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The Constituent Function Analysis of Functions

The emergence of modern physics and evolutionary biology brought with it a general ban on talk of final causality in the natural sciences. No natural science ought to put forward hypotheses about entities that strive toward a certain goal, since such strivings can only belong to beings with consciousness. Aristotle's view that the function of acorns is to become fully grown oaks, and that acorns actually strive to become oaks, came to be regarded as an anthropomorphization. Nonetheless, even after Darwin biologists and medical scientists have continued to talk about functions in a seemingly pre-Darwinian way. What to say about this? Do not functions presuppose goals, and are not goals subjective, be they person-subjective or culture-subjective?

1. Today's Philosophy of Functions

In the philosophy of science, the mainstream view of the 20th century and of today is that all function talk within biology and medicine can, without loss of scientific content, be reinterpreted as being only about efficient causality in general or, more specifically, about natural selection as a purely causal phenomenon. This re-interpretation is thought to take away only a shell of unscientific purpose talk, and its result has been called neo-teleology (Cummins 2002) even though it might just as well be called non-teleology. There are, however, critical voices such as Robert Cummins (1984 [1975], 2002), Christopher Boorse (1976, 2002), and Richard N. Manning (1997) who argue that function talk cannot at all be reduced to evolutionary talk. Cummins has put forward an alternative analysis of functions that I will call, like Peter Melander, the *intrasystemic role analysis* (1997, p. 51). Boorse calls it the causal role analysis of functions (2002, p. 64), and he calls his own alternative the *general goal-contribution analysis* of functions; Manning's contribution to the discussion is mainly critical. For an attempt at an overall classification of philosophical analyses of functions, see Mark Perlman (2004).

I agree with many of the criticisms of the mainstream, neo-teleological view of functions, and the rejection of this view will in what follows be taken for granted. Nonetheless, I find both Cummins's and Boorse's own alternatives wanting. Therefore, I will here put forward what I hope is a better alternative; it will be called the *constituent function analysis* of functions.

According to Cummins, "[t]o ascribe a function to something is to ascribe a capacity to it which is singled out by its *role* in an analysis of some capacity of a *containing system*" (1994, p. 67; italics added). That is, the function of an entity is its intrasystemic role in a larger system that carries out a certain activity. The function of the heart is to pump blood because this is its intrasystemic role in the activity of the circulatory system.

He criticizes both teleological and neo-teleological analyses of functions and wants them to be replaced by his proposed brand of functional analysis: "While teleology seeks to answer a why-is-it-there question by answering a prior what-is-it-for question, [intrasystemic role]

functional analysis does not address a why-is-it-there question at all, but a how-does-it-work question" (2002, p. 158).

According to Cummins, a *functional analysis* of the heart must be kept distinct from an *evolutionary analysis* of the heart. Only the latter is concerned with the problem why there are hearts. I agree, and the view that I will put forward comes close to Cummins's, but my complaint is that he never answers the following questions:

- In what significant sense does the concept of *role* differ from that of *function* itself? What is the difference between saying that "the role of the heart is to pump blood" and "the function of the heart is to pump blood"? That is, isn't Cummins's analysis circular? It takes away the explicit concept of function only to introduce an implicit function concept, that of role.
- Mustn't the "containing system" spoken of be a *functional* whole? In a purely causal system such as the solar system, there are no roles for the planets. That is, again, isn't Cummins's analysis circular? It takes away the explicit concept of function, but introduces instead an implicit function concept in its concept of containing system.
- Are there mind-independent roles in nature? That is, on Cummins's analysis can there be objectively existing functions?

Boorse is in favor of classical teleology, and he treats his concept of goal-directedness as a primitive concept. He analyzes "functions as causal contributions to goals of a goal-directed system," and he "takes goal-directedness to be an objective, non-mental property of all living organisms" (2002, p. 63-64). Function statements in this sense are, he claims: "literally true throughout the whole biological domain, not merely metaphorically true, heuristically useful or the like" (2002, p. 63-64). However, I can't see that he ever succeeds in explaining the presumed objectivity of the goal-directedness spoken of.

I regard it as a fact that we often spontaneously *perceive* living organisms as being engaged in goal-directed behavior. For instance, when I hunt a fly I perceive it as fleeing from me. Such perceptual facts, however, cannot prove the objective existence of goal-directed behavior in animals. In sunsets we perceive the sun as moving, but this does not prove that the sun really is moving, as Copernicus made clear. When Boorse discusses the objectivity of goal-directedness (2002, section 2), he simply bypasses this problem of the possibility of illusory perceptions of goal-directedness.

In my view, neither Cummins nor Boorse has managed to establish that his own philosophical analysis of functions gives rise to a concept of function that supports the view that functions can be objectively investigated by science.

