Citation for published version (APA):
Fundamental Powers, Evolved Powers, and Mental Powers

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13 December 2017

Abstract

Powers have, in recent years, become a central component of many philosophers’ ontology of properties. While I have argued that powers exist at the fundamental level of properties, many other theorists of powers hold that there are non-fundamental powers also. In this paper I articulate my reasons for being sceptical about the existing reasons for holding that there are non-fundamental powers. However, I also want to promote a different argument for the existence of a certain class of non-fundamental powers: properties whose existence and nature have natural selection to thank. Such properties will include functional properties of organisms and so may include their mental properties also.

1 Introduction

The ontology of powers has become popular in the last decade. While the initial focus was on its benefits as regards our understanding of the identity of properties and of the laws of nature, this ontology has been applied to an increasingly broad range of philosophical topics from causation (Mumford and Anjum 2010, 2011) to the philosophy of mind (Ellis 2002, 2013; Groff 2013) and even to ethics and political philosophy (Anjum et al. 2013). While I have myself made the case for this ontology (Bird 2007), I am sceptical about many of its more specific applications, especially as regards phenomena at an ontologically macro scale—such as causation between stones and bottles or free-will. To be more precise, I regard the extension of the ontology from the fundamental properties to macro properties as undermotivated—in the extant literature I don’t see any good arguments for doing so (Bird 2016). In this paper I articulate my reasons for scepticism. However, my arguments do not rule out the possibility of macro powers. We just need better, more discriminating arguments for them. So in the later parts of this paper I develop new reasons for thinking that some macro properties are powers. The properties in question are those sparse properties that have functions: properties that exist because they have been selected for their function are powers.

2 Are there macro powers?

In this section I briefly introduce the ontology of powers and sketch what I take to be the good reasons for thinking that there are powers. These arguments deliver powers only at the fundamental level. I then look at the arguments that can be found for the
conclusion that some non-fundamental properties are powers. None of these are sound.

2.1 What are Powers?

First let us distinguish between (in my terminology) ontic and predicatory properties, which roughly corresponds to Lewis’s (1986) distinction between sparse and abundant properties. One can use ‘property’ loosely, so that more or less any predicate defines a property—so some things have the property of being grue, in this sense. That’s the predicatory or abundant use of ‘property’. On the other hand we can use the term ‘property’ with ontological import, restricting its use to entities that are components of our ontology. This is the sparse or ontic sense of ‘property’.¹

There is no property of being grue in this sense. There may well be an ontic or sparse property of being green (this is a matter of debate). There very probably is an ontic property of having a spin quantum number (spin) of 1/2.

How do we tell when a property really is ontic/sparse? The standard test is whether the alleged property make a contribution to causal and nomic explanations, e.g. by being a component in a law of nature. So if our best explanatory scientific theories employs a property in a non-redundant way in such explanations, that is strong evidence that the property really is ontic.²

Now we can articulate what a power is: a power is a sparse property that has a dispositional essence.³ Powers contrast with properties that are quiddities. A quiddity is a property with primitive identity and without a non-trivial essence. A power therefore has the same dispositional character across possible worlds, whereas a quiddity does not. Powers therefore have this important characteristic:

(Modal Fixity) Powers are modally fixed properties (have invariant characters across possible worlds).

The powers ontology stands in opposition to the ontological views of, for example, David Lewis and David Armstrong. Both hold properties, fundamental ones at least, to be quiddities. It is not part of their essential nature or identity to engage in any particular dispositional, causal, or nomic relations with other properties. Such relations are the result, on their views, of the contingent laws of nature. According to Lewis the instantiation of a property in the Humean mosaic is a matter that is, modally, entirely independent of the instantiation of that property anywhere else in the Humean mosaic and also independent of the instantiation of any other wholly distinct property at that or any other point in the Humean mosaic. Armstrong’s view is similar except that the pattern of instantiation in a particular world is determined by the laws of nature there. But the latter are contingent and provide no constraints

