about physics being causally complete and, consequently, the special sciences, insofar as they are not reducible to physics, being haunted by the spectre of epiphenomenalism, tacitly assumes that causation is a fundamental physical feature. Papineau, however, voices reservations about that assumption (p. 11). He locates causation at the level of thermodynamical phenomena because these phenomena have a preferred direction of time, which is not found among basic dynamical phenomena. 203 This view is objectionable: Consider quantum mechanics. If one accepts a version of quantum mechanics that includes the reduction of quantum superpositions to classical physical states, then the best concrete physical proposal for such a version is the one of Ghirardi, Rimini and Weber (GRW). The GRW-equation is a candidate for a fundamental physical law and it includes a preferred direction in time, since state reduction is irreversible (see Albert 2000, chapter 7). If one does not endorse a version of quantum mechanics that includes state reductions, then there nevertheless are processes of decoherence that lead to the appearance of a classical world to local observers. Decoherence is for all practical purposes an irreversible process in the same way as are thermodynamical processes; the latter ones are not strictly irreversible either if one takes thermodynamics to be reducible to statistical mechanics. Thus, if there is causation on the level of thermodynamical phenomena, then so there is causation on the level of basic dynamical phenomena, and nothing therefore speaks against taking causation to be a basic feature of the world.

Since Papineau does not regard causation as a fundamental physical feature, he does not consider it necessary to take a stance on the issue of whether or not there are determinable as well as determinate causes – such as the object's being *S* is a determinable and the object's being *P* a determinate cause of a given effect, without these two causes being identical (p. 11). However, as Gillet and Rives (2005, section 3) point out, the determinate properties include by definition all the causal powers of the respective determinables. Consequently, the determinate properties are sufficient to bring about all the effects that the determinables could cause. Unless one acknowledges token identity between the determinable and the determinate properties of objects, one thus faces again the epiphenomenalism objection, and it is doubtful to say the least whether admitting some sort of systematic overdetermination is able to counter that objection (not to speak of endorsing an interactionism that contradicts the completeness of physics).

Any token coming under a kind in which a special science trades can cause the effects that characterize the special science kind in question only by bringing about the effects that a certain configuration of physical tokens produces qua configuration. For instance, any gene token can produce certain proteins only by having all the molecular effects that a certain configuration of nucleic acids has qua configuration, for it is through those effects that the protein comes into being. To take another example, any pain token can cause pain behaviour only by producing the neuronal effects that a certain configuration of neurons has qua configuration because it is through those effects that the pain behaviour comes about. There thus is a good argument for taking the way (mode) insofar an object comes under a certain special science kind *S* to be identical with the way (mode) insofar that object comes under a certain physical kind *P*, although these kinds are not coextensive; but that sort of multiple realization is no obstacle to reduction as sketched out above. If there is token identity, it does not make sense 204 to ask whether an object brings about a certain effect in virtue of coming under *P* or in virtue of coming under *S*, since both are one and the same way (mode) an object is. Consequently, an object is not epiphenomenal insofar as it comes under *S* in the same way as it is not epiphenomenal insofar as it comes under *P*.

To sum up, coming back to the problem sketched out at the beginning of this comment, there are good reasons for abandoning the attitude of a principled non-reductionism with respect to even those special sciences that focus on selection, since there is a way open for a conservative reductionism, vindicating the scientific quality of the special sciences and the causal efficacy of objects insofar as they come under kinds in which the special sciences trade.

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