A Pragmatic Account of Functions

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Abstract

In this article, a pluralism of function concepts is defended on the basis of pragmatic considerations. It is shown that we use functional statements for a variety of explanatory purposes, and that each explanatory purpose asks for a specific notion of function. More specifically, I argue that the meaning of the statement "the function of *x* is to *φ*" depends on the explanation-seeking question that this statement is supposed to answer, and that we cannot construct one ultimate notion of function that is appropriate in every explanatory context. Several explanation-seeking questions are explicated, as well as the function concepts that can be used to answer them, resulting in a pragmatic framework for function concepts. This framework is applied to both the technical and the biological domain.

Keywords: artifact functions; technical functions; biological functions; functional explanation; pragmatism; teleo-pluralism; Perlman; Wouters; Neander; Cummins

1. Introduction

A long-standing debate in philosophy of science and technology concerns the nature of functions and the identification of necessary and sufficient conditions for ascribing a function to an object, property, etc. Let me give a very brief overview of the basic contemporary positions in this debate. Cummins (1975) ascribes a function to a system component if it has a capacity that contributes to the system capacity that we are interested in. Other theories assume that a function is a contribution to a goal, and not just to whatever system capacity that we are interested in (e.g., Boorse 1976, Adams 1979). Etiological theories (starting with Wright 1973), on the other hand, ascribe a function to an item on the basis of the causal history of this item, often considering natural selection (e.g., Millikan 1984, Neander 1991a) to be crucial for biological functions,[1] and intentions of the designer/user for technical functions (e.g., Neander 1991b, McLaughlin 2001, Houkes and Vermaas 2004). One can also bring natural selection and intentional selection into the picture without focusing on the past, that is, by ascribing functions to items on the basis of their propensity to be selected (Bigelow and Pargetter 1987). None of these theories is entirely

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[1] For alternative etiological accounts of biological functions, see e.g., McLaughlin (2001), Krohs (2009).

unproblematic. As the problems for each approach are sufficiently documented in the literature (e.g., Wouters 2005), I will not revisit them here.

How should we deal with this plurality of theories concerning functions? One way to deal with it is to pick out one of them, and argue that it is the only adequate one; or one can develop a new unifying theory that is supposed to avoid the problems of the existing theories (e.g., Longy 2009, Vermaas 2009). Alternatively, one can endorse a plurality of theories, stressing the need for more than one notion of function. The underlying idea is often that the biological domain and the technical domain ask for different notions of function (e.g., Griffiths 1993, McLaughlin 2001, Vermaas and Houkes 2003), but one can also argue for accepting more than one notion within the biological domain (e.g., Amundson and Lauder 1994), or in both the biological and the technical domain (e.g., Preston 1998). Most pluralistic function theories allow two notions of function.

More extreme versions of pluralism are proposed by Wouters (2003, 2005) and Perlman (2009).[2] Wouters (2005) thinks that if we want to understand biological inquiry, we should look at the actual practice of biological inquiry, instead of studying our intuitions. As a first step toward understanding explanation in functional biology, Wouters (2003) studies function ascriptions in biological practice. Based on this study, he distinguishes four notions of function: a function could be (1) an activity, (2) a biological role, (3) a biological advantage, or (4) a selected effect. He links these different notions to different kinds of questions: functional statements in which notion (1) is used answer the question "What does it do?", statements that correspond with notion (2) answer the question "How is it used?", statements in which notion (3) is used address the question "How is it useful?", and statements in which notion (4) is used concern the question "For what effect was it selected in the past?" This pragmatic pluralism of function concepts is extensively supported by examples from biological textbooks and research papers. Since Wouters' account only concerns biological functions, an account of artifact functions is needed.

Perlman (2009) proposes a point of view that is similar to Wouters' account. He thinks that many people have lost sight of what functional statements are used for: to explain things. Once we acknowledge this goal, we see why we should embrace a variety of function concepts: rather than that we should always use the same notion of function, we should use that concept that is most useful for the goal of explaining, and because different function concepts are useful in different explanatory contexts,[3] our explanatory toolbox should include various function concepts. Perlman summarizes his position as follows.