¹Lewis does not think that there is an ontological distinction between the abundant and sparse properties—they are all sets, just that the sparse properties are special, they are natural. Armstrong (1978) on the other hand sees an ontological distinction—the sparse properties are universals and the abundant properties are not. I side with Armstrong on this. C.f. Schaffer 2004

²Must any ontic/sparse property be involved in some law or explanation? Those who have a quiddistic conception of such properties, among whom I include Armstrong, will hold that it is not essential to such properties that they do so. The dispositional essentialist will say that it is necessary that any property is engaged in some such relation. So although in my view there is a necessary connection between sparse properties and laws/explanations, I do not regard this as an analytic truth about the concept ‘sparse property’.

³The term ‘power’ can and has been used by philosophers in other ways, and this can and does lead to confusion. For that reason, I would prefer to use the term ‘[a] potency’ instead of ‘[a] power’ so defined, but this usage has, regrettably, not caught on.
between worlds. For both Lewis and Armstrong, properties, being quiddities, do not show modal fixity.

2.2 Arguments for Powers

Why should we accept that any properties are powers? There are two principal reasons that I think are sound. And I mention a third reason that is more speculative.

First, with powers we have an account of property identity. The notion of a quiddity, a property with primitive identity looks ad hoc by comparison. It leads to the possibility that two worlds could be genuinely distinct, but two properties swap their nomic (and so causal) roles entirely. For example, another world could be exactly like ours except that the property that is inertial mass in our world would behave like electric charge in that world while electric charge behaves like inertial mass there. In that world two bodies with the same inertial mass would repel each other. But that mass would play no role in determining how a body’s motion would respond to a force—instead charge does that. That world is a genuinely distinct world according to the quidditist. But according to the powers theorist it is not genuinely distinct—what the property does (more precisely, what it is disposed to do) is what the property is.

Secondly, the existence of powers provides an attractive account of the laws of nature. The dispositional character of properties explains why they engage in regular behaviour with one another. In particular it explains why we associate some kind of necessity with the laws of nature, whereas the regularity view of Lewis denies any such necessity and Armstrong’s ersatz version can be shown to be unstable: either it reduces to regularity or it requires the existence of at least one power.

A further argument in favour of the ontology of powers is that it may be able to provide an account of possibility and necessity, one with advantages over Lewis’s modal realism. Dispositions are linked with counterfactual and subjunctive possibilities. If powers are ontologically fundamental, then this fact about dispositions may be used to ground facts about what is possible (see Bird 2007: 218; Borghini and Williams 2008; and Vetter 2015).

I mention these arguments not because I expect these short sketches to be convincing, but to give a notion of what the arguments are and how they intend to show the existence of powers.

2.3 Fundamental and Macro Powers?

The central question of this paper is whether there are any powers that are not fundamental properties. Let us call non-fundamental properties ‘macro’ properties, and likewise non-fundamental powers ‘macro’ powers. Let us then distinguish between two theses concerning powers:

The Fundamental Powers Thesis (FundPT). Many fundamental natural properties are powers.

The Macro Powers Thesis (MacroPT). Many macro properties are powers (such properties play a role in explaining important phenomena involving macro entities, such as causation, intentionality and free will).

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4See Wang (2015) for a criticism of this argument for powers.
How do the arguments just mentioned bear on these two theses? If sound they support FundPT. Indeed the argument from property identity supports a strong version of FundPT, that all fundamental properties are powers. However, none supports MacroPT.

Let us assume that the existence of fundamental powers is established by the fact that they explain the fundamental laws of nature. The non-fundamental laws supervene on the fundamental laws of nature. So the hypothesis of fundamental powers explains the existence of the non-fundamental laws also. There is no need to hypothesize the existence of non-fundamental powers also. Thus the argument from the laws of nature supports only FundPT, not MacroPT.

