Constituent Functions

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1. An Intuitive Picture

We wouldn't care much about other things if we didn't care about ourselves. Therefore, a very common and fundamental reason why we care about something is that it affects us in some way. Where this is so, we understand this thing in terms of what we can do with it and what it can do to us. We understand it by embedding it in our own life. Where this way of approaching things fails, we may often still understand them in terms of how they affect the lives of other kinds of living beings.

One especially important way of embedding a thing in a life form, human or other, is to assign a function to it. Most functions are realized by processes, and so in most cases, to assign a function to a thing is to relate it to a certain kind of process. A hammer, for instance, is for hammering, and hammering is a process.

Just as we understand many things in terms of what one may do with them, we understand many processes in terms of what one may achieve by undergoing, performing, or causing them. When we understand a thing in terms of its function, we usually also understand its function in terms of what may be achieved by actualizing it.

Descriptions of what instances of a life form do tend to form teleological systems. The particular elements of such systems are descriptions of processes as contributions to other processes, and descriptions of things as typically involved in such processes. For instance, when we identify some parts of an animal as its teeth, we understand them in terms of chewing, which is part of eating, which belongs to metabolism, which contributes to many further processes, all of which are ultimately part of this animal's form of life.

Seen in this way, for a thing to have a function is for it to do something that contributes to a teleological system of processes. This view of what a function is resembles the one offered by Robert Cummins. Cummins says that "[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" (Cummins 1975: 765). If we take the containing system to be a living being and its form of life, this amounts to

saying: To ascribe a function to a thing is to describe it as the kind of thing that is typically involved in a process that contributes to a certain form of life.

So much for an intuitive grasp of what it is for an item to have a function. In this paper, I will take up several of Ingvar's ideas concerning the notion of a function. I will mainly discuss his definition of a constituent function, but in the course of this discussion, I will also touch upon his distinction between functions and functionings, his suggestion that function concepts behave like measurement units, and his emphasis on certain formal similarities between functions and intentional actions. It will turn out that in order to properly define constituent functions along the lines Ingvar suggests, one needs to understand two notions: functional relevance and functional contribution. I will explain both in terms of the "in order to" relation, and I will shed further light on the latter by relating it to certain kinds of reasoning. Much of what I say will remain sketchy, and I will not generally cite every source I have learned from.[1] I hope this is okay, since I am not making any claim to originality (except that all mistakes should be attributed to me).

2. Ingvar on Constituent Functions

The functions we have been considering are constituent functions: they are functions of parts of functionally organized systems (life forms). Ingvar (2006) specifies the following necessary and sufficient conditions for something's having a constituent function:

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.

As a definition of what it is for B to have a function, these conditions fail in several respects. Ingvar immediately points out one of them: Since condition (a) involves the notion of a functional whole and the subunit introduced in (b) is, presumably, a functional part of the whole,

[1] In particular, the first few paragraphs are inspired by §18 of Heidegger's *Being and Time* (1962), much of the rest draws on Anscombe's *Intention* (1963) and Thompson's *Life and Action* (2008).

the notion of a function is already presupposed. So all the above does is to define *constituent* functions in terms of a given notion of a function.

One might further wonder whether (c) is too restrictive. Many things that have functions do not actually do anything, even if doing something is their function. My hair dryer has a function even it has never been used and never will be. It will retain its function even if it is broken, and it would have it even if it had been broken all the time.[1] It would have no use then, but it would have a function. So for my hair dryer, its function cannot consist in its actually doing anything.[2] The same should be true for constituent functions. When the part of a functional system exercises its function, it does something in relation to other things that are relevant for the system, but it may have the function even when it does not or cannot do this kind of thing. By demanding that F is the constituent function of B only if B does F, condition (c) seems to go too far.