> In some cases a focus on Cummins-style systematic functions will give us the best explanation of the phenomenon in question (many of the issues in biochemistry, neuroscience, or developmental biology). In other cases, an evolutionary account such as Millikan's account will be preferable. In still others, a focus on recent-past (goal-contribution) will do better than focus on distant evolutionary past (especially for talking about the designer's intention as a source of the function of a human artifact). In still other cases, future-looking propensity and disposition will tell us more and explain more. Let's give ourselves an arsenal of all of these useful concepts, and not insist that one of them is the ultimate and exclusive account of function. (Perlman 2009, pp. 32-33)

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[2] I consider Wouters' and Perlman's versions of pluralism more extreme because Wouters and Perlman recognize many more notions of function. Note that Wouters' account is not limited to the four basic notions of function he distinguishes: he points at the possibility to make finer distinctions, resulting in even more notions of function (Wouters 2003, p. 653).

[3] The idea that different function concepts are useful for different explanatory projects, has also been proposed in Godfrey-Smith (1993), Mitchell (1993), and Kitcher (1998).

Perlman dubs this position 'Pragmatic Teleo-Pluralism'. Since he proposes Pragmatic Teleo-Pluralism as a guideline or a piece of advice, rather than as a fully-developed account of functions, he does not offer an extensive defense of it, stating only that a similar attitude allowed epistemologists to move away from the chaos they were in from the early 1960s to the late 1980s.

In this article, I try to take Pragmatic Teleo-Pluralism to the next level by developing and defending a pragmatic and pluralistic account of functions that is more advanced than Perlman's preliminary recommendation. Since Wouters has already paid a lot of attention to biological functions, I will mainly focus on artifact functions, but I also take functions of biological objects into account. In sections 2 to 5, I discuss explanation-seeking questions we can ask about technical objects, and I demonstrate that in order to be able to answer these different questions by referring to functions, we need different function concepts. The relevant function concepts are explicated and discussed, resulting in a pragmatic framework for ascribing functions to technical objects. This framework is extrapolated to the biological domain in section 6, and I conclude in section 7.

2. Backward-looking questions

A first kind of explanation-seeking question we can ask about an artifact, and that can be answered by one or more functional statements, is a backward-looking question:

Why is *x* there?

This question can mean several different things:

Why was *x* produced?
Why has *x* been maintained?
Why was *x* integrated in system *s*?
…

Such questions can be answered with statements of the form "the function of *x* is to *φ*". But which conditions have to be satisfied for this function ascription to be explanatorily relevant for the production/maintenance/integration of *x*? What does the functional statement that *x* is to *φ* mean if it is used to answer a backward-looking why-question?

Consider an example. The question why a screwdriver was produced can be answered by the statement that the screwdriver is for driving screws. The reason why the function of the screwdriver explains its being produced, seems to be that the producer made the screwdriver with the intention of making something that can drive screws. Because this intention caused the production of the screwdriver, it explains why the screwdriver is there.

However, sometimes, a functional statement can answer a backward-looking question without any intentions of the designer/manufacturer being involved. Suppose a car, let us call it the 'Splendor', was designed and produced for transporting people, but that it cannot perform this function very well: driving it always causes car trouble. Yet, many buyers turn out to be very happy about the car, because it increases their status. They advise their friends to buy one as well.

The manufacturer reacts to the rising demand by producing a second load of Splendors,[4] although he has no clue as to why the car is such a success. So neither the designer, nor the manufacturer is aware of the status-enhancing properties of the car, but yet, it seems perfectly plausible to explain the production of the second-generation Splendors by the statement that the function of the Splendor is to enhance the owner's status.[5]

