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ON THE CAUSAL IRREDUCIBILITY OF NATURAL FUNCTION STATEMENTS

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One topic of interest to a number of philosophers of science is whether functional explanation can be reduced to some other kind of explanation, such as causal explanation. Some philosophers have tried to reduce talk of natural functions to talk of causes. I here examine some such attempts and try to provide, in addition to the traditional counter-examples, an argument as to why such reductions should fail. Certain parallels are drawn between attributions of natural functions to parts of organisms and attributions of propositional attitudes to persons.

† † †

The complexity of the activities of living organisms has impressed most students of biology. Certain biologists and philosophers have proceeded to argue that organic life exhibits such unusual traits that if we are to understand organic phenomena adequately we must postulate some kind of special, non-standardly-physical entity in virtue of which biological activity occurs. Hans Driesch, for example, has spoken of *entelechies* (1927). Other philosophers and biologists, while not wishing to share Driesch's enthusiasm for postulating a special entity, have still argued that there are certain characteristic features of organic phenomena which make the project of giving a wholly adequate explanation of biology in terms of physics and chemistry seem an unlikely prospect. What I shall be concerned with here is one such feature, namely, functional explanation. By functional explanation I mean explanations of the occurrence of some trait in an organism in terms of some function that that trait satisfies. The claim has been made that although functional explanation is a perfectly acceptable method of explanation of many of the activities of living organisms, yet this sort of explanation (since the abandonment of Aristotelian physics) is not derivable from explanation of non-organic physical activities. Thus, if there is an acceptable mode of explanation for organic phenomena which does not apply to non-organic phenomena, then this fact should pose a barrier to attempts to work out the reduction of all biology to physics. What evidence can we point to in favor of this claim?

Consider the standard model of scientific reduction

(Nagel, 1963). Roughly, one theory is shown to be reduced to another if (1) all the terms of the theory to be reduced can be defined (correlated) with terms of the reducing theory, and (2) all the laws of the theory to be reduced can be derived, by means of these definitions, from the laws of the reducing theory. I will be concerned here only with the first requirement. For, obviously, if the first requirement cannot be met, there is no point in worrying about the second.

The particular term that I wish to consider is the term 'function' as it occurs in sentences such as, "The function of the heartbeat in mammals is to circulate the blood." As has been noted many times, the term 'function' has many different uses. I shall here be concerned only with what we might call the 'natural function attribution' sense of the term. That is, I wish to discuss that sense of 'function' which we use when we attribute a function to some biological item.

Here it might be objected that what is at stake is not the reducibility of biology to chemico-physics but rather the reducibility of function-attributions and functional-explanation. But if the term 'function' naturally occurs in biological discourse, as one would suppose it *must* in discussions of physiology, surely this term needs to be accounted for if one is really to reduce biology without remainder to physics and chemistry. (See for example, recent standard biological texts such as Curtis, 1975 and Weiss, 1971.)

A number of philosophers have thought functional-explanation a suspect form of explanation and have attempted to reduce it to some other sort of non-teleological explanation. In this paper I shall consider some attempts to reduce functional explanation to causal explanation. By a causal explanation I mean an account of the occurrence of some phenomenon which appeals to its causes. Such accounts typically include statements of laws of nature which express causal regularities. I shall concentrate on the attempt to reduce talk of functions to talk of causes. If this can be accomplished, then we would have no reason to suppose that a separate form

of explanation need be involved in accounting for the activities of parts of organisms to which functions are naturally attributed. The task of the proponent of the causal reduction of functional explanation is to show how the following function-attribution schema can be accounted for in strictly causal terms:

(F) The function of X is Y.

One might try to hold that (F) comes to no more than

(G) X is causally sufficient for Y.

One might try to support this by noting, in terms of the above example, that the beating of the heart in mammals is causally sufficient for the circulation of the blood. However, a little reflection reveals that a more cautious claim needs to be made here, namely:

(H) X usually causes Y.