Ingvar might not agree with this line of argument, since he seems to think that hair dryers and broken hair dryers are two different kinds of things. He says that "a functioning and a broken machine quite simply instantiate two different four-dimensional universals" (Johansson 1989: 257). Now if my broken hair dryer differs in kind from your intact one, it is possible that what it doesn't do is also not its function. On a closer look, however, there is no reason to think that because the two instantiate different universals, they also have different functions. Whatever my hair dryer does instantiates a four-dimensional universal, i.e. it is extended in space and time and may happen more than once. It differs in kind from what your hair dryer does. This is a rather harmless metaphysical fact. However, despite this difference, the two hair dryers may still belong to the same kind, "hair dryer," so that the function of both of them is to dry hair.

It is perfectly possible that the function of a thing is not what it actually does. If so, one needs to distinguish between the universal that my hair dryer actually instantiates, i.e. what it actually does, and the uni-

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[1] Cummins (1975: 757) says that for an item to have the function to do F, it must be capable of doing F. If that means it can't be broken, it is wrong.

[2] Davies (2001: 142) concludes from this that there is no place for functions in a physical universe. I would rather argue that since there are functions, our universe is either not physical or there is more space in a physical universe than Davies makes out.

versal that it would instantiate if it weren't broken and would be doing its job. The latter is, presumably, its function.

Ingvar accordingly distinguishes the function of a thing from its *functioning*.[1] My broken hair dryer has the same *function* as your intact one; the difference is that mine is not *functioning* as well as yours. Conversely, something may be functioning as a hair dryer even though this is not its function.

It is therefore important to emphasize the simple present tense in condition (c). The function of an item is what it *does*, and not what it *is doing*, or more precisely, it is *what items of its kind do*. The simple present expresses genericity on two levels here. First, the function of an item is what it typically does, not what it is doing right now. Second, the function of an item is what instances of its kind do, not necessarily what this particular instance does. Read in this way, (c) is not too restrictive.

Note in passing that what things of a kind typically do has nothing to do with statistical frequency. The function of a sperm cell may be to fertilize an egg, even though most sperm cells don't end up doing so. They *typically* do it, even though they *usually* don't. That they typically do it means that it belongs to the *type*, not to all or most instances. The judgment that a sperm cell is what fertilizes an egg has a distinguished place in a general description of certain life forms. If a judgment of the form "this kind of thing does that kind of thing" occupies such a distinguished place in the description of a form of life, chances are that doing that kind of thing is the function of this kind of thing.

3. Degrees of Functioning

Functionings take degrees, functions don't. My hair dryer may function more or less well, but it does not have its function more or less well. The degree to which hair dryers are functioning may differ precisely because they all have their function to the same degree. Now the function of a thing is what it would do if it worked. Therefore, degrees of functioning may be measured against the functioning of a hypothetical, flawlessly working instance. For instance, a prototypical hair dryer. If my hair dryer did exactly what this prototype does, it would function perfectly well; since it falls short of it in significant ways, it does not.

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[1] Although in Johansson et al. (2005: 159) it is said that functionings are temporal parts of functions.

Ingvar helpfully compares this situation to other cases of measurement (Johansson 2004, 2008). In general, when we measure something, we compare it to a standard token in a certain respect. The respect of comparison is the dimension of measurement, e.g. length, weight, or luminosity. The item we compare it to is either a single measurement unit or something that is divided into such units, e.g. a yardstick or a measuring tape.

Measuring units are standardized in the International System of Units (SI). This system currently covers seven dimensions, including length, time, luminous intensity, and amount of substance. Ingvar points out that the latter dimension, amount of substance, differs from the others in an important way (Johansson 2008: 103). Usually, the results of measurements are stated in the following form:

A is n [unit] [dimension], e.g.
A is 25 cm long.

The amount of substance, however, cannot be specified without also referring to the kind of substance involved. Thus, whereas it is fine to say that something is 25 cm long, it is not enough to say that something is 25 moles amount of substance. One needs to specify the kind of substance in question, e.g. by speaking of 25 moles of sodium atoms, so that there are as many subdimensions of amount of substance as there are kinds of substances. Here, the measurement has the following general form:

A is n [unit] [dimension] of [kind], e.g.
A is 25 mol amount of sodium atoms.