So intentions of the designer/manufacturer are not required for a functional explanation of the production of an artifact. What does seem to be required, is that the function to which the explanation refers, corresponds with a (remote or proximate) cause of the production of the artifact. The function to drive screws corresponds with the producer's intention to make something that can drive screws, and the function to enhance status corresponds with the fact that first-generation Splendors enhanced the status of their owners, which caused, via a rising demand, the production of the second-generation Splendors. The correspondence with a cause is crucial. Suppose the production of the second-generation Splendors is neither due to the status-enhancing qualities of previous-generation Splendors, nor to an intention to make something that can enhance status, as is the case with the first-generation Splendors. The car's capacity to enhance the status of its owner would then not correspond with a cause of its production. It seems, then, that we could no longer explain the production of the Splendors by stating that their function is to enhance the status of their owners. That is not why they were built; they were built because the designer and manufacturer wanted to make something that can transport people, and their status-enhancing qualities are accidental. So the statement that the function of x is to φ can only explain why x was produced if φ-ing corresponds with a cause of the production of x.

The same is true with respect to the maintenance of x. The question "Why has Peter maintained his motorcycle?" can only be adequately answered by "the function of the motorcycle is to slip through traffic" if slipping through traffic is part of a causal history of the fact that the motorcycle has been maintained, either in the form of an intention of its maintainer, or in the form of something that it did in the past, or that other motorcycles did in the past. If the causal history of the maintenance of the motorcycle does not involve slipping through traffic in any way (maybe Peter has only maintained the motorcycle because he wants to sell it for a lot of money later), then "the function of the motorcycle is to slip through traffic" does not explain why Peter has maintained it. In general we get: "the function of x is to φ" can only explain why x is there if φ-ing corresponds with a cause of the fact that x is there.

So in order to understand why functional statements can answer backward-looking questions, we need a causal-historical or etiological notion of function. The most ingenious etiological notion of function is, in my opinion, offered by Neander (1991b):

"The function of x is to φ" means that φ-ing is the effect for which x was selected.

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[4] From here on, I refer to the Splendors from this second load as the 'second-generation Splendors'. The first load of Splendors are referred to as the 'first-generation Splendors'. The difference between the first- and the second-generation Splendors is that, while the first-generation Splendors were produced before any Splendor had ever enhanced the status of its owner, the second-generation Splendors were produced *because* antecedent Splendors had enhanced the status of their owners in the past.

[5] Perlman offers a similar example:

… some religious ritual might be seen by those who practice it (i.e., from the intentional side) as involving tribute to a deity, and the artifactual objects used in the ritual might be said by the adherents of that religion to have various supernatural functions. But an anthropologist might analyze the situation as one in which the behaviors serve to reinforce kinship relations, and the object functions as status indicator and economic vehicle, even if no one in the group has that intention, and even if no one in the past ever had that intention. (Perlman 2009, p. 28)

This is Neander's general account of functions. With respect to artifact functions, Neander focuses on intentional selection, stating that "the function of an artifact is the purpose or end for which it was designed, made *or* (minimally) put in place *or* retained by an agent" (p. 462, my italics), but she also recognizes the possibility of "artifact functions that derive from a selection process more akin to natural selection" (p. 462n).

I think that this account corresponds with what we mean when we answer the general question "Why is *x* there?" with a functional statement. But we have seen that there are also more specific backward-looking questions, and in order to answer these more specific questions, we need more specific function concepts. If the question is, for instance, "Why was *x* produced?", then Neander's general notion is too liberal. It allows that the function of *x* is just some purpose that *x* was, say, maintained for, without requiring that it is also what *x* was produced for. But if we answer the question "Why was *x* produced?" with "the function of *x* is to φ", then this means that φ-ing is the effect for which *x* was produced, rather than that φ-ing is the effect for which *x* has been maintained. A similar point could be made with respect to the other more specific backward-looking questions. Accordingly, the following etiological notions of function are needed to answer the more specific backward-looking questions:

"The function of *x* is to φ" means that φ-ing is the effect for which *x* was produced.
"The function of *x* is to φ" means that φ-ing is the effect for which *x* has been maintained.
"The function of *x* is to φ" means that φ-ing is the effect for which *x* was integrated in system *s*.
…

We can conclude that for answering backward-looking questions (with functional statements), we need etiological function concepts, and that different backward-looking questions ask for different etiological notions of function.

