

signify the same; then it would be as valid to infer that whatever was a man necessarily was *not* a two-footed animal as to infer that whatever was a man necessarily *was* a two-footed animal, i.e. it would be *no more* valid to make the latter inference than to make the former. But, of course, Aristotle cannot hold that both these inferences are valid, so long as he maintains the PNC, so he must say either that neither is or that 'man' and 'not-man' do not signify the same. But, then, in the absence of proof that 'man' and 'not-man' do not signify the same, his opponent could say that he had no right to assume that *either* was valid—given his acceptance of the PNC. And so Aristotle provides such a proof.<sup>1</sup> As Aquinas puts it:

Now the things demonstrated above are useful to his thesis, because if someone were to think that the terms man and not-man might signify the same thing, or that the term man might signify both being a man and not being a man, his opponent could deny the proposition that man must be a two-footed animal. For he could say that it is no more necessary to say that man must be a two-footed animal than to say that he is not a two-footed animal, granted that the terms man and not-man signify the same thing, or granted that the term man signifies both of these—being a man and not being a man.

<sup>1</sup> In opposing the PNC Aristotle's opponent is not denying that some of the things Aristotle believes are true, but rather is claiming that *more* things may be true than Aristotle believes to be possible, viz. the contradictories of some of the true propositions which Aristotle believes. Thus it is natural for him to confront any argument Aristotle puts forward, not by denying its validity, but by proposing another argument whose conclusion is the contradictory of the conclusion of Aristotle's argument, and then challenging Aristotle to explain why just *his* argument is valid. I take the purpose of the paragraph beginning at 1006b13 to be to forestall just such a challenge.

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## FURTHER NOTES ON FUNCTIONS

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**M**Y beloved stuffed moose head is functioning as a hat rack, and occasionally functions to hold coats and umbrellas. But it is really a decorative, rather than functional, addition to my study; it is the function of my hat rack to hold hats, and a function of the coat rack to hold umbrellas. The moose head often functions only to frighten small children.

Attention to the many different ways in which we speak of functions is called for by the flurry of recent work done on the topic, and especially by Christopher Boorse's recent contribution (*Philosophical Review*,

January, 1976). Boorse's article involves a critique of Larry Wright's original formulation for functions (*Philosophical Review*, April, 1973), using in part counter-examples similar to my own (ANALYSIS 35.2, 1974). Wright seems to recognize the force of such an attack (ANALYSIS 36.3, 1976).

As a critical piece, Boorse's article has much in its favour. Boorse also attempts, however, to supply what Wright as of this writing has not: an adequate account of precisely what it is that talk of functions amounts to. In the end, I think, Boorse's proposal is less satisfactory than the account it is designed to replace.

Boorse claims that 'functions are, purely and simply, contributions to goals' (p. 77), and offers an analysis of 'X is performing the function Z . . .' on the basis of an outline of 'goals'. He goes on to discuss 'the function of X is Z' and 'a function of X is Z' in terms of 'X is performing the function Z . . .' The three main steps in his presentation are thus: (1) the outline of 'goals', (2) the analysis of 'X is performing the function Z . . .' in terms of 'goals', and (3) the transition from 'X is performing the function Z . . .' to 'the function of X is Z' and 'a function of X is Z'. I hope to point out important difficulties which arise with each step.

## I

Boorse first specifies 'goals', following Sommerhoff in *Analytical Biology*, as follows

To say that an action or process *A* is directed to the goal *G* is to say not only that *A* is what is required for *G*, but also that within some range of environmental variation *A would have been modified* in whatever way was required for *G* (p. 78).

Boorse discusses two objections to such an account proposed by Scheffler (*British Journal for the Philosophy of Science*, 9, 1959), and alters the outline of 'goals' in terms of them. The first objection Boorse considers and attempts to resolve as follows

Presumably a cat which waits by an empty mousehole may have the goal of catching a mouse; but it is hard to see how any behavior can literally be required for catching a nonexistent mouse. The cat's behavior can, however, fairly be called appropriate to catching a mouse; it is, for instance, the kind of behavior that leads to catching mice when they are there. And this answer seems sufficient . . . (p. 79).

What Boorse is proposing, I think, is the following amendment of the outline of 'goals' above:

To say that an action or process *A* is directed to the goal *G* is to say not only that *A* is what is required for *G* or *appropriate to G-ing*, but also that within some range of environmental variation *A would have been modified* in whatever way was required for *G*.