Function is not a measurement unit as defined in the International System of Units. Yet when we say that your hair dryer works much better than mine, we measure the degree to which they function. As in the case of mole, the dimension of measurement cannot simply be "degree of functioning," it must be "degree of functioning as an X." My hair dryer is functioning badly as a hair dryer; as a paperweight it does a much better job. So if the degree of functioning is a dimension of measurement, there are as many subdimensions of it as there are functions (or prototypical function bearers).

Measurements of degrees of functioning differ in two further respects from other measurements. First, they are usually approximate. There is no way of deciding whether an item works 50% or 51% well, unless its

working can be measured in one of the official dimensions, such as length or luminosity. Second, functions are always measured by fractions of the standard unit. We don't measure the function of an item in multiples of perfect functioning, but always in fractions of perfect functioning.

In any case, Ingvar's idea is that the following two judgments are importantly similar:

This is 25 mol amount of sodium atoms.
This is a malfunctioning hair dryer.

Given the differences that have already been noted, the point of this comparison is presumably that functions are, or are associated with, standards by which things are measured and evaluated. The bottom line is that for every function there is a prototype in comparison with which all bearers of the function may be said to function more or less well.[1]

4. More Trouble with Condition (c)

So the function of an item is not what it is doing but what instances of its kind typically do. What they typically do is what a prototypical exemplar would be doing. According to Ingvar, then,

F is a *constituent function* of B if and only if:
(a) There is a functional whole A.
(b) B is a spatial part and subunit of A.
(c) Bs typically F in relation to further entities X, Y, Z that are relevant for A.

Taken at face value, however, this version of condition (c) still seems quite wrong. Why on earth would any old thing that a typical B does in relation to things that are relevant to A be the function of B? The large pimple on my nose may be the kind of thing that typically disgusts everyone I meet, and this might be highly relevant for my well being; but this would not imply that its function is to disgust people. It is obviously not enough to say that a typical B does F "in relation to" entities that are "relevant" for A.

One way of improving on (c) might be to demand that what B does must positively contribute to something the other entities do, which in

[1] Ingvar says that the choice of a prototype is always conventional (Johansson 2004: 110).

turn positively contributes to something that is important for A's well-being. However, apart from the difficulty of saying when exactly a contribution qualifies as positive, this would still not work. To take a well-known example, my heart typically does something in relation to the doctors I am visiting. It makes thumping noises that they may use as diagnostic aids. So what my heart does contributes positively to something that doctors do, which is in turn important for my well-being. Still, making thumping noises is not my heart's function (cf. Bigelow & Pargetter 1987: 195).

We had better step back a little and ask ourselves what we want condition (c) for. I take it that the basic idea is the following. What the parts of my body typically do is their function if it amounts to a contribution to something that my body typically does. If a part of my body typically does something, but this does not in any way contribute to what the other parts of my body typically do, chances are it's not its function. On the other hand, if what a part does contributes to the functioning of other parts of the system, it will probably be its function.

If the function of a part is simply its contribution to what the containing system does, we may skip the reference to entities X, Y, Z. B may contribute to something relevant for A by acting on further entities, but this need not be made part of the notion of a constituent function. So let us, in a first step, put (c) as follows:

(c) Bs typically contribute to something that is relevant for A.

It remains to be clarified what is meant by contribution and relevance in this context. In order to do this, I will now briefly reflect on the relation expressed by "in order to" and "by." For it seems that one process A contributes to another one B if A occurs in order that B and B occurs by means of A.

5. Functional Contribution and Relevance

Consider the following series of statements:

Beavers use their teeth to fell trees.
Beavers fell trees in order to build dams.
Beavers build dams in order to raise the water level.
Beavers raise the water level in order to protect their nest.

The first statement in this series is a function ascription. It assigns a function to the teeth of a beaver: They are for felling trees. That this is

indeed their function is confirmed by the second statement, which describes felling trees as a contribution to something further they do. It does this by saying that beavers fell trees *in order to* build dams. This is one way of answering the question, "Why do beavers fell trees?" This other thing beavers do, building dams, further gains relevance because it is described as a contribution to something further and so on. Each step in this series increases the likelihood that the beaver's teeth are for felling trees.