3. Forward-looking questions

We can also ask forward-looking questions about artifacts, such as:

Why will *x* be (re)produced?
Why will *x* be maintained?
Why will *x* be integrated in system *s*?
…

These questions can be answered by stating that *x* is for φ-ing. What does this statement mean when it is used in such contexts?

Let's consider an example. Suppose the question is "Why will the first-generation Splendors be reproduced?" An adequate answer to this question is that the function of these cars is to enhance status.[6] This is an adequate answer because the status-enhancing qualities of the first-

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[6] Note that while this statement explains why the first-generation Splendors will be reproduced, it does not explain why they were produced in the first place. According to the etiological notion we use for answering questions of the form "Why was *x* produced?" (the function of *x* is the effect for which *x* was produced), the function of the first-

generation Splendors cause their reproduction (via a rising demand), as we saw in the previous section. There is also another way in which "the function of the first-generation Splendors is to enhance status" would explain their being reproduced: suppose the reproducers *believe* that the first-generation Splendors can enhance status, and that they reproduce them because they believe this, but that this belief is mistaken (the first-generation Splendors are not actually capable of enhancing status). In this case, it would still seem plausible to explain the reproduction of the cars under consideration by claiming that their function is to enhance the status of their owners, although they cannot actually do that.

What do both ways in which the functional statement is explanatory relevant, have in common? In both cases, we would say that enhancing status is the effect for which the Splendors will be reproduced. We can construct the following notion of function:

"The function of x is to φ" means that φ-ing is the effect for which x will be reproduced.

This is the notion we use when we answer questions of the form "Why will x be reproduced?" For other forward-looking questions, we can construct similar function concepts. If we want to explain, say, why x will be maintained, or why x will be integrated in system s, by referring to the function of x, we use, respectively, the following notions:

"The function of x is to φ" means that φ-ing is the effect for which x will be maintained.
"The function of x is to φ" means that φ-ing is the effect for which x will be integrated in system s.

The major difference between these forward-looking function concepts and the etiological function concepts is that according to the former, x can have the function to φ even if φ-ing isn't a purpose or end for which an agent has designed, made, used or maintained x in the past, if x has never performed this function, and if tokens of the same type as x have never performed this function either. Maybe φ-ing is just something that x will do in the future, or maybe only future agents will use x for φ-ing. Forward-looking notions do not ascribe a function to x on the basis of x's past, but on the basis of x's future. That is exactly the kind of notion we need for answering forward-looking questions: forward-looking questions do not focus on the past, as backward-looking questions do, but on the future; why will something happen in the future? If we answer a forward-looking question by stating that the function of x is to φ, then φ-ing should be relevant for x's being reproduced/maintained/… in the future, but whether it has anything to do with how x came into being, or with x's causal past, does not matter.

4. Normative questions

A third kind of explanation-seeking question that can be answered by one or more functional statements is a normative question. There are several kinds of normative questions:

Why should x be maintained?
Why should x be repaired?

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generation Splendors is to transport people. It is this function, and not the function to enhance status, that explains their being produced.

Why should *x* be integrated in *s*?

…

I think all these normative questions have an underlying motivation in common. If some artifact (component) *x* should be maintained/repaired/…, then there must be something that makes *x* useful; there must be one or more goals that *x* can serve, otherwise there would be no reason to maintain/repair/… *x*. If we ask a normative explanation-seeking question about *x*, then we want to know what it is that makes *x* useful.

So for a functional statement to be an adequate answer to a normative question, it should reveal why *x* is useful. In order to meet this requirement, we can use the following notion of function:

"The function of *x* is to φ" means that φ-ing is the effect that makes *x* useful.

This notion is more liberal than the etiological and forward-looking notions. It allows that φ-ing is the function of *x*, even if *x* was not produced, maintained, etc. for φ-ing in the past, and if *x* will not be reproduced, maintained, etc. for φ-ing in the future. If we consider John's fireplace useful because it makes the living room more cozy, then this is, according to the 'usefulness' notion, a function of the fireplace, even if the architect did not integrate the fireplace in his architectural design for that purpose, if John did not maintain it for that purpose, and if the fireplace will neither be maintained, nor reproduced for making the living room more cozy in the future.