Cat and mouse problems, and perhaps even Scheffler's original cat and mouse problems, remain. Suppose that kitty lurks around empty mouseholes with the goal of catching mice. Not only does it appear that lurking around empty mouseholes is not required for catching mice, it also appears that lurking around empty mouseholes is totally *inappropriate* to catching mice. Nor, in the end, is 'lurking around empty mouseholes' the kind of behaviour which leads to catching mice when they are there, since if there are mice in the hole kitty's 'behaviour' can no longer be described as 'lurking around empty mouseholes'. Lurking around mouseholes may lead to catching mice when they are there, but no logically respectable cat could possibly lurk around empty mouseholes full of mice.

We can, of course, make things still worse for the formulation. Poor kitty, demented as she is, commonly does totally unrequired and inappropriate things with the goal of catching mice. If Boorse's formulation for 'goals' were correct, we would be forced to say that doing totally unrequired and inappropriate things is here required for or appropriate to catching mice.

Boorse also considers a second difficulty, and once again revises the account of 'goals' in terms of it. So as to avoid difficulties with 'behaviours' required for or appropriate to several ends, Boorse specifies that

When a process appropriate to several ends at once has a true goal, I suggest it is because the process is produced by an internal mechanism which standardly guides pursuit of that goal but not the others (p. 79).

With that amendment, the entire formulation becomes:

To say that an action or process *A* is directed to the goal *G* is to say not only that *A* is what is required for *G*, or *appropriate to G-ing and if appropriate also to any other X-ing is produced by an internal mechanism which standardly guides pursuit of G but not of any other X*, but also that within some range of environmental variation *A would have been modified* in whatever way was required for *G*.

The attempt to avoid one type of difficulty here, I think, quickly raises another. Thus consider the following case. Kitty's one central goal in life is to appear sinister, and everything she does is guided by that goal in one way or another. She often crouches as if to pounce, silently glaring and extending her claws, solely in order to appear sinister. Should some additional need to catch mice or annoy her mistress arise, kitty's central goal of appearing sinister will guide these efforts as well; she catches mice and annoys her mistress in as sinister a manner as possible. If kitty's central goal of appearing sinister has a 'mechanism' *m*

(little electrical trails in kitty's brain, perhaps), *m* is part of the 'mechanism' of everything kitty does.

Kitty is at present crouching near the mousehole, silently glaring and extending her claws, and is doing so merely with the goal of appearing sinister. Such behaviour is also appropriate to catching mice or annoying her mistress, of course, but kitty's goal in this case is merely the familiar one of appearing sinister. Here the formulation above would seem to require that kitty's present 'behaviour' be 'produced by an internal mechanism which standardly guides' the attempt to appear sinister but does *not* standardly guide *other* attempts such as catching mice or annoying her mistress. But this is not the case; kitty's goal here, as well as whatever 'mechanism' goes with it, are such that they guide everything kitty does and thus do not guide merely the kind of thing she is doing at the moment. As it stands, the formulation above seems to exclude all such cases. If Boorse's account were correct, in fact, neither kitty nor anyone else could act solely in pursuit of a goal which also standardly guided the pursuit of other goals.

There finally seems to be some difficulty in the 'would have been modified' clause of the formulation. Certainly I might have a goal *G* which I know can only be accomplished by doing some very simple *A* or some very strenuous *A'*. I do *A* with the goal of *G*, but had *A* failed to produce *G* I would have totally abandoned *G* rather than subject myself to the rigours of *A'*. Here action in terms of a goal seems obvious, though the specifications of the formulation are not fulfilled in that my action would not have been modified within any 'range of environmental variation . . . in whatever way was required for *G*'.

Boorse's attempt is not simply to clarify ordinary notions of goals, since he wants to label thermostats and guided missiles as 'goal-directed' as well and speaks of 'goal-directed behaviour outside of the realm of intentional action' as something like 'a theoretical concept of biology to be explicated according to convenience' (p. 78). To that extent, his earlier claim that 'functions are, purely and simply, contributions to goals' (p. 77) becomes misleading without inverted commas around 'goals' and a clarificatory footnote. But Boorse also seems to want his formulation to present necessary conditions for 'goals' in the ordinary sense, or at least to avoid difficulties of a type he considers, and with an eye to either of these standards he appears to have failed on three counts.