For, with respect to our example, the beating of the heart will not result in the circulation of the blood unless the heart is properly connected with the rest of the body (is, for example, not resting by itself in a saline solution). But (H) by itself will not do. One traditional counter-example to this sort of account is that, whereas the beating of the heart usually causes heart sounds, it is not (we assume) a function of the beating of the heart to produce heart-sounds. Thus, (H) is too broad to be an adequate analysis of (F).

Another attempt at reducing function-attributions involves construing them as causally necessary conditions for some state-of-affairs. Thus, one might propose that (F) comes to no more than:

(I) X is a causally necessary condition for Y.

Modifying our example to (I), we might claim that the beating of the heart is a causally necessary condition for the circulation of the blood. Here again, there is a traditional counter-example. For the existence of artificial heart-machines which make possible the circulation of the blood demonstrates that the beating of the mammalian heart is not causally necessary for blood circulation. Therefore, (I) is too restrictive to be an adequate analysis of (F).

One might try to salvage the strategy behind (I) by noting that one only attributes functions to items that are parts of some natural system (Gruner, 1965). Thus we may attempt to accommodate (F) as:

(J) In system S, X is causally necessary for Y.

Thus, if we let S be the *normal* mammal, then we may avoid the problem that heart-machines raised for (I). However, (J)

still does not give us an adequate analysis of (F). (J) is too liberal an account, as it cannot handle the problem of heart-sounds raised earlier. For, although in the normal mammal the beating of the heart is causally necessary for the production of heart-sounds, this production is not a function of the beating of the heart. Furthermore, (J) is also too restrictive an analysis. Part of an organism (for example, the right kidney in a human) can have a function (to purify the blood of impurities) without that item being naturally causally necessary for satisfying the function (after all, we can get by with only one kidney).

Let us grant, therefore, that neither appeals to causal necessity nor causal sufficiency will work. Yet we should not, I think, be tempted to suppose that function-attributions do *not* involve causation at all. We may certainly grant that (F) does entail:

(K) In system S, X typically contributes causally to Y.

Even if (K) does not give us a reductive analysis of (F) (for example, it cannot handle the problem of the heart-sounds), it is still important to note that in attributing a function to an item we are also asserting that there clearly is a causal contribution relationship between the elements in question. For example, if the beating of the heart did not typically contribute causally to the circulation of the blood in normal mammals, we would *not* be inclined to attribute the function of circulating the blood to the beating of the heart.

At this point we might be tempted to modify (K). Let us note that what seems to be problematic about the case of heart-sounds is that the production of heart-sounds by the beating of the heart seems not to contribute naturally to any goal of the normal mammal. With this in mind we might then try to modify (K) as follows:

(L) In S, X causally contributes to Y and Y is some goal, G, of S, or Y contributes causally to G.

(L) does allow us to distinguish between the spurious heart-sounds case and our paradigm example of blood circulation. However, (L) is not all that happy a result. For although it does not contain the term 'function,' it nonetheless does make use of a concept which is just as teleological, namely the concept of a goal. Thus, in order to carry out the present project it seems that a reductive non-teleological analysis needs to be provided for the concept of a goal.

While I doubt that such an analysis can be given, I will offer no specific arguments to that effect here. (For further discussion of these and further attempts to reduce function-attributes, see Nissen, 1971. Compare also, Bunge, 1963.) What I wish to present here is a theory as to why the above reductions fail. I suggest that there is a kind of irreducible

“directedness” in function-attributions which is responsible for the failure of the above attempts at analysis. This notion of irreducible directedness is, admittedly, rather vague. To make it somewhat more precise, let us consider an analogous phenomenon in the philosophy of mind. In discussing the question of whether or not there is a unique characteristic of mental phenomena, Franz Brentano held that every mental phenomenon had the property of being directed upon an object which need not exist (Brentano, 1973). The property of being directed upon an object which need not exist, or, as it is presently known, of *intentionality*, does seem to be a characteristic of a group of mental phenomena called propositional-attitudes. (These include such phenomena as believing, knowing, desiring, hoping, despising, fearing, etc.) To motivate this notion of being directed upon an object which need not exist, consider the sentence:

(M) Smith believes that Zorinsky is prudent.

Smith’s belief, we may say, is directed on Zorinsky. But the truth of (M) surely does not imply that Zorinsky exists. For note the sentence:

(N) Smith believes that Santa Claus is benevolent.

Various formal criteria have been proposed to capture Brentano’s intuition that there is some distinctive feature of psychological attitudes (Marras, 1972).

It is not my purpose here to explore the question of whether there is an adequate criterion of this feature of intentionality. Instead, what I do wish to point out is that it has proved most difficult to reduce causal claims about external behavior and internal states. Some have held that it is the intentionality of propositional-attitudes which is responsible for this. What I wish to suggest here is that, similarly, it is a *sort* of intentionality, or directedness on a state-of-affairs or condition which need not exist, which is responsible for the failure of the above attempt to reduce natural function statements to statements of causal relations.

To support this contention, let us consider, for example, the following, which has been proposed as a criterion of the intentionality of propositional attitudes:

(C₁) A [further] mark of intentionality may be described in this way. Suppose there are two names or descriptions which designate the same things and that *E* is a sentence obtained merely by separating these two names or descriptions by means of “is (are) identical with.” Suppose also that *A* is a sentence using one of those names or descriptions and that *B* is like *A*, except that, where *A* uses the one, *B* uses the other. Let us say that *S* is intentional if the conjunction of *A* and *E* does not imply *B* (Chisholm, 1957).

Note that this neatly fits our belief sentence (M). For consider:

(M) Smith believes that Zorinsky is prudent.

(O) Zorinsky = Nebraska’s senior senator.

(P) Smith believes that Nebraska’s senior senator is prudent.

From (M) and (O) we cannot deduce (P). This criterion also seems to fit our function-attribution sentence:

(Q) The function of heart beating in mammals is to promote the circulation of the blood.

(R) The circulation of the blood is the activity most commonly used as a philosophical example of a biological activity.

(S) The function of heart beating in mammals is to promote the activity commonly used as a philosophical example of biological activity.

From (Q) and (R) it seems that we cannot deduce (S). But consider a causal case:

(T) Heart beating causes heart noises.

(U) Heart noises are my favorite noises.

(V) Heart beating causes my favorite noises.

In this case it is clear that the inference from (T) and (U) to (V) certainly goes through.

To strengthen my argument, let us consider another rough criterion of intentionality (or “directedness”):

(C₂) A sentence expressing a *dyadic*-relation (a relation between two elements) is intentional if the truth of the sentence and the existence of either element of the relation does not entail the existence of the other element of the relation.

Let us apply this criterion to our examples. First, with respect to belief; the truth of (M) and existence of Smith doesn’t entail existence of Zorinsky. Second, with respect to function-attributions, the truth of (Q) and existence of a heart-beating doesn’t entail existence of a blood-circulation. But, third, with respect to causal-attribution, the truth of (T) and existence of heart-beating does entail existence of heart noises.

Thus we have two criteria of intentionality which apply to both propositional-attitudes and function-attributions but not to the attribution of causes. What I hope to have suggested

here, then, is that there are certain properties which are such that: (1) propositional-attitude sentences and function-attribution sentences share them, (2) causal-attributions lack them, and (3) these properties intuitively are expressed in the phrase "directed on an object or state-of-affairs which need not exist."

What follows from this? Certain philosophers have held that persons are best to be understood as a sort of thing with two different sorts of properties, (1) purely causal physical properties, and (2) psychological properties, arguing this on the grounds that the latter sort of property cannot be reduced to the former. Some biologists also hold that organisms are best understood as a sort of thing with two different sorts of properties: purely causal physical properties, and functional properties. I have tried to consider here a sort of argument to support this latter view, which also unifies it with the former.

In response to my remarks someone might argue that a dual-properties view, such as I suggest, need not be accepted because teleology is an anthropomorphic concept (Simon, 1968). The proper reply, I think, to this remark is that we should not take the denial of the dual-properties position seriously until we can produce either a reductive account of teleological notions, like function, or a convincing reason that these teleological concepts can be dispensed with. And both of these tasks, it seems to me, remain to be done.

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