The fact that the 'usefulness' function concept is more liberal in this way, corresponds with our intuitions on which functional statements can answer normative questions. Suppose that the only purpose for which John has maintained his fireplace, and for which the architect integrated it in the architectural design, is for heating the room, and that the fireplace will neither be maintained, nor reproduced in the future. In that case, making the living room more cozy would neither be an etiological, nor a forward-looking function of the fireplace. But still, "the function of the fireplace is to make the living room more cozy" could be an adequate answer to the question "Why should the fireplace be maintained?" The 'usefulness' notion of function allows this.

5. Analytical questions

A final kind of question that can be answered by referring to functions, is an analytical question:

Why does system *s* have the capacity to ψ?

An example can clarify how this question can give rise to function ascriptions. There are two ramps, and between the ramps, there is a seesaw. At a certain moment, a ball turns up at point A on the first ramp, and rolls down this ramp to end up on one side of the seesaw. A computer screen accidently falls on the other side of the seesaw, and the ball is launched to the second ramp. The balls rolls down this ramp, towards point B. Someone who is not aware of all these sub-behaviors, but only knows that the system, constituted by the two ramps, the seesaw, and the computer screen, moved the ball from point A to point B, could then ask: Why does the system have the capacity to move a ball from point A to point B?

We could answer this question as follows. The function of the first ramp is to move the ball from point A to the seesaw, the function of the computer screen is to set the seesaw in motion, the function of the seesaw is to launch the ball to the second ramp, and the function of the second ramp is to move the ball to point B. Note that none of these functions are likely to be functions in an etiological or forward-looking way. The computer screen was probably not produced for setting the seesaw in motion, and it will probably not be maintained or reproduced for setting seesaws in motion. It is also not assumed that the functions make the components useful ('usefulness' notion of function). Maybe we want the seesaw to stay still; it would then be odd to say that setting the seesaw in motion is what makes the computer screen useful. So neither the etiological and forward-looking notions, nor the 'usefulness' notion, can account for the function ascriptions in a function-analytical explanation. We need a more liberal notion.

A function concept that can help us out, is inspired by Cummins (1975):

"The function of x is to φ" means that x's capacity to φ contributes to s's capacity to ψ.[7]

This account, which I call the causal-role notion of function, is more liberal than the etiological and forward-looking accounts, and than the 'usefulness' account, in that it allows us to ascribe to the computer screen in the aforementioned example, the function of setting the seesaw in motion. On the other hand, it is also more strict in at least two ways. A first way in which it is more strict, is by requiring that there is a system of which x is a part, and that this system has a capacity to which x contributes. So if there is no capacity of a containing system to which a CD-player contributes by playing CDs, then playing CDs is, according to the causal-role notion, not a function of the CD-player. The other function concepts do not have this restriction.

A second way in which the causal-role notion is more strict, is by requiring that x must contribute, not to any system capacity, but to that capacity that we are analyzing. When we are analyzing the capacity of the aforementioned system to move a ball from point A to point B, then the function of the computer screen is, according to the causal-role theory, to set the seesaw in motion, and not, say, to display images, because it is by setting the seesaw in motion that the computer screen contributes to the system's capacity to move a ball from point A to point B, and not by displaying images. This corresponds with what we mean when we answer analytical questions with functional statements. If we answer the question "Why does the system have the capacity to move a ball from point A to point B?" by ascribing functions to the system components, then these functions should correspond with how the components contribute to the system's capacity move a ball from point A to point B. Otherwise, the function ascriptions would be misleading.