Before I embark on my central, ontological task – to show that there is indeed a kind of objectively existing function, which I call 'constituent function' – I will say some words about the semantics of the concepts of causes, goals, and functions. If it is not regarded as trivially true that these concepts are different and not semantically reducible to each other, then at least this fact becomes clear when their possible referents are related to time.

2. Causes, Goals, Functions, and Time

Whatever time is, it has to be represented as a line, be it straight, circular, or curved in some other way. For the purposes of my remarks, we need to distinguish between (i) a certain chosen instant in time, (ii) the next moment, (iii) a more distant future moment, and (iv) the time interval between the instant and the future distant moment. The problem of how to apply the concept of the next moment to continuous time – in continuous time, between any two time points there is necessarily a third time point – will be disregarded; it is of no importance for my argument.

In everyday talk as well as in philosophical discourse, the concept of cause seems to be used in such a way that the effect of a cause is either (i) simultaneous with the cause ("His presence causes irritation") or (ii) it comes into being in the next moment ("His cutting the rope was the cause of the flag's falling").

Goal talk has another relation to time. One may have a goal that (i) is instantly realized; for instance, showing someone that you are hearing and understanding what she is saying. And one may have a goal that (ii) is possible to realize in the next moment, e.g., opening the door. In this respect, there is a similarity between goals and causes. However, there are also goals that (iii) can be realized only in a distant future moment. Example: my goal now is to have a finished paper by next week. When such a goal exists, there is a directedness (intentionality) towards a future distant moment. A time jump from "now" to "future" is in some sense involved since "the next moment" is not taken into account. Finally, there are goals that (iv) directly encompass a whole time interval. All activities that are regarded as ends in themselves have this character. If my goal is to listen to music, then my goal has an implicit relation to a time interval.

Goals, I shall argue, inhere in goal-bearers (persons) in about the same way as monadic qualities such as shape and mass inhere in quality bearers (things). Many human goals, in the sense of "prior intentions" (Searle 1983, pp. 84f), are of kind (iii), i.e., they are directed towards something in a distant future moment of time. This might seem to be the case even with things such as goal-seeking cruise missiles, but this is a wrong impression. When such a missile is heading towards its target, there is no goal (towards a future hitting of the target) that inheres only in the missile. Without a more or less continuous fit between "the map within" and "the world around" the missile in itself has no goal whatsoever, even though the people who programmed it had. A cruise missile that is fired from the wrong place has no goal at all, but a human being can retain a goal to travel to a certain place quite independently of where on earth he happens to be situated. Even more, a human being can have a goal without knowing how to realize it, but no present-day artificial goal-seeking device can be ascribed such a goal.

What then about function talk? I think one example is enough to sustain my point that it differs from both causal talk and goal talk. The function of the heart is to pump blood. At every moment that a heart is functioning, it has a relation to the same or to the next moment (of the sort which obtains in the case of causes), but it is not able (in contrast to what is the case with humans with goals) to be directly aiming at a distant moment. Even though a function can exist at a single point of time, an actual functioning is necessarily extended in time. Essentially, if only implicitly, function talk makes reference to whole time intervals; see also Johansson (2004, pp. 98f).

This brief excursion into conceptual analysis will have to do. If I am right, then every presumed semantic reduction of the intension of "function" to that of "cause" or that of "goal" does violence to at least one of these concepts' relation to time. Let me now turn to ontology. Do the three concepts in question have an extension? Certainly, there are goals. First-person introspection reveals that I have goals. But are there causes and functions? In what follows – for the sake of both simplicity and (I think) truth – I will assume that the mind-independent world contains causes and causal relations. Nonetheless, nothing in my argument hinges on this assumption. What is at stake is the ontology of functions. This brings us to the next section.

3. Constituent Functions and Intrinsic Functions

Let me start by introducing two distinctions: first between *subjective* and *objective* functions of material entities, and then between *intrinsic* and *constituent* functions.

Objective functions are functions that have in some sense a mind-independent existence, whereas subjective functions are functions that are wholly projected onto material entities by human beings (or by some other beings with minds). If the entities in question are designed, the projection comes with the design. Surely, there are subjective functions, both culture-subjective and person-subjective. Most functional *artifacts* can be regarded as having culture-subjective functions. But I can also myself assign a new function to an already existing culture-subjective functional artifact and thereby create a person-subjective function. For instance, I can start to look upon one of the books on my desk as having the function of killing flies and mosquitoes. John Searle, who also opposes the reduction of functions to causes, claims that *all* functions are subjective, primarily culture-subjective (1995, p. 14).