## II

For the sake of argument, however, we might allow Boorse's discussion of goals as a discussion of 'goals' in a particular sense, and consider his definitional efforts as purely stipulative ones. All of this would be harmless if the analysis of 'functions' came out right.

Boorse offers the following as an account of 'what is perhaps the weakest of all functional attributions'

*X is performing the function Z in the G-ing of S at t, means*

*At t, X is Z-ing and the Z-ing of X is making a causal contribution to the goal G of the goal-directed system S (p. 80).*

'G' and 't' here are variables for goal and time. 'S' stands for 'system', a term for which we are never really given an explanation.

I must confess to some difficulty with the phrase 'is performing the function Z' simply because it sounds so pretentious (much as 'believe' commonly sounds in speaking of what people think and as 'performing the action a' commonly does in speaking of what people do). I hope my words are functioning to get my message across, but to say that I hoped they were 'performing the function of getting my message across' would seem at least unnecessarily awkward. Boorse, in fact, never uses precisely that phrase in context. 'Is functioning to' seems a more natural candidate for the 'weakest of all functional attributions', but I don't want to saddle Boorse with a phrase he did not attempt to analyse.

Neither phrase, however, seems right when we are speaking of people in certain situations, and for that reason Boorse's account faces a simple form of counter-example. Thus consider a Rube Goldberg contraption the goal of which is to produce pretty patterns on an oscilloscope. Rube has set the whole thing up in such a way that it relies in part on the snoring of Professor Emeritus, who knows nothing of the device and is lost to the world. In such a case it may be that Professor Emeritus is snoring and his snoring is making a causal contribution to the device's production of pretty patterns on the oscilloscope. But it would seem odd to say either that Professor Emeritus is performing the function of snoring, or that Professor Emeritus is functioning to snore. We can make the case worse by building a device which relies on Professor Emeritus lying there unconscious or even dead (we want a flat EEG reading, perhaps). Though he may be lying there unconscious or dead and that may contribute to the goals of the 'system', it would be very strange to claim that Professor Emeritus is either functioning to lie there unconscious or is performing the function of lying there dead.

Other difficulties face Boorse's account as well. Though he speaks of it constantly as an analysis of 'performing the function' and even at one point as an analysis of 'performing a function', his account is strictly speaking an analysis rather of the complex phrase 'performing the function Z in the G-ing of S at t'. As such, even if the account were successful, it would not follow that 'functions are, purely and simply, contributions to goals' (p. 77) nor that 'to accept our analysis of performing a function is to settle the question of what sort of thing a

function is—namely, a contribution to a goal' (p. 81). The phrase for which he presents an analysis is one which requires the mention of some particular 'goal' (as a substitution for 'G-ing') and thus the claim that such a phrase can only be analysed in terms of some 'goal' is a foregone conclusion and a fairly uninteresting one. The least that is required to substantiate Boorse's more general claims that 'functions are, purely and simply, contributions to goals' is an analysis in terms of 'goals' of some subspecies of function talk which need not explicitly mention 'goals'.

Boorse may have intended his analysis to be more than it in fact is; the account is followed immediately by the claim that 'all functional statements, weak and strong, seem to me implicitly relative to system, goal, and time' (p. 80), and he speaks later of 'variables suppressed' in 'function statements' (p. 85). If Boorse intended his account to cover cases where 'goals' are not explicitly mentioned, the following examples suggest direct counter-examples in terms of both 'performing functions' and 'functioning to'. Boorse's specific analysis aside, such examples make implausible any account of the form required to substantiate his more general claims regarding the necessity of an analysis in terms of 'goals'. Thus consider:

- (1) The advertising department has for twenty years been performing a function detrimental to all goals of the company, society at large, and even the department itself.
- (2) The seniority committee is to this day performing a function inimical to all goals of the legislative branch and government in general. (Give it a new name and it would simply be the same committee performing the same function inimical to the same goals.)
- (3) The vast distances of space are functioning to prevent communication between us and our nearest star.
- (4) The force of the current is functioning to sweep small boats quickly out of little boys' reach.