6. Functions in biology

Finally, I want to stress that the superiority of a pragmatic and pluralistic account of functions is not due to some peculiarity of the technical domain. I think my account is adequate with respect to function ascriptions in other domains as well. To demonstrate this, let me briefly

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[7] Cummins may not entirely agree with this account. He states that the appropriateness of function-ascribing statements is a matter of degree. He thinks that it makes little sense to talk about functions if the system under consideration does not have a relatively complex organization and if the analyzing component capacities are of the same type and degree of sophistication as the analyzed system capacity. So it is possible that a component capacity contributes to a system capacity, and that it is still inappropriate to ascribe a function to the component.

consider the realm of biological phenomena. The most obvious way in which biologists use function ascriptions, is to explain why an organism has a certain characteristic (e.g., we have a heart because the function of the heart is to circulate the blood). The question asked is then a backward-looking question (e.g., why do we have a heart?), and to answer such a question with a functional statement, we need an etiological function concept. An example of such a concept is:

"The function of x is to φ" means that φ-ing is the effect for which x was selected by natural selection.

According to this notion, novel characteristics, that appear for the first time in evolutionary history, cannot have a function, because they do not have the appropriate history of natural selection. This corresponds with the fact that we cannot answer the question why a novel characteristic is there (backward-looking question) by stating that its function is to do something. We cannot explain why the first heart was there by stating that its function is to circulate the blood. The first heart was there because of a mutation. It is only after one or more generations of organisms with hearts that we can use the statement "the function of the heart is to circulate the blood" to account for the heart's being there.

But sometimes, it does seem appropriate to ascribe a function to a novel characteristic. If the question is: "Why is it useful for the first possessor of a heart to have a heart?", then the reply that its function is to circulate the blood may be fully satisfying. The reason is that when we answer such a question with a functional statement, we do not use an etiological function concept, but rather the 'usefulness' notion of function (see above). This notion can be used to answer not only questions of the form "Why is x useful?", but also for answering normative questions, such as "Why should we make sure that the population rate of plankton remains sufficiently high?" This question can be answered by the statement that the function of plankton is to feed the whales. Here, we cannot use the etiological concept, because feeding the whales is not what plankton were selected for. It is something that makes plankton useful, and therefore, it is a 'usefulness' function of plankton.

But the etiological notion and 'usefulness' notion are not sufficient to account for function ascriptions in the biological domain, we also need a third function concept. Suppose we want to slow the withering process of a flower as much as possible, and that we therefore ask: "Why does a flower wither?" While we are answering this question, we can use function ascriptions such as "the function of the microbes in the withering process is to decompose the plant detritus". Decomposing the plant detritus is not the etiological function of the microbes because that is not what they were selected for by natural selection. It is also not a 'usefulness' function. By decomposing the plant detritus, the microbes contribute to the withering process, and we do not want our flowers to wither. So it would be odd to claim that decomposing the plant detritus is what makes the microbes useful; it would be more adequate to claim that that is what makes them harmful. So neither the etiological, nor the 'usefulness' notion allows us to ascribe to the microbes the function of decomposing the plant detritus. A function concept that does allow this, is the causal-role notion (see above). I think that the causal-role notion corresponds with what we mean by functional statements when we use them to analyze biological processes.

7. Conclusion

A lot of function theorists have neglected the fact that one term can have several meanings, depending on the context in which it is used. We have seen that there is no context-independent meaning of "the function of x is to φ"; the meaning of a functional statement depends on the specific kind of explanation-seeking question that this statement is supposed to answer. We use different function concepts in different contexts, and it is only because we allow more than one notion of function that functional statements are useful for so many explanatory purposes. If we would restrict ourselves to an etiological notion, then functional statements could only answer backward-looking questions; if we would restrict ourselves to a forward-looking notion, then functional statements could only answer forward-looking questions, and so on. I think this is a good reason to attribute a positive value to the plurality of function concepts, instead of accepting only one ultimate notion of function.

Still, a lot of research remains to be done. More evidence is needed with respect to functions of biological objects, and what about functions in the socio-cultural domain? What do we mean when we ascribe a function to a social practice or institution? Do we use different notions of function in this domain as well? Which notion is useful for which kind of question? We can also wonder what the benefits are of using functional statements. Why do we often prefer them to non-functional statements? Is it because they allow us to make abstraction of unimportant details, or maybe for esthetic reasons (the more concepts we have to describe something, the more elegant we can make our descriptions)? Explicitly spelling out the questions that functional statements are supposed to answer, can help us in answering these questions in the future.

Acknowledgements

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