I will by stipulation define an intrinsic function as being objective and monadic. An intrinsic function inheres in an entity in the way a quality like mass is assumed to inhere in Newtonian corpuscles, or in the way personal human goals are assumed to inhere in individual persons. A constituent function, on the other hand, is a relational entity. It is a feature of something that is a spatial part of a larger entity. Instead of the term "constituent function," one might also profitably use terms such as "component function" and "part-to-whole function." All these terms indicate that constituent functions are relational in character. The question whether constituent functions exist subjectively or objectively will be answered below. Its answer will expose a complication in the subjective-objective distinction.

It is clear that there are subjective functions. I will now argue that it is no less clear that there are constituent functions also. However, no attempt will be made to answer the question whether or not there are intrinsic functions. My argument in favor of the existence of constituent functions needs the *concept* of intrinsic functions, but not their *existence*.

A sufficient and necessary condition for something's being a constituent function is the following:

- F is a constituent function borne by B if and only if:
  (a) there is a functional whole A;
  (b) B is both a spatial part and a subunit of A;
  (c) B F's in relation to some other entities (X, Y, Z) that are relevant for A.

This requirement can be directly applied to our prototypical example of the function of the heart, and by implication, also to many other traditional examples. Here comes a constituent function of the heart:

- To pump blood (F) is a constituent function borne by the heart (B) since:
  (a) there is a functional whole, the circulatory system (A);
  (b) the heart (B) is both a spatial part and a subunit of the circulatory system (A);
  (c) the heart (B) pumps blood (F) in the blood vessel system (X).

This requirement must not be interpreted as a definition of the concept of function, even though it may be regarded as being not only a requirement but an unfolding of the intension of the concept of constituent function. As a definition of "function" it would be circular, since this concept also appears in the definiens, both explicitly (in "functional") and implicitly (in "subunit of A" and "relevance for A").

In my opinion, "function" is a primitive undefinable concept. Physics works with seven undefined quantities, the so-called base SI-units: length (metre), mass (kilogram), time (second), electric current (ampere), thermodynamic temperature (kelvin), luminous intensity (candela), and amount of substance of kind K (mole). As "length" comes with the idea that there can be different lengths, and "substance" comes with the idea that there can be different

amounts of a certain kind of substance, "function" comes with the idea that a certain kind of function F can be realized more or less well. Even though it seems impossible to quantify well-functioning, there is a grounded similarity between quantity-talk in physics and functioning-well-talk in medicine and biology (Johansson 2004). The life sciences can regard "degree of well-functioning of function F (goodness)" as an undefined concept on a par with the SI-units of physics.

The essence of the definition is that B has its constituent function only as part of, and in relation to, a whole A that already has a function. Constituent functions are inherited functions. This fact, of course, gives rise to this question: Should the functional whole A be allowed to have (1) a subjective, (2) an objective-intrinsic, or (3) a constituent function? In my opinion, all three alternatives can be allowed, but, unfortunately, all three may also give rise to the false impression that they are problematic:

(1) If A's function is subjective, then are not the corresponding constituent functions also subjective? That is, are we not then allowing in the life sciences the kind of subjectivity that the natural sciences should avoid?

(2) If A's function is objective-intrinsic, then do we not have to try to establish that nature truly can contain intrinsic functions? That is, do we not then have to offer an account of what an intrinsic function is? Would this not threaten to require a rehabilitation of classical teleology?

(3) If A's function, too, is a constituent function, then are we not facing a vicious infinite regress, in which B gets its functionality from A_1, which gets its functionality from A_2, which gets its functionality from A_3, and so on?

The answer to the first question is that a constituent function can have, appearances notwithstanding, a kind of objectivity even when its functionality is inherited from a functional whole with a subjective function.

Artifacts (screwdrivers, nails, cars, radios, etc.) are entities with subjective functions. When, in some time interval, such a material entity realizes its function, a material process occurs independently of man, but without man there is no function and functioning. Think of a house and its doors. In itself, the house and its parts make up a pure material structure that lacks functionality. However, as soon as the house is ascribed its usual house-function, *it becomes an empirical question* whether or not the door-parts have a function. If one finds that the doors have a function in relation to the function of the whole house, e.g., to make it possible for people easily to move between its rooms, then, second, it also becomes an empirical question whether each door performs this function in a bad or in a good way. Therefore, the constituent function of the doors is not a mere projection – in spite of the fact that the function of the whole house is a subjective function. Of course, one might say that objective-constituent functions (as I will now call them) are not as objective as objective-intrinsic functions (if such there are); but they deserve nonetheless to be called objective. From a scientific point of view, they are open to normal empirical and theoretical investigations.

Constituent functions are not the only kind of entities that have this kind of objectiveness. The same is true of actions with means-end rationality. Let me explain. Is it rational never to lie? Kant claimed, famously: Yes, it is absolutely and categorically rational never to lie. According to Kant, each act of attempted truth-telling is an *intrinsically rational* action. Today, however, most philosophers would say that the concept of intrinsic rationality has no extension, but that it depends on one's goals in life whether or not it is rational to tell the truth or a lie in a given situation. The question whether it is rational never to lie has been transformed into the question whether lying can be a rational means to achieve some pre-given subjective goal. Science cannot investigate what the subjective goals ought to be; but as soon as such a goal is given, it can be scientifically investigated what actions are rational from the point of view of means to ends. Is it rational to be a non-smoker? If it is a question of

intrinsic rationality it seems to be unintelligible or to have no answer; but if it is a question of means-end rationality it can be objectively investigated as soon as some end is specified, be this end rational or irrational. Game theory is a science wholly devoted to the study of complicated means-end rationalities.

Actions that are means-end rational are relational in character, just like constituent functions. What has become known as means-end rationality could equally well have been called means-to-end rationality, and what I call constituent functionality might also be called part-to-whole functionality. Doors have a part-to-whole function in relation to the houses of which they are parts, and hearts have such a function in relation to the circulatory systems of which they are parts.

Thus my answer to question (1) brings with it an easy solution to (2). If there can be objective-constituent functions in relation to wholes with subjective functions, there can of course be objective-constituent functions in relation to wholes with objective-intrinsic functions as well. Therefore, one can investigate constituent functions scientifically without bothering about whether the functional whole in question has a subjective or objective function. Both believers and non-believers in intrinsic functions can equally well study constituent functions.

What, finally, of question (3)? Can any function whatsoever be an objective-constituent function? The answer is simple: No, it cannot. Without a starting point, a pre-given functional whole (recall Aristotle's "unmoved mover"), the concept of constituent function loses all its sense. The introduction of constituent functions does not make it possible to delete completely the traditional alternatives in the philosophy of functions. Every meaningful regress of constituent functions has to be finite and end in either a subjective or in an intrinsic-objective functional whole. Nonetheless, a constituent function can be an objective-constituent function in relation to a whole whose function is merely in its turn an objective-constituent function.

Let me summarize. An objective-constituent function can derive its functionality either from a subjective function, an objective-intrinsic function, or another objective-constituent function. Therefore, the life sciences can study objective-constituent functions while disregarding the question of classical teleology. However, philosophy cannot do the same.

In the final section, I will concretize the regress problem.

4. The Objective-Constituent Function of the Heart

Nothing in the arguments put forward excludes the possibility that an entity is at one and the same time the bearer of a subjective, an objective-intrinsic, and an objective-constituent function; it may also be the bearer of several objective-constituent functions simultaneously. However, let us assume that the human heart is the bearer of only one function, namely the one already presented:

- To pump blood (F) is a constituent function borne by the heart (B) since:
  (a) there is a functional whole, the circulatory system (A);
  (b) the heart (B) is both a spatial part and a subunit of the circulatory system (A);
  (c) the heart (B) pumps blood (F) in the blood vessel system (X).

Let us next assume that even the circulatory system has only a constituent function: to transport substances. We then get:

- To transport substances (F) is a constituent function borne by the circulatory system (B) since:

(a) there is a functional whole, the human body (A);
(b) the circulatory system (B) is both a spatial part and a subunit of the human body (A);
(c) the circulatory system (B) transports substances (F) between several bodily systems (X, Y, Z).

What now about the functional whole of the human body? What is its function? Three kinds of contemporary proposals are:

(1) The human body as a whole has the *culture-subjective* function of preserving its own life.
(2) The human body as a whole has the *objective-intrinsic* function of preserving its own life.
(3) The human body as a whole has the *objective-constituent* function of (a) converting some substances into some other substances in the ecological system of the earth, or (b) promoting the existence of the human species.

The main criticism of the first proposal is that it looks too conventional, and the main criticism of the second one is that it makes death unexplainable. Often, much too often, death comes through accidents, diseases, killings, and murder, but there is also a kind of death that appears just as natural as life. Of course, all persons who make proposals of the third kind have to face the regress I have mentioned. Ecologically minded persons who put forward (3a) have to answer the question: What is the function of the ecological system of the earth? And in case of (3b) the question becomes: What is the function of the human species? Does the human species have an objective-intrinsic function? Be this as it may.

The point of this paper, applied to the heart and the circulatory system, is that we can in an objectively scientific way study the functions of both of them without bothering about the trilemma stated for the human body as a whole. Independently of whether or not self-preservation is itself an intrinsic function of the human body, a merely projected function, or an objective-constituent function in a larger whole, the human body contains many *objective-constituent* functions. This fact suffices to make also non-evolutionary studies of functions a tractable scientific enterprise. Furthermore, functions might very well provide the ground for taxonomic work. One might order the parts of the human body according to their function and create a *functional anatomy*, see (Johansson, Smith, et al., 2005).

Philosophy can, I think, meet “the function challenge” that the life sciences have posed.

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