Each of these would appear to resist analysis in terms of 'goals', (1) and (2) because they explicitly deny that the work of the advertising department or the seniority committee furthers any goals which might seem relevant in such an analysis, and (3) and (4) because there seems to be no 'goal' in sight appropriate to such an account. Only if the waters of the world were in conspiracy against little boys would (4) fit such an account, and only if the universe were plotting against interstellar communication would (3) go through. There need be no such goals in any of these cases in either the common sense of the term or in that uncommon sense Boorse has defined. It was required of the latter that

'within some range of environmental variation  $A$  would have been modified in whatever way was required for  $G$ ' (p. 78). But none of these cases need be ones in which anything would have changed. Departments and committees remain out of apathy, and rivers don't change their courses suitably to the loss of small boats.

### III

Boorse's third attempt is to move from an account of 'performing the function  $Z$ ' to a broader outline of 'the function of  $X$ ' and 'a function of  $X$ '. Like its two predecessors, I think, this step in Boorse's discussion faces its own peculiar difficulties.

Whatever 'the' or 'a' function of a thing is, then, it must at least be a contribution to a goal . . . what more is required for a function performed by  $X$  to be among 'the functions' of  $X$  is not any fixed general property but instead varies from context to context (p. 81).

Boorse's final accounts read:

'A function of  $X$  is  $Z$ ' means that in some contextually definite goal-directed system  $S$ , during some contextually definite time interval  $t$ , the  $Z$ -ing of  $X$  falls within some contextually circumscribed class of functions being performed by  $X$  during  $t$ —that is, causal contributions to a goal  $G$  of  $S$ .

'The function of  $X$  is  $Z$ ' means that in some contextually definite system  $S$  with contextually definite goal(s)  $G$ , during some contextually definite time interval  $t$ , the  $Z$ -ing of  $X$  is the sole member of a contextually circumscribed class of functions being performed during  $t$  by  $X$  in the  $G$ -ing of  $X$ —that is, causal contributions to  $G$  (p. 82).

These are not, Boorse warns, to be taken as analyses 'in the sense of two-place synonymy relations', precisely because of contextual variance. A very major problem arises with respect to the general attempt here nonetheless.

In his original article, Wright notes that

The function of that button on the dashboard is to activate the windshield washer, even if all it does is make the mess on the windshield worse . . . That would be its *function* even if I never took my car out of the garage—or broke the windshield . . . If the windshield wiper comes from the factory defective, and is never repaired, we would still say that its *function* is to activate the washer system . . . (p. 146).

Boorse rejects this general claim out of hand as a 'curious ruling' (p. 73), but in fact Wright was correct first time around and this very point indicates an essential problem with Boorse's attempt to derive 'a function' and 'the function' from 'functions being performed'.<sup>1</sup>

<sup>1</sup> Strangely enough, Boorse considers this problem briefly in a footnote (p. 83) which itself seems to go directly against his explicit accounts.

Some things have a particular function, and the function they have is of a certain nature, despite the fact that there is no time  $t$  at which or during which they are performing that function, functioning, or even functional. The function of the light switch in the west bedroom is to turn on that light. But the electrician hooked it up wrong. It doesn't, and cannot perform any useful function and will probably never be functional. The function of a crab's claws is to ward off aggressors. That's true even of Charlie the crab's claws, though Charlie lives alone in my aquarium and will never meet any aggressor; there will be no time  $t$  at which Charlie's claws are functioning to ward off an aggressor. The function of Snowball's ears is to allow her to hear things, despite the fact that she is a white blue-eyed cat and there is nothing known to science which would allow the poor dear to hear things.

If Boorse's account were correct, moreover, we could never decide whether something had a particular function without knowing whether it ever would so function. A perfectly functional windshield wiper switch might never be used, or the entire car might explode before anyone gets close to the switch. But we need not wait and see whether any such thing happens before declaring its function to be the wiping of windows.

Thus the attempt to get 'a function' and 'the function' from 'is performing the function' seems doomed, as doomed as the attempt to define 'functioning' or 'is performing the function' in terms of 'goals' and as doomed as Boorse's outline of 'goals' itself.

#### IV

The notion of 'functions' and the attempt to give a clear account of it are important enough for all contributions to be applauded, and Boorse's work is important as a critique of accounts which have preceded it. For a more adequate account than those he criticizes, however, we must look elsewhere.<sup>1</sup>

<sup>1</sup> I am much indebted to Ms Kriste Taylor for the loan of her linguistic ear.