Now let us assume that we have established the existence of fundamental powers thanks to the argument from property identity. Does not the same argument establish the existence of non-fundamental powers? If quiddities are a poor account of property identity, do we not need powers to account for property identity for all properties? No, for that assumes that the only two options regarding property identity are quidditism and dispositional essentialism. That may be plausible for fundamental properties. But it certainly is not the case for non-fundamental properties. For such properties, the manner in which they supervene on the fundamental properties provides a third answer. So if one property is compounded out of other properties, then the identity of the property may be given by the nature of that composition.

Furthermore, the argument that powers provide an attractive account of modality, if sound, supports FundPT. But it does not support MacroPT. For what is possible or not regarding things with non-fundamental properties supervenes on what is possible or not regarding things with fundamental properties. There are no possibilities left unaccounted for by fundamental powers, to account for which we would have to posit macro powers.

So, the arguments from property identity, the laws of nature, and modality, even if they do establish FundPT, do not—as they stand—provide any support for MacroPT.\footnote{My supervenience claims may be open to challenge. Perhaps there are laws and explanations concerning macro objects and their properties that do not supervene on the fundamental laws of nature or explanations concerning fundamental objects and properties. (Maybe the examples I go on to discuss in Section 3 are examples.) Similarly, perhaps there are possibilities for macro objects that do not supervene on possibilities for fundamental objects. Such arguments need to be made and then deployed in the relevant cases to show that as a consequence we need macro powers. But they have not yet been forthcoming.} Other arguments are needed to establish the latter. I now look at these.

### 2.4 Arguments for MacroPT?

There are three arguments one can distil from the literature. In summary these are as follows:

1. Properties supervening on powers will also be powers. So if the fundamental properties are powers, so also are macro properties.
2. The existence of macro dispositions shows that there are macro powers.
3. The distinctive features of powers (e.g. direction, intensity, ability to exist unmanifested) explain important macro phenomena. Therefore the relevant macro properties are powers.
First argument

It is tempting to think that once one has established that the fundamental properties are powers then the rest follow as a matter of course. But this is simply not correct. For there are many ways in which one property might supervene on powers without itself being a power. To see this one need only see that even simple ways of composing dispositions do not deliver dispositions. And so composing properties with dispositional essences cannot be guaranteed to deliver a composed property with a dispositional essence. For example, the conjunction of two dispositions is not itself a disposition. Note first that the conjunction of two counterfactuals A→B & C→D is not equivalent to A&B → C&D or any other such counterfactual. If we could equate dispositions and counterfactuals, as the simple conditional analysis of dispositions holds, then if would follow that not all compounds of dispositions are themselves dispositions. Now, the simple conditional analysis is strictly false, because of the possibility of interferers (finks, masks/antidotes). But that does not help the case for composing dispositions. That’s because cases where counterfactuals fail to compose are not all cases of interference with the underlying dispositions. If dispositions do not generally compose to form new dispositions, then we cannot expect dispositional essences to compose to form new dispositional essences. Furthermore, even if dispositions did compose neatly to form new dispositions, would that show that a composition of powers is also a power? It would need to be argued that the resulting compound is itself a sparse property. But arbitrary compounds of powers would not form sparse properties. And even if it is sparse, why would the compound property have its dispositional character essentially? Its essence might be just that it is the compound that it is.

Second argument

Many authors writing on the topic of powers treat ‘power’ and ‘disposition’ as synonymous (e.g. Marmodoro 2010; Mumford and Anjum 2011). And since dispositions are common at the macro level, then so are powers. This argument is not made explicitly, but it is implicit in many discussions. And it is clearly unsound. One could of course choose to take ‘disposition’ to mean what ‘power’ means: a property with a dispositional essence or nature. But then it is not at all clear that there are any dispositions (in this sense) at a macro level—that is just what we want to establish. Our normal use of ‘disposition’ is not like this: it carries no implication that dispositions are sparse properties, nor that if sparse they have any particular kind of essence. Is fragility a sparse property rather than an abundant property? It isn’t at all clear that it is. The rear brakes on my bicycle are disposed to rub when accelerating round a corner. Is there a sparse property of being disposed to have rubbing rear brakes when accelerating round a corner? I doubt it. Even so, let us say that ‘fragility’, at least, does name a sparse property (though I do not think that it does—see below). It is still not clear that it must name a property whose essence is dispositional. According to both Lewis and Armstrong there are dispositions such as fragility, but none of them are essentially dispositional—just as there are philosophers, none of whom is essentially philosophical. On their view, a sparse property or complex of properties has its dispositional character in virtue of the contingent laws of nature. In a different world with different laws, the same property or complex will have a different dispositional character. In so thinking Lewis and Armstrong are not being