As it happens, the series of statements given above may be put in reverse order, as in:

Beavers protect their nest by raising the water level.

...

Beavers fell trees by using their teeth.

Here, the question answered is not the question "Why?", e.g. "Why do beavers fell trees?", but its converse: "How do beavers protect their nests?" So the series we are considering is held together by a pair of complementary questions, "Why?" and "How?" (Johansson 1989: 60). It is important to focus on cases where these two questions belong together because there are cases where they don't (cf. Johansson 1989: 69). I move my hand by contracting certain muscles, but it would be odd to say that I contract these muscles in order to move my hand. Even more so when it comes to the nerve firings by means of which I contract my muscles. At the other end of the spectrum, we often do things in order to achieve something that is quite external to our actions. In such cases, we do A in order that B, but it would be odd to say that we do B by doing A. For instance, someone who is buying food in order to eat it is not eating the food by buying it. As Elizabeth Anscombe says, there is a "break in the series" where the questions "Why?" and "How?" do not any longer belong together (Anscombe 1963: 38). In order to understand functions, we don't need to look beyond this break. We may safely confine ourselves to cases where something does A in order to do B, and thus does B by doing A. Let us say, provisionally:

Process A *contributes to* process B if and only if
A occurs in order that B occurs and B occurs by means of A.

As far as condition (c) is concerned, we may now proceed in two steps. First, we define as follows what it means for an activity of a functional system to be functionally relevant for the system.

> Let an activity of a functional system be *functionally relevant* for this system to the extent to which it contributes to further activities of the system.

Functional relevance is thus defined by means of contribution, which is defined in terms of the "in order to" / "by" relation. We say "to the extent to which" because relevance admits of degrees. According to the above definition, an activity is the more relevant, the more other things the system does in order to or by engaging in it.

Once this notion of relevance is in place, we may say in a second step that if a part of a system contributes to something that is functionally relevant for the system, this is a prima facie reason for assuming that what the part does is its function. Some fine-tuning remains to be done. More will have to be said about when a prima facie reason is sufficient. Also, one might want to include cases where the mere presence of an item, rather than one of its activities, is relevant for a functional whole. But none of this will change the general picture much.

I thus suggest replacing condition (c) as follows:

F is a *constituent function* of B if and only if:

(a) There is a functional whole A.
(b) B is a spatial part and subunit of A.
(c) There is a process G that is sufficiently functionally relevant for A. (A does sufficiently many further things by doing G or in order to do G.)
(d) Instances of B's kind typically do F in order that instances of A's kind do G, so that As do G by means of a B's doing F.

In both (c) and (d), the "in order to" / "by" relation plays an important role. It will pay off to consider it a while longer. The question is: What kind of contribution is expressed by "in order to" and "by"?

6. The Accordion Effect

When we do one thing by doing another thing, it may often seem difficult to decide whether we are doing one thing or two. There is an argument that generally leads to the latter conclusion: Since we are doing the first thing in order to do the second, but not the second in order to do the

first, they must be different things (Goldman 1971). As Anscombe points out, however, this argument pattern is too powerful to be valid (Anscombe 1981: 212). By the same token, we might reason that when someone is unhappy because she is alone, but is not alone because she is unhappy, the lonely and the unhappy must be two different persons.

So it is not the case that whenever something A is done in order to do something B, A and B are two distinct activities. When a beaver is felling a tree in order to build a dam, it is not doing two things at once, as it would when it is digesting food while felling the tree. One might instead say: It is doing one thing that admits of two descriptions. Joel Feinberg has introduced the term "accordion effect" for such cases (Feinberg 1970: 134; cf. Johansson 1989: 68–9). He says: We may stretch and compress the description of an action. We can point at the beaver and describe what it is doing as biting a tree trunk, felling a tree, building a dam, raising the water level. All these descriptions are true of the one thing the beaver is doing.

Yet there is also a clear difference between felling a tree and building a dam. Felling the tree does not take as long as building the dam. This, at least, should be a reason to distinguish them (cf. Davidson 1980: 57). So the situation is complicated. Even though the beaver is not doing two numerically distinct things at once, felling a tree and building a dam, it is doing a short thing, felling a tree, which (for now) coincides with a longer thing, building the dam.

As Ingvar points out, the accordion effect applies to both actions and functions (Johansson 1989: 70). That is, whenever an item performs a function, its functioning may be described in more or less broad terms, just as in the case of an intentional action.

The descriptions generated by the accordion effect, as Feinberg introduces it, are not merely more or less general descriptions of the same. Otherwise, as Michael Thompson has once remarked (in conversation), the accordion effect would be about as interesting as what may be called the Venn-effect: When Peter kisses Mary, his action may be described as "Peter kisses a woman", "Peter kisses a human being", "Peter kisses a mammal" etc.

Feinberg suggests that the accordion effect is generated by taking a narrow description of an action and adding to it its causal consequences, results, or effects. However, there does not seem to be a simple rule to

the effect that whenever someone causes Y by doing X, doing Y is also one of their actions. Not all causal consequences of an action may be used to re-describe this action in terms of them. For one thing, there are cases of intervening agency. The undercover agent who causes someone to sell drugs is not responsible for the drug sale (cf. Feinberg 1970: 173). For another, there are many cases where causing something to happen is just that: causing it to happen. When an agent does something, e.g. cook or do exercises, which merely happens to cause the room temperature to change, it will be misleading to describe her action as changing the room temperature. Further, many of the causal consequences of our actions lie far beyond Anscombe's "break in the series." So, as Ingvar says, "not all consequences of an action add up to a new action" (Johansson 1989: 71). The same holds true for functions. Not all causal consequences of the functioning of an item are also its function.

Ingvar suggests that "the accordion effect ... means that certain actions include other actions ... in time" (Johansson 1989: 74). But this does not mean that conversely, whenever one action includes another action in time, the latter may be described in terms of the former.[1] On the contrary, it is certainly not the case that whenever a process is a spatio-temporal part of another one, the second contributes to the first; at least not in the sense of "contributes" that we are after.

Our brief discussion of the accordion effect has yielded two notions of contribution. There is Feinberg's causal contribution: Something causally contributes to another thing by being one of its causes. This is not the kind of contribution we need here. Our noses cause the glasses we wear to stay where they are, but this is not their function (cf. Wright

[1] It is not even clear whether in all cases where an agent does something in order to do something else, the latter temporally includes the former. Frodo may be said to destroy the ring by going to Mordor and throwing it into the Crack of Doom, but the actual event of destroying the ring only takes seconds, whereas going to Mordor takes weeks. Ingvar might object to this kind of case that the description of an action in terms of its final phase is incomplete, so that for instance the description "Gavrilo Princip killed the Archduke" should be completed by specifying the way in which and the means by which Princip killed the Archduke (Johansson 1989: 238). Yet it does not seem right to require such a completion in Frodo's case. The description "Frodo destroys the ring by throwing it into the Crack of Doom" is, despite actually being false, reasonably complete, and it does not include a reference to a trip to Mordor.

1973: 148). Second, there is Ingvar's mereological contribution: A process may be said to contribute to another one simply by being a spatiotemporal part of it. This is also not what we want. What a part of a system does may be a spatiotemporal part of what the system does without being a function of the part. What our appendix does is part of what our intestines do, but our appendix does not have a function.

The kind of contribution that we are looking for should probably be called *functional contribution*. This is the kind of contribution that is expressed by the "in order to" / "by" relation. So far, I have not done more than distinguishing it from causal and mereological contribution; I have not said much about what it consists in. There might not be that much to be said after all.

7. Practical and Functional Reasoning

Ingvar points out that functions are like actions in that both are subject to the following three questions:

(a) Why is A done? – In order to do B.
(b) How is B done? – By means of doing A.
(c) Why is A done by means of B? (Johansson 1989: 61)

The first two questions are considerably less involved than the third one. By distinguishing them from it, Ingvar shows that one does not need to know the history or purpose of a system in order to be able to account for the functions of its parts. The first two questions concern the function and functioning of a system, only the second concerns an explanation why and how the system and its parts came to have this function. Wright's definition of a function as an activity of a thing that explains why this thing is there (Wright 1973) confuses the first two questions with the third one.

Anyway, in the case of actions, all three questions may be answered by bits of practical reasoning. This is true even if the actions themselves do not involve deliberation. The reason why I am chewing is that I am eating (and chewing is one of the means by which humans eat). This reasoning explains the relation between chewing and eating, even though I don't need to reason in order to eat by chewing.

In practical reasoning, we relate means to ends. It may be used in order to answer both "Why?" questions and "How?" questions. Its general form is this:

For a given goal G,
Doing M leads to G,
Therefore, there is a good prima facie reason for doing M.[1]

Such reasoning is highly defeasible, because there may be many other considerations that speak against doing M. Where the reasoning goes through, it relates a goal G to a subgoal M, so that G may achieved by doing M and M is done in order to achieve G.

Anscombe has pointed out that the interest of such an account of practical reasoning is not that it depicts the actual reasoning of an agent, nor that it helps us find out what we ought to do. What it does is merely to describe "an order which is there whenever actions are done with intentions" (Anscombe 1963: 80). This order is precisely the order we are interested in. It is also present whenever items have functions. It is the order that is there whenever one process occurs in order that another one does, so that the second occurs by means of the first.

Aristotle and Anscombe describe this order for the case of intentional action. What we need to do is to generalize their account, so that it covers other kinds of teleological processes, including functionings (cf. Geach 1975). There are, of course, important differences between actions and other teleological processes. For instance, actions may result from prior deliberation, even if they don't always require it. The teleological processes that go on in animals and plants, however, do not involve any prior deliberation. As a consequence, whereas agents may aim at highly idiosyncratic goals, other teleological beings can only be taken to aim at what instances of their kind are generally known to strive for. We cannot ask a plant what it wants to do, nor can it ask itself, but we know fairly well what plants aim at. For instance, light. A further important difference between actions and functions is thus that the goals of beings other than intentional agents can only be generic. Only conscious agents can choose their goals; other beings just have them, if indeed they have any.

Thus the kind of reasoning that applies to teleological processes in general will have roughly the following form:

For a goal G that beings of kind K are known to aim at,

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[1] My favourite discussion of practical reasoning is Anscombe's *Practical Inference* (1995).

Doing M leads to G,
Therefore, there is a good prima facie reason for assuming that Ks do M.

Of course, one will then have to look and see whether Ks actually do M, rather than achieving G by some other means. Just like practical reasoning, teleological reasoning is highly defeasible. But if Ks actually do M, the bit of reasoning above will help confirming that doing M has a point in their life. A very similar kind of reasoning may also be used to confirm whether what a part of a system does has a function:

For a goal G that Ks are known to aim at,
That a part B of a K does F leads to G,
Therefore, there is a good prima facie reason for assuming that Bs do F.

All in all, this gives us two fairly independent ways of understanding what functional contribution amounts to. First, the descriptions that are generated by the accordion effect may be taken to refer to a hierarchy of processes and their parts. Here, the parts may be taken to functionally contribute to the processes of which they are parts. Second, the relation of contribution may be rendered explicit by a kind of reasoning that is somewhat analogous to practical reasoning.

These have been rather sketchy remarks in the spirit of both Ingvar and Anscombe. Starting from Ingvar's idea that functions are formally similar to actions in that they are described and explained in a similar way, so that both admit of an accordion effect, I have turned to Anscombe's insight that the point of practical reasoning is to render explicit the relation between the different descriptions of an action generated by the accordion effect. The upshot is, roughly, that an item has a function if what it does can be accounted for by functional reasoning. Put differently, a part of a system has a function if what it does is a functional part of what the system does. In order to make this more precise, a lot more would have to be said about functional and practical reasoning. But this would probably involve presenting a lot more of my own work, and I don't want to hijack a Festschrift for doing that.

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