

# Functional Reasoning

## Introduction

Proceeding from the observation that function executions share some important formal features with intentional actions, I will propose an account of functional reasoning that parallels the Aristotelian one of practical reasoning. The idea is to explain what it is for an item to have a function by describing the explanatory nexus in which function ascriptions figure.

A second, closely related point will be that the teleological relations that are rendered explicit in such reasoning also suggest a certain account of natural kinds of living beings. In practical reasoning, we infer intended actions from other such actions. In contrast, teleological reasoning starts from what prototypical instances of a kind of living being do and proceeds to further things that such instances generally do. I will claim that teleological reasoning does not only presuppose some general account of what healthy and typical instances of a kind of living being typically do, but that it is the very means by which we can give and elaborate such an account. The standards for health and typicality that apply to instances of a life form as such are defined recursively. The recursion step is exactly what I call teleological reasoning.

This is a fairly dense paper. I will talk about such seemingly diverse subjects as (1) teleological relations and the logical form of practical reasoning, (2) natural teleology, natural kinds, intrinsic ends and finally what I call “functional reasoning”. This is necessary precisely because functions are not intrinsic features of their bearers taken in isolation. To attribute a function to an item is to allude to a very general framework.

Some important parts of my analysis resemble the account of functions given

by Robert Cummins: to attribute a function to an item is to situate it in a goal directed and hierarchical system. Achievements of complex systems are analyzed in terms of achievements of component systems.<sup>1</sup> My proposal differs from his in that function attributions will always relate to types rather than particular tokens, excluding cases where something is merely accidentally beneficial. Second, the assignment of a goal to a living being, which is the only kind of system considered here, will not be arbitrary or observer-relative. Rather, I will specify an objective method for establishing the set of goals that living beings of certain kinds have.

## 1 Actions

### 1.1 Teleological Structure

The primary function of an item is what it does when it works. When we ascribe a function to an item, we relate it to something that items of that kind are supposed to do. We have a standard story in mind about what such things normally do or have done in such and such normal circumstances.<sup>2</sup> This normal and successful performance of a function will be called a *functioning*. Functionings are in important respects similar to intentional actions.<sup>3</sup> Both admit of what Joel Feinberg has baptized the “accordion effect”. Feinberg puts this in terms of efficient causes and effects:

He turned the key, he opened the door, he startled Paul, he killed Paul—all of these things we might say that Peter *did* with one identical set of bodily movements. Because of the “accordion effect”, we can usually replace an ascription of causal responsibility to a person by an ascription of agency or authorship. We can, if we wish, inflate our conception of an action to include one of its effects, . . .<sup>4</sup>

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<sup>1</sup>“Functional analysis”, *Journal of Philosophy* 72, 1975, 741–765.

<sup>2</sup>Cf. Ruth G. Millikan, *Language, Thought and other Biological Categories*, MIT Press 1984, p. 33.

<sup>3</sup>See Ingvar Johansson, *Ontological Investigations*, Routledge 1989, chpt. 5.

<sup>4</sup>*Doing and Deserving*, Princeton University Press 1970, p. 134.

I should immediately stress that I do not at all believe in the privileged status of bodily movements. When I turn a key, then this particular happening is, I suppose, identical to some particular bodily movement. But this does not license any attempts at reducing actions to such bodily movements. First, identity is a symmetric relation. Instead of saying that everything comes down to “mere bodily movements”, one could therefore as well suggest reducing all such bodily movements to “mere intentional actions”. Second, I do not see any reason to claim that hand movements are in any sense “more bodily” than key turnings. There is nothing non-bodily about turning a key. Finally, it is not always sufficiently clear which happenings are more basic than others. When I pronounce “non” in French in order to find out which muscles I use in doing that, I do something allegedly less bodily (pronouncing “non”) in order to do something more bodily (contracting muscles).<sup>5</sup> Thus I do not agree with Davidson’s account of the “accordion effect” as the possibility of giving several different descriptions of one and the same basic bodily movement.<sup>6</sup>

Further, I would not rely as happily on the notion of a causal relation or link as Feinberg appears to do. Consider my breaking a particular egg, done in order to make an omelette. Is there any sense in which it causes my making of an omelette? Breaking an egg is neither necessary nor sufficient for an omelette making. But still, it may be said to *belong or contribute to* making an omelette.

Hence I would not suggest reducing actions to bodily movements, nor would I try to reduce teleological connections to more basic *causal* links. The bodily movements and the kind of causality that must be considered here will not be less difficult to explicate and not any more naturalistic than the actions and teleological links with which we started. One of the aims of the present paper is to clarify the relation that is involved here. It is explored and rendered visible in practical reasoning.

But anyway, it remains a very interesting and important fact that action descriptions can be “inflated” along certain links. The underlying rule appears to be

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<sup>5</sup>Annette C. Baier, “Ways and means”, *Canadian Journal of Philosophy* 1, 1972, 275–293; p. 278–282.

<sup>6</sup>Cf. his “Agency”, in *Essays on Actions and Events*, Clarendon Press 1980.

something like the following:

Where doing *A* contributes or belongs to *B*, doing *A* often *is* doing *B*.

For instance, if breaking an egg belongs to and contributes to making an omelette, then breaking this egg already *is* making the omelette. While I am breaking the egg, I am making the omelet. But as Elizabeth Anscombe has remarked, there must be an end for applying this rule.<sup>7</sup> It may be true that by turning the key I have startled Paul and thus startling Paul was something that I did. But this cannot hold for every consequence that causally follows from what I did. We had better not be made responsible for every causal consequence of our actions.<sup>8</sup>

The point that I want to stress here is that functionings also admit of the “accordeon effect”. I move my hand, turn the key, open the door. Likewise, my heart contracts its muscle, pumps blood, contributes to my survival.

In both cases, something *A* is done *in order to* achieve something *B*, and conversely, *B* is accomplished *by* doing *A*. Again, the “by” relation is not supposed to be in any sense easier to handle or more naturalistic than the converse “in order to”. Not everything *B* of which we ordinarily say that it happened *by* *A*’s happening stands in a teleological relation to this *A*. For instance, a stone may cause damage by hitting the ground. But it need not have hit the ground in order to cause damage. The “accordeon effect” is only possible because actions and functionings occur for the sake of something. Doing *A* is doing *B* in the relevant sense only when *A* causes *B* and is done *A* occurs in order that *B*. We get closer to an understanding of teleology once we realize that the “in order to / by”-relation makes the “accordeon effect” possible.

This is then the idea from which I take my starting point: actions and functionings both admit of the “accordeon effect” because both occur for the sake of something. By these criteria, we can subsume them both under the more general heading of a “teleological process”. Teleology is often associated with a hierarchy

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<sup>7</sup>*Intention*, Basil Blackwell 1957, p. 40.

<sup>8</sup>Cf. Hannah Ahrendt, *The Human Condition*, University of Chicago Press 1958, §32.

of purposes, human or divine ones being located at its top level, and therefore with a kind of religious or anthropomorphic worldview. I start naturalizing teleology by correcting this picture. I take it that processes are teleological simply by bearing teleological relations to other processes. A process is teleological if and only if it occurs in order that some other process occurs. It need not be beneficial to anything in order to be teleological.

## 1.2 Practical Reasoning

Given the similarities between actions and functionings, let us now ask what might explain them. Anscombe has pointed out that the teleological structure of actions is closely related to what Aristotle has called *practical reasoning* (Intention, p. 80). Practical reasoning proceeds along the teleological links between actions. Since functionings stand in the same kind of relation to another, there should also be an analogous form of reasoning. This is what gives the present paper its title: “Functional Reasoning”. The idea is to elucidate the notion of natural teleology by characterizing canonical forms of practical, teleological and functional reasoning.<sup>9</sup>

I will start by discussing practical reasoning. This will take some time. Practical reasoning differs from theoretical or speculative reasoning (both of which are here taken to be the same). However, it has not always been clear wherein the difference lies. First, it has been assumed that practical reasoning differs in that it always leads to the performance of an action rather than to the truth of a proposition. Second, practical reasoning has been said to follow its own inference rules. As they stand, both assumptions are incorrect.

*The Action as Conclusion.* The claim that practical reasoning is reasoning that leads to an action is often backed up by a passage in Aristotle’s *De Motu Animal-*

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<sup>9</sup>Predictably, all this goes back to Aristotle. After his brief discussion of practical reasoning in *Metaphysics Z7*, 1032b6–10, he remarks that “things which are formed by nature are in a similar situation” (*Z9*, 1034a32–3). Moreover, he does not mean that we describe nature in anthropomorphic terms but conversely, that insofar as we act for reasons, we imitate nature (*Physics B8*).

*ium* 7. Perhaps surprisingly, this passage rather suggests the contrary. It reads as follows:

But how is it that that which thinks sometimes acts, sometimes not, sometimes moves, sometimes not? It seems that something similar happens in the case of those who reason and syllogize about objects that are not subject to change. But in this case the end is a truth seen. For, when one thinks the two premises, one has already thought and constructed the conclusion. In the present case the conclusion which results from the two premises is an action. (701a7-13)

Aristotle begins with the very claim that that which performs practical reasoning sometimes does *not* act accordingly. This is possible because we do not deliberate about facts but only about things that may or may not become real. Indeed, every reader of Aristotle must know that we often fail to act according to our plans and deliberations (*Nicomachean Ethics* H7, 1150b19-21). But what are we to say about the reasoning if it does not result in any conclusion? Without a conclusion, there will be no concluding, and hence no reasoning at all. That is to say that if the conclusion of every chain of practical reasoning were an action, it could not be the case that we fail to act according to our practical reasoning.

Philip Clark has suggested a reasonable alternative.<sup>10</sup> The conclusion of a practical syllogism is not an action, but an action content or, as I would put it, an *action type*. When Aristotle says that sometimes that which thinks does not act, he must be talking about action types rather than particular actions. There is no way of *not* doing a *particular* action. But then practical reasoning does not differ much from theoretical reasoning. The conclusion of a piece of theoretical reasoning is not some particular belief state, but rather something that *should* be believed by anyone who believes the premises.<sup>11</sup> Likewise, the conclusion of a practical syllogism is something that anyone who underwrites the premises *should* do.

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<sup>10</sup>“The action as conclusion”, *Canadian Journal of Philosophy* 31(4), 2001, 481–506.

<sup>11</sup>Only in this sense can Aristotle maintain that someone who believes the conclusions “must” necessarily draw the conclusion (*Nicomachean Ethics* H5, 1147a26–30).

*Rules of Practical Inference.* Now for the second alleged distinctive feature: that practical reasoning follows its own rules. In his seminal paper, Anthony Kenny has suggested that this may be the case.<sup>12</sup> For instance, the following appears to be a valid practical syllogism.

- (1) People of my age need vitamin *V*  
 Pigs tripes contain vitamin *V*  
 Here's some pigs tripes
- 
- For me to eat what's here

However, there is no valid theoretical reasoning of the same form. Consider the following.

- (2) People of my age have a wife  
 There is a wife living in every terrace house  
 There is a terrace house over there
- 
- Me having a wife living in that terrace house

Since there is a form of valid practical reasoning that cannot be filled with speculative content *salva validitate*, practical reasoning must be reasoning of a different form.

What is this form? Where do its rules come from? Consider the following example given by Aristotle:

Why does he walk about after dinner? Because walking prevents the foodstuffs from remaining on the surface at the mouth of the stomach and this is healthy. (Cf. Posterior Analytics *B*11; 94b12-26)

This instance of reasoning has the following form:

- (\*) *A* causes *B*  
*B* contributes to *C*
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- Therefore, *A* contributes to *C*

<sup>12</sup>“Practical inference”, *Analysis* 26(3), 1966, 65–75.

Syllogism (\*) is a perfectly valid *speculative* one. But it does *not* answer the question with which Aristotle started. His question was: “Why does he walk about?” Rather, syllogism (\*) is part of a complex explanation that consists of two different parts:

- (3) For a goal  $G$ ,
- (\*)  $A$  causes  $B$   
 $B$  contributes to  $G$
- 
- Therefore,  $A$  contributes to  $G$
- 
- Therefore, this man performs  $A$

Walking about after dinner causes the foodstuff to enter the mouth of the stomach, which contributes to health (94b18-19). This speculative reasoning is embedded into the following teleological argument: Since walking about after dinner causes a state that contributes to health, this man is walking about after dinner for the sake of health (94b20-21). What we have here is a piece of speculative reasoning incorporated in a practical context. In general, practical reasoning is a calculation of what to do in which speculative reasoning may play an important part.<sup>13</sup> But, as I will argue, there is no specifically practical way of calculating. The calculating bit is done exclusively by following the rules of speculative reasoning.

In a syllogism like (3), we infer that  $A$  may be done given a goal  $G$  from the fact that there is a valid speculative syllogism for the inverse direction, according to which  $G$  follows from  $A$ . The starting point of practical reasoning is the endpoint of the reasoned action, and the starting point of the action is the conclusion of the reasoning. In a way, all teleological movement starts from its end. In procreation, an existing animal causes its likeness, and in executing medical art, the conception of health causes health. In both cases, the end is already realized in some form: in an ancestor or in the mind of the maker.<sup>14</sup> Let me therefore, tentatively, abbreviate a practical inference from  $G$  to  $A$  as  $G < A$ , mirroring its

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<sup>13</sup>Anscombe, *Intention*, p. 60.

<sup>14</sup>Cf. *Nicomachean Ethics* Z2, 1139a31–33; *Metaphysics*, Z7 1032b6–9.

speculative counterpart  $A > G$ .<sup>15</sup>

This is more or less what Kenny has claimed: practical reasoning is, as it were, the mirror image of speculative reasoning. We apply the very same rules that we apply in speculative reasoning, but *backwards*.<sup>16</sup> That however means that there are in fact no separate rules for practical inference. The validity of a specimen of practical reasoning depends completely on the validity of its speculative ingredients.<sup>17</sup> But the possibilities of mirroring speculative inferences are limited. Given that speculatively,  $A > G$ , we cannot be sure that  $A$  is the only or best means by which  $G$  can be attained. Characteristically, a practical syllogism can be rendered invalid by the addition of premises.<sup>18</sup> The reason is that this would amount to adding arbitrary conclusions of the corresponding mirrored speculative syllogism. We cannot infer, practically,  $(G \& H) < A$  from  $G < A$ , because we cannot infer, speculatively,  $A > (G \& H)$  from  $A > G$ .

*Final Causes.* Turning briefly to the more general topic of this paper, let me advance some unguarded remarks concerning the relation between efficient and final causality.

I assume that when we have a complete speculative explanation of why something happened, then this explanation may be given the form of a speculative syllogism. Secondly, I assume that for everything that happens, such an explanation can in principle be given. I do not want to defend these assumptions here, nor need I insist on them in order to maintain the rest of this paper. Here I want to stress that even under such assumptions, there is room for final causality in nature.

Simplifying drastically, let me call the relevant factors that enter the complete speculative explanation of something its *efficient cause*. Then if every practical

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<sup>15</sup>The speculative part need only express the knowledge that  $A$  *contributes to*  $G$ , not that  $A$  *entails*  $G$ . Hence the sign  $>$  does not have a precise logical meaning here.

<sup>16</sup>We do the same as in trial and error testing, drawing inferences to the best explanation, and abductive or “retroductive” reasoning (Peirce, *Collected Papers* 1.74).

<sup>17</sup>Cf. Anscombe, “Practical inference”, in R. Hursthouse, G. Lawrence, and W. Quinn, eds., *Virtues and Reasons*, Clarendon Press 1995.

<sup>18</sup>Cf. Peter T. Geach, “Teleological explanation”, in S. Körner, ed., *Explanation*, Blackwell 1975.

reasoning  $G < A$  must incorporate some speculative reasoning  $A \dots > G$ , then for every final cause  $G$ , there must be a corresponding efficient cause of which  $A$  is a part. Therefore, it should be beyond doubt that final causality is not another factor *besides* efficient causality.  $G$  can *only* be the final cause of  $A$  if  $A$  is a part of the efficient cause of  $G$ .<sup>19</sup> It is perfectly all right to try to explain everything in terms of efficient causality, but this does not at all prove the nonexistence of final causes. In this sense, final causes are irreducible to other causes.<sup>20</sup> To the extent that practical reasoning mirrors speculative reasoning, final causality is simply the mirror image of efficient causality. The question “what is this for” and “how does it work” are complementary.

Aquinas has gone one step further. In his *Summa Theologiae* IaIIae 1,2, he writes that for every efficient cause, there must be a final cause. This is perhaps more plausible when we consider what it means to describe something as the efficient cause of something else. If anything is a cause, then it is a *cause-of-some-effect*. As a cause, it is described with respect to something that it will cause. Hence, to refer to something *qua* efficient cause of something else is to posit the latter as the final cause of the former.

*Mirroring Chains of Reasoning.* I will shortly conclude the first half of this paper by presenting a canonical form of practical reasoning. Before doing that, I had better introduce some qualifications. They are three in number.

(i) I have claimed, or rather confirmed what Kenny has claimed, namely that practical syllogisms mirror chains of speculative reasoning. But what about the kind of practical inference that Georg Hendrik von Wright discusses in his writings?<sup>21</sup> His basic rule for such inferences is that whoever wants an end must also want the necessary means. But where  $A$  is a necessary means for attaining  $G$ , we have the following situation:

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<sup>19</sup>Wolfgang Wieland, *Die aristotelische Physik*, Vandenhoeck und Ruprecht 1992, p. 265.

<sup>20</sup>Cf. Allan Gotthelf, “Aristotle’s conception of final causality”, *Review of Metaphysics* 30, 1976, 226–254.

<sup>21</sup>See “Practical Inference”, in his *Philosophical Papers* vol. 1, Basil Blackwell 1983.

- (4) I need to attain  $G$   
 $G \Rightarrow A$

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Therefore, I need to accept that  $A$

This reasoning already works in the forward gear. Worse still, it ceases to make sense once we mirror it. There is nothing to conclude from  $A$  and  $G \Rightarrow A$ . But there better had be something to conclude, since the mirror image of (4) should be a speculatively valid syllogism. I suggest that von Wright's favorite example is not a case of practical deliberation at all.  $G \Rightarrow A$  does not refer to a relevant teleological connection between  $G$  and  $A$ ; that is, it need not be the case that we do  $G$  in order that  $A$  or vice versa.  $A$  is a necessary consequence of  $G$ , but that does not mean that we choose  $A$  in order that  $G$ . It is completely open what we shall do in order to obtain  $G$ , and this is not what reasoning (4) is about. This is not to criticize von Wright, who has correctly pointed out that he is not really interested in proper *Aristotelian* practical inference. Von Wright is interested in necessary means. But practical deliberation is not about what is necessary. It is about what is *better*.

(ii) More generally, one might want to object that we cannot simply invert chains of speculative reasoning in order to obtain a valid practical syllogism in the more Aristotelian sense. For consider again the following:

- (1) People of my age need vitamin  $V$   
 Pigs tripes contain vitamin  $V$   
 Here's some pigs tripes

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For me to eat what's here

Again, if this is a mirror image of a speculative inference, we should be able to mirror it back. This, however, would yield the following rather useless sequence of sentences.<sup>22</sup>

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<sup>22</sup>Cf. Geach, *Logic Matters*, University of California Press 1980, p. 285-6.

(1') For me to eat what's here

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Here's some pigs tripes  
 Pigs tripes contain vitamin *V*  
 People of my age need vitamin *V*

However, the theoretical reasoning in question was not originally 'mirrored' in that way. The trick was not to invert the complete sequence of sentences of a speculative syllogism, but to insert the relevant piece of speculative reasoning into the pattern given in (3):

(1'') For the goal of getting vitamin *V*,

(\*) Pigs tripes contain vitamin *V*  
 Here's some pigs tripes

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Therefore, eating what's here gives one vitamin *V*

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Therefore, for me to eat what's here

Again, (1'') is a practical syllogism incorporating an ordinary speculative syllogism (\*). Syllogism (\*) is doing the work, the rest of (1'') only providing the practical context. Regarding the current objection, we see that practical inference mirrors speculative reasoning only on a large scale. The incorporated reasoning is not mirrored in its details, but its starting point is taken as the conclusion of the overall practical deliberation and vice versa.

(iii) There is another, related difficulty when it comes to actually mirroring speculative syllogisms. In ordinary reasoning, one may infer  $(A \ \& \ B) > G$  from  $A > G$ . But in practical reasoning it is often inappropriate to license the mirrored inference  $G < (A \ \& \ B)$  given that  $G < A$ . For instance, if I need to do *A*, and *B* already causes *A*, doing *B* and *C* need not be an appropriate means to achieve *A*. But of course, it *is* a way of doing *A*. I may burn down my house in order to roast a chicken.<sup>23</sup> The reason why this appears inappropriate is that burning my house is likely to flout other objectives, such as having a shelter, or saving money. Therefore, we have to assume that practical reasoning is evaluated against

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<sup>23</sup>Cf. Anscombe, "Practical inference".

a backdrop of *all* relevant goals, goods, and ends, including efficiency. Indeed, if there is nothing that speaks against burning my house, it might be quite efficient to roast a chicken that way.

I mention the necessity of introducing some such efficiency clause on the canonical practical reasoning only to put it aside. I will not care about the exact formulation of this condition, since it will not be needed in teleological and functional reasoning.

*The Canonical Practical Syllogism.* This, then, will be our canonical practical syllogism:

- (P) For a set  $\Gamma(\alpha)$  of goals of an agent  $\alpha$ ,  
 given that as a result of speculative reasoning,  
     achieving  $A$  would contribute to some  $G \in \Gamma(\alpha)$   
 modulo *some efficiency condition*
- 
- for  $\alpha$  to achieve  $A$  (in order that  $G$ )

The only further move that I have implicitly made was turning the goal  $G$  into a set of goals  $\Gamma(\alpha)$ . Obviously, there must be some such set of goals (possibly a singleton set) if there is any goal. By this I do not mean a *mathematical* set that could not gain or lose members. Rather,  $\Gamma(\alpha)$  is like a collection of facts or a story about  $\alpha$  that can be continued, interrupted and revised.

Once we have stated the syllogism in terms of  $\Gamma(\alpha)$ , we can see the following connection between the first and the last premise, constituting the practical context into which the speculative bit is inserted. For often, an agent may choose a means for attaining one of his goals without being directly able to attain the means. Then the chosen means will simply be added to the set of goals  $\Gamma(\alpha)$ . Hence, by starting from a set  $\Gamma(\alpha)$  of goals that an agent  $X$  has, we infer *further goals* that he may pursue in order to attain these goals. Since these goals are endpoints of actions, we may also say that in practical reasoning, we relate actions to other actions.<sup>24</sup> Our reasoning is correct when these actions in fact bear the corresponding teleological

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<sup>24</sup>Cf. Thompson, *Naive Action Theory*, Typescript; Forthcoming as part of *Life and Action*, Harvard University Press.

relations to one another. With this in mind, we may simply put the conclusion as follows:

$$(P') \quad \frac{\dots}{\text{to include } A \text{ in } \Gamma(\alpha)}$$

In practical reasoning, we infer goals of an agent from goals of the same agent. In this sense, the structure that is rendered explicit in practical reasoning maps onto the teleological structure of actions that I have described in the beginning of the present paper. For we might as well say that we infer something to do from something else to do; that is, actions from actions. We establish a teleological connection between the goals or action types already included in  $\Gamma(\alpha)$  and the action types or goals that follow as a practical conclusion. Where a chain of practical reasoning leads from some  $G \in \Gamma(\alpha)$  to an  $A$ ,  $\alpha$  may do  $A$  in order to achieve  $G$ . And if this is the case, doing  $A$  is achieving  $G$ .

Establishing the corresponding canonical teleological and functional syllogism will again require some preliminary discussion. I will turn to this now.

## 2 Natural Teleology

When addressing teleological reasoning, I have in mind explanations of the following kind:

- (i) In order to maintain their proper working state, horses need to sleep. Therefore, horses sleep (Cf. Aristotle, *De Somno* 2, 455b15–30).
- (ii) In order to be able to accommodate radical changes in the environment, animals have to be capable of equally radical change. But once a mammal is fully developed, it cannot any longer change thus radically. Therefore, mammals reproduce sexually and die after a certain time (e.g. *De Generatione Animalium* B1, 731b32–732a4).

Again, we have a mirrored speculative inference. That horses sleep contributes efficiently to their maintaining their proper working state. If the latter is one of

the goals that horses may be assumed to have (this will be discussed below), then we may infer that conversely, they sleep in order to maintain their proper working order. Regarding the second example, Aristotle himself remarks that the final cause of reproduction is prior as a goal, but the efficient causes involved are prior in terms of being (*B6*, 741a21–23).

Such pieces of reasoning do not involve the assumption that particular horses ever decide to sleep, even less that any animal decides to reproduce and die. Rather, they explain how some observed trait of a living being fits into a general story about this kind of living being.<sup>25</sup> The conclusion of a teleological syllogism is a fact that we already know by observation. Horses do in fact sleep, the reasoning goes, and this is why. We do not infer things to do from other things to do, but we relate facts to further facts.<sup>26</sup> Whereas practical reasoning is about what should be the case, or at least about what someone wants, teleological reasoning does not warrant any normative and counterfactual claims. It is about what actually is the case, and about the purposes and final causes of what is the case. In teleological reasoning, we do not deliberate what to do. Hence, in contrast to practical deliberation, teleological reasoning does not enter the constitution of its object. The one who does the thinking need not be the one who does the reasoned acting.

This is the reason why no efficiency condition need be given in teleological reasoning. For one thing, we need not assume that nature always finds the most efficient way of doing things. Second, we do not need any condition to exclude gross inefficiency. As long as an observed trait does serve a purpose, this purpose may be taken to be its final cause. We need not consider arbitrary and possibly absurd alternatives to the observed behavior.<sup>27</sup>

But what is probably the most important difference is that practical reasoning is about *particular* agents and their goals, whereas teleological reasoning is about

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<sup>25</sup>Cf. Thompson, *Apprehending Human Form*, Typescript.

<sup>26</sup>Cf. Thompson, “The representation of life”, in R. Hursthouse, G. Lawrence, and W. Quinn, eds., *Virtues and Reasons*, Clarendon Press 1995, p. 293.

<sup>27</sup>I owe this point to John Pollock.

*kinds* of beings.<sup>28</sup> In practical reasoning, we infer particular things to be done from further things to be done by a particular agent. In teleological reasoning, we infer what beings of some general type generally do from other things they generally do. We do not care about the specific goals and interests of particular horses, but only about what “the horse in general” does. Although we reason in order to explain some particular observed behavior, we do this by stating the general point in doing such a thing. We situate it in the general story about the kind of being under investigation. Teleological reasoning is not about fitting actions into particular plans, but about fitting observed behavior into general stories.<sup>29</sup>

Despite of all these differences, however, there is one striking formal similarity. In both practical and teleological reasoning, the conclusion may be added to the set of goals with which the reasoning starts. In practical reasoning, we infer particular goals from other particular goals. In teleological reasoning, we infer what things of a kind typically do from other things that they typically do. I will now justify the assimilation of what things of a kind typically do to what their goals are.

## 2.1 Natural Kinds

Since teleological reasoning is about kinds of things rather than particular specimens, any account of biological functions must address the topic of generic types, species, or natural kinds. I suspect that this is the reason why discussions of biological function turn so easily into debates on evolution. In order to talk about functions, we need a way of referring to kinds rather than to isolated instances, and one way of doing this is to talk about what Millikan calls “reproductively established families” (op. cit. p. 23–8). I do not want to deny beforehand that this may be a necessary second step in the discussion. But I insist on postponing it. An account of what it is to have a biological function should not presuppose any

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<sup>28</sup>Cf. William J. Fitzpatrick, *Teleology and the Norms of Nature*, Garland Publishing 2000, p. 154–8.

<sup>29</sup>I may also explain my actions by saying that this is “what one does” under certain circumstances, thereby situating my action in a more general account of human life.

facts about evolution. Evolutionary biology may turn out to explain why biological items actually have functions. But to explain the presence of a function and its bearer is not to say what functions are. Rather, in order to give such explanations, we first need an independent account of what it is that we are supposed to explain. And even if evolution should be the only possible explanation of why there are kinds and species of living beings, we would still need an account of what to explain (kinds and species) before we give such an explanation. For these reasons, I will avoid any further reference to evolution in this paper.

*Prototypical Instances.* Pending an explanation of why such things as functionings and biological kinds happen to be there, we still need some account of what it means to be a typical or atypical instance of a natural kind.

I cannot discuss every possible or even reasonable account here. Let it suffice to say that what things of a kind typically do is not what most specimens of this kind do, are disposed to do, or are capable or doing. “Typically” does not mean “mostly”, “usually” or “normally”. For instance, we may claim that fertilizing eggs is what sperm cells do. Taken literally, this is an obvious falsehood, since only few sperm cells actually fertilize an egg. Some sperm cells will not be disposed to fertilize an egg even in the weakest possible sense of “disposed to”. And none, I suppose, fertilizes *eggs* (in the plural). This only means that we have to find another reading for such sentences.

In general, what things of a kind “typically” do will be what *healthy* instances of this kind are supposed to do. We may also put this in terms of paradigmatic or *prototypical* instances. A prototypical sperm cell fertilizes an egg; a prototypical horse sleeps now and then, and a prototypical mammal reproduces. When we classify living beings as instances of a kinds, we associate them with prototypical instances of this kind. That is, we describe them relative to a standard of health that applies to all specimens of that kind as such.<sup>30</sup>

This makes the following objection inevitable. Our task is to establish a setting

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<sup>30</sup>Thompson, “Representation of Life”, p. 295. Note that I say “*a*” rather than “*the* prototypical instance”. Often, there will not be one most prototypical *S*. For instance, most animals come in a male and a female version, neither of which is deformed relative to the other.

in which one may talk about functions and more generally, about natural teleology. We have noted that natural teleology is attributed not to particular items but to kinds of items. Then I have suggested an account of what it is to be of a kind that relies on the notion of a prototypical, healthy instance of that kind. Are we not going round in circles, then? For to be healthy should amount to having everything perform its function. Hence, we need an account of teleology and functionality before we can give an account of what it means to be a healthy instance of a kind of living being.

My answer to this is that we are indeed going round in circles. For one thing, I doubt that we have a reasonable alternative. For another, this circularity is one of the main themes of this paper. In practical reasoning, I have said, we infer actions from actions. In teleological reasoning, we infer what prototypical instances of a kind do from what else they do. Hence, *teleological reasoning is the very means by which we may establish the standards of health* for a given kind of living being. If there is something that healthy instances of *S* are known to do and something else that would contribute to that, then this other thing may perhaps belong to the things that healthy *S*s do. By applying teleological reasoning, we flesh out the notion of health, relative to a certain form of life *S*. The resulting description sets a standard for any instance of the respective life form.

*Starting Point.* Hence, we establish a general account of what instances of a kind of living beings do by a sort of recursive definition. Given a suitable starting point, we can infer by applying teleological reasoning what healthy instances do from what else they do. This is why general accounts of living beings constitute teleological systems, why they “give the ‘how’ of what happens in a life cycle”.<sup>31</sup> But where to get the required starting point? Is that not the point where we finally have to resort to a system of values that *we* hold?

Often we will simply *have* some such initial knowledge. When encountering a new kind of fish, we can start with our general knowledge about what other kinds of fish do. We may have to correct some of our initial assumptions, but we will

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<sup>31</sup>Philippa Foot, *Natural Goodness*, Clarendon Press 2001, p. 32.

have something to begin with. Imagine, however, that we need some initial fact about a yet completely unknown form of life. We can point at it, but we do not at all know what it is and does. I do not know what assumptions we should plausibly make, besides of course this one: that what we have here is a kind of *living being*. We cannot point at a mere “this” anyway; we have to start with some such sortal concept, pointing at “this such”, “this living being”. I take it that it is not even a matter of empirical observation whether something is a living being or not. It may be a matter of observation to determine to which kind of living being something belongs. But we could not observe that something is alive *simpliciter*, without knowing anything about the life it leads. And we need not observe anything in order to know some basic facts about what it is to be alive, since we are living beings ourselves. We may know without observation what it is to be alive.<sup>32</sup>

But what is it to be alive? I suggest that to identify something as a living being is to assume that it is somehow engaged in making more of its life form possible.<sup>33</sup> (This is only a necessary condition.)

Consequently, to treat something as being alive is to assume that it underlies some standards of health. For if something has the task of making more of its own life possible, then there must be some standard according to which it may be said to have succeeded in doing that. This will be the standard of health that also applies to itself.

The starting point will then be that, assuming this is a healthy instance of its kind, *whatever it does will have as its most general point that it makes more of whatever it typically does possible*. This is not a claim about some particular value that we ourselves hold. Rather, self-perpetuation is supposed to be inherent in the very meaning of the sortal term “living being”. It may remain completely open what kind of life a living being perpetuates and by what means it does this. But interestingly, the answer to these two questions will converge. In the end, it does what it does *in order to do and by doing* what it does.

*Intrinsic Ends.* Let us assume, then, that the most general goal of an instance of

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<sup>32</sup>Cf. Thompson, *Apprehending Human Form*, Typescript.

<sup>33</sup>Cf. Aristotle, *De Anima B4*, 415a26-b1.

a life form *S* is to perpetuate this very life form. Whenever we point at a living being, we may say that “this is right now engaged in making more of its kind possible”. We can do this thanks to the “accordion effect”. For what it does will somehow contribute to the perpetuation of its life form. Hence, what it does will *be* perpetuating its life form.

The most general end of what an instance of a life form *S* does is the very same life form *S*. In this sense, Aristotle can claim that the fully developed form or soul of a living being is also its final cause.<sup>34</sup> I suggest that where the formal and final cause of something is the same, we are justified in calling this cause its *intrinsic end*.<sup>35</sup> The intrinsic end of a living being *S* is the form of a healthy, flawless, and prototypical *S*.

## 2.2 The Canonical Teleological and Functional Syllogism

Let me now resume what I have said, with a view to finally establishing a canonical form of teleological and functional reasoning. Teleological reasoning starts with some knowledge about what healthy and prototypical instances of a life form *S* are known to do. By going through a chain of teleological reasoning, we situate

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<sup>34</sup>*Physics* B8 199a30-1. In *De Anima* B4, Aristotle tells us more generally that the soul is at the same time the source of movement, the end, and the essence of the living body (415b9-20). In *Physics* B7, he writes that “in many cases, the last three causes [i.e. the formal, final and efficient cause] come to the same thing. What a thing is and its purpose are the same, and the original source of change is, in terms of form, the same as these two: after all, it is a man who generates a man”, adding that “things which are not like this are not the province of natural science” (198a24–8). In *Metaphysics* H4, 1044b1, Aristotle writes that the form and *telos* of man are “perhaps” the same and in *De Generatione Animalium* A1, 715a4–5, he maintains that *ousia* and the *telos* of an animal or organ are “almost one and the same”. This also explains why Aristotle usually does not distinguish between final and formal causes in cases of natural or teleological change (e.g. *Metaphysics* Z7; *De Generatione Animalium* B1, 733b25–6).

<sup>35</sup>Cf. Kant, *Kritik der Urteilskraft*, §§64 and 65. I am thereby paying what Peter McLaughlin calls “the real metaphysical cost of functional explanation”: “a commitment to entities that can stop a functional regress”, that “have an instrumental relation to themselves” (*What Functions Explain*, Cambridge University Press 2001, p. 211). These entities, I should note, are not particular organisms, but *life forms*.

an observed fact within this more general story. If there is an according to which the observed trait contributes to something that healthy  $S$ s are, in general, known to do, then the observed trait may itself be included among the things that  $S$ s typically do. Since all that is at stake is the relation of observed behavior to already assumed or known facts, the efficiency clause can be dropped. Hence, we obtain the following canonical form of *teleological reasoning*.

- (T) For a set  $\Gamma(S)$  of things that a prototypical  $S$  does,  
 given that some particular  $S$  is known to do  $A$  and  
 that as a result of speculative reasoning,  
 a prototypical  $S$ 's doing  $A$  would contribute to some  $G \in \Gamma(S)$
- 
- to include the fact that a prototypical  $S$  does  $A$  in  $\Gamma(S)$

It is only a small step from here to *functional reasoning*.

- (F) For a set  $\Gamma(S)$  of things that a prototypical  $S$  does,  
 given that some particular  $F$  is known to do  $A$  and  
 that as a result of speculative reasoning,  
 a prototypical  $F$ 's doing  $A$  would contribute to some  $G \in \Gamma(S)$
- 
- to include the fact that a prototypical  $F$  does  $A$  in  $\Gamma(S)$

Again, we start with the observation of a particular trait, behavior or property of an  $F$ . The conclusion may then be that this particular trait is not merely particular but that it has a more general point. And just as in teleological reasoning, the one who does the reasoning is not the one who does the acting (or functioning).

The difference between teleological and functional reasoning is that functionings do *not* contribute to the goals of the function bearer  $F$ , but to the goals of some life form  $S$  *other than*  $F$ . Indeed,  $F$  will most often not be a living being. Syllogism (F) is not about fitting observed traits into a story about  $F$ 's, but about fitting traits of an item into the story about *another* item.<sup>36</sup>

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<sup>36</sup>Aristotle draws this kind of distinction in *De Generatione Animalium* B6. First, he writes, there are those things whose goal is their own form. Second, there are tools that contribute to a goal that is not their intrinsic end (742a28–34).

What else can we say about the relation between the living being described,  $S$ , and the function bearer  $F$ ? In some cases, both seem to coincide, as when we say that the mating behavior or the death of an animal has this and that function. But then it is still not the case that the animal has the function to reproduce or to die; not everything that has a goal has a function. The animal's *behavior* has a function, and the behavior differs from the animal. Intentional actions are bits of functional behavior. Agents can assign functions to their own behavior by performing practical reasoning. Looking back, it is indeed a remarkable feat of agents to get themselves in the position of both the beneficiary and the imposer of functions. But they would not have that capacity if there were no more basic biological functions of the kind described here.

In a number of cases, the function bearer will be a part of the living being in question, as with our bodily organs and tissues. Sometimes, however, the function bearer will not be properly called a part even when inside the organism, like certain enzymes and vitamins. In still other cases, the function bearer may even be located outside the organism of the relevant life form. This is the case with spider webs, beaver dams, the galls that gall wasps use, and the empty sea shells that serve as a shelter for hermit crabs.

## Conclusion

I have not given a definition of the kind “the / a function of an  $F$  is  $X$  if and only if ...”. The term “function” does not appear in the canonical functional syllogism. This should not come as a surprise, since “intention” does not usually appear in practical reasoning, and “cause” need not appear in speculative reasoning. Functional explanation relates items to the wider context of a life form rather than explicitly specifying “their function”.

In order to understand what we mean when we talk about biological functions, we therefore need to understand the status of general descriptions of living beings. The life description of “the  $S$ ” articulates standards for being an  $S$ , such that an  $S$ , if it does not comply with this description, is atypical as an  $S$ . Such a life

form description is used in teleological reasoning, but it is also established by this very same kind of reasoning. Kinds of living beings are described recursively, possibly starting with the only assumption that what we have here is something that is alive. The description of “the *S*” articulates what I have called the *intrinsic end* of an *S*: the fully developed form of “the *S*”, which is also the final cause of every particular *S*.<sup>37</sup>

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