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6It may well have the dispositional character necessarily, but that is different.
incoherent. Our ordinary term ‘disposition’ is metaphysically neutral and cannot be co-opted in favour of the powers ontology. A property may be a disposition without being essentially that disposition; it will only accidentally be that disposition. And that is a view that can be shared by those who accept Fund PT. It might turn out that a sparse property with a dispositional character has that character necessarily, if the laws are all necessary. Still, that does not give that property a dispositional essence. In summary, not all dispositions are powers.

In summary, a disposition may be:

- **abundant**—not a sparse property; or
- **accidental**—sparse, but not essentially dispositional; or
- a **power**—sparse and essentially dispositional.

Dispositions that are not powers are ‘mere’ dispositions. What is true of some dispositions, mere dispositions, may not be true of powers. In particular, the fact that some dispositions are macro properties does not show that there are macro powers—those dispositions may be mere dispositions.

**Third argument**

The most explicit argument made for MacroPT stems from the use to which powers are put in theories concerning macro phenomena, such as causation, intentionality, meaning, and so forth. Given that powers can provide a satisfying account of such phenomena, that is a reason to believe that they exist. For example, some philosophers have attempted to show that intentionality can be accounted for by powers (Ellis 2002). For a power, having a dispositional essence, has the feature of intentionality, its about-ness, that it is directed towards a certain object or outcome. A thought may be about or directed towards a certain person, for example, and fragility is, in a sense, directed towards breaking. And in both intentional and dispositional states, that object or outcome may be non-actual: I am thinking of the fictional Anna Karenina; the fragile object never is broken.

Even if plausible, that does not give us a reason to believe in powers. For this analogy trades on the dispositional character of a property, it does not in any way depend on that character being essential. That is, this argument does not establish the modal fixity of the relevant properties, the distinctive feature of powers. For example, the dispositional essentialist thinks that the property we name ‘charge’ has a dispositional essence—the disposition to attract objects with an opposite charge. The categoricalist thinks instead that this property is a quiddity which contingently gives rise to the disposition to attract oppositely charged objects, thanks to the contingent laws of nature. On both views there is a disposition, on both views the disposition ‘points to’ a possible outcome (attracting oppositely charged objects), and on both views that potential outcome can be non-actual (a lone object with a charge). The same will go for macro dispositions. As far as the project of explaining macro phenomena is concerned, there is no difference between the claim that the explanantia are macro-powers and the claim that the explanantia are quiddities (or complexes thereof) plus underlying laws of nature.

So the conclusion of this section is that no arguments available so far give us good reason to believe that there are non-fundamental powers.
3 Macro powers after all?

The conclusion of the preceding section does not rule out the possibility of macro powers. It demands that we remain agnostic unless a new argument is forthcoming. The purpose of this section is to provide that new argument. I claim that evolved functional properties are powers.

Let us first review what success would look like. We would have an argument that shows that some property is:

(i) non-fundamental. The existence of the property and its instantiation supervene on the fundamental properties and their instantiations.
(ii) genuinely sparse. The property is not abundant (and so not a mere disposition for that reason).
(iii) essentially dispositional. The property’s identity is therefore not constituted by its mode of supervenience.

The challenge we face is that of showing how (i) and (iii) can be true together. For (i) requires the property to be supervenient, while (iii) requires that the relationship of supervenience does not fix the property’s identity and essence.

3.1 Proposal: evolved functional properties in biology are macro powers

I purpose that requirements (i)–(iii) above are satisfied by evolved functional properties (cf. Vicente 2002, 2004; Bird 2008). More generally if a sparse property exists in virtue of objects being selected for their dispositional characteristics, then that property will satisfy those requirements.

Consider sightedness, the property of having sight, the capacity for vision. Natural selection explains the development of vision in that large majority of animal species that are sighted. Initially photoreceptors, then directional photoreceptors, would have evolved in aquatic animals, then low resolution vision, and then higher resolution. In each case the development meant that animals would be able to gather more information from their environments that would aid survival and reproduction. That sightedness is a natural and so a sparse property is evidenced by the role that sightedness plays in scientific explanations, both as an explanans and as an explanandum.

Sightedness obviously explains instances of the behaviour of individuals. It explains how animals find food, seek and attract a mate, escape from a predator, and so on. For the same reasons sightedness explains also characteristic behaviours and other traits of animal kinds. It explains the structure of the stick insect, whose camouflage allows it to escape detection by sighted predators. If the predators were not sighted but used other means of detection, such as smell, then there would have been no selective pressure to evolve that distinctive appearance. It explains the coloration of flowers, which attracts insects that will aid in pollination. It also explains the coloration of the non-venomous scarlet king snake which mimics the appearance of the venomous coral snake in order to deter predation. Differences in visual capacities explain differences in behavioural capacities—why owls can hunt at night whereas the osprey hunts during the day. The osprey’s sight is also particularly well-adapted to spotting objects beneath the surface of the water compared to other birds of prey.
Sightedness is also an explanandum. Natural selection clearly explains why many species have sight. Nonetheless, some species are not sighted, such as some moles, as well as deep-sea lobsters (Thaumastochelidae), several other species of sea animals, and some flatworms. This too can be explained, by the fact that such species live in lightless environments.

The key feature of sight exploited in these explanations is the fact that sight is a capacity to gain information using light. It is this feature that explains the increased fitness of better sighted predators and the increased fitness of better camouflaged prey. It also explains why species that inhabit lightless environments are sightless.7

In summary, the property of sightedness:

(i) is not fundamental. That something has sight supervenes on its structure and on the properties of its parts.
(ii) is a natural property, and so is sparse. It is the product of natural selection and it enters into causal and other scientific explanations, and so is plausibly sparse.
(iii) has a dispositional/functional essence. Plausibly sight is a property whose essence is the capacity to use the light reflected/emitted by objects to gain information about them.

So, prima facie, sightedness meets the requirements for being a macro power.

### 3.2 A counterproposal: reduction to realizers (causal bases)

(i)–(iii) look plausible for sightedness. I aim to strengthen the argument in the next subsection. To help to do so it will be useful to look at a counterproposal that would deny (ii) and (iii).

Sightedness is multiply realized. Different kinds of animal have sight in virtue of quite different structures. It is true that convergent evolution has produced similar organs and processes of sight by different evolutionary routes, e.g. vertebrate eyes and octopus eyes are surprisingly similar. But sight in arthropods is very different from either. According to this counterproposal, sight is disjunctive between different kinds of sight (vertebrate sight, arthropod sight, and many others), so (ii) is false. A fortiori (iii) is false. Each type of sight is identical to its realizer (causal base). (So (iii) is false even for each kind of sight, considered as a distinct property.)

According to the counterproposal sight is comparable to fragility. Fragility is multiple realizable. Different kinds of object have fragility in virtue of different structures. For example, consider the following fragile objects: a desiccated leaf and an acicular crystal (an acicular crystal is a crystal that grows many long thin needles, and so has a porcupine appearance). The fragility of leaf has a different causal basis from the fragility of the crystal. Fragility does not provide an explanation of breaking in each beyond the explanation provided by each kind of causal basis, each realizer type. Fragility is therefore not a natural, sparse property; it is an abundant disposition.

One may further suggest that if there are any natural fragility-related properties here, these there are the different kinds of fragility related to the different realizer types. So there is fragility-of-desiccated-leaves and fragility-of-acicular-crystals etc. These will be type-identical to their causal basis (realizer) types.

7Darwin proposed that natural selection as well as promoting sight in some animals also accelerates the loss of vision in animals such as sightless moles.
3.3 Argument for (ii)/(iii)

The challenge for the view that the property of having sight is a power is to explain why sightedness has a unity that fragility lacks. The response to this challenge starts by pointing out that although the types of sight in the various families, genera, and species of animals, are different, there is a commonality to explanations involving sight that is lacking from explanations involving fragility. This commonality is their shared evolutionary story.

The reason why the evolutionary story provides an explanatory commonality is that explanations involving natural selection are largely independent of the details of the causal bases (realizers) that realize the capacity in question. The selective advantage of being able to see is insensitive to the mechanism whereby a creature does the seeing. This is because, as Alexander Rosenberg (1994: 25) puts it, ‘selection for function is blind to structure’. Consequently sight and other evolved functional properties transcend their various causal bases.

This is evidenced by the fact that explanations involving sightedness can encompass different types of realizer. First, consider sightedness as an explanans. When explaining how the form of the stick insect provides protection against sighted predators, that explanation encompasses both predators with vertebrate sight, such as birds, and predators with arthropod sight, such as spiders. Not only is that explanation independent of the realizer of sight, it is a more informative explanation than a conjunction of two explanations referring to the two different realizers of sight. We say that the stick insect has this form because that form is camouflage that protects it against sighted predators, such as birds and spiders. That explanation extends to all sighted predators in virtue of their common property of sightedness. Compare: the stick insect has this form because that form is camouflage that cannot be detected by animals with the arthropod visual system, such as spiders and because it cannot be detected by animals with the vertebrate visual system, such as birds. The latter is less accurate and informative because it is incomplete to the extent that it does not extend to predators that are sighted but have some other visual system.

Likewise explanations where sightedness is an explanandum also encompass different types of realizer to provide a more informative explanation than can be provided by referring to the realizers alone. We can ask why both star-nosed moles and the Thaumastochelidae lobsters are blind whereas kinds related to these, such as European moles and crayfish respectively, are sighted. To this question there is a uniform answer: the former have evolved to exploit ecological niches where there is no light and so where vision is not possible, whereas the latter inhabit environments where there is light and so where vision is possible. Thus sight confers no selective advantage on the former kinds but does on the latter kinds. That uniform answer is possible because the explanation has no need to refer to the realizer.

We cannot get a similarly informative answer to the question, ‘why are both desiccated leaves and acicular natrolite crystals fragile, while bamboo plants and gypsum crystals are not?’ All one can say in response to the latter is to explain why the particular structure of the leaves makes them fragile, and why the structure of the natrolite crystals makes them fragile, why the structure of the bamboo makes it robust and why the structure of gypsum crystals makes them robust.

We can see the same difference when we ask why the property in question has instances. Compare the questions, ‘why are some things fragile?’ and ‘why are some things sighted?’ If the former has an answer, it is: because some things have a structure that is one of the causal bases of fragility. The latter has a more informative
answer: because of natural selection. The answer is not: because some things possess the causal basis of sight. The existence of the causal basis type (e.g. the mollusc visual system) is itself explained by the fact that it confers sight. In short, natural selection selects things that see, which in turns explains why there are the various causal bases for sight. This kind of explanation is not available for the fragility of natural objects: it is not the case that the existence of acicular-crystal-type fragility is explained by the fact that it realizes fragility.

There are, therefore, scientific explanations that refer to the property of having sight that cannot be replaced by explanations that employ the realizer properties. Thus we have good grounds for concluding that the property of having sight is a sparse rather than abundant property. What is the nature or essence of this property? For the same reasons, its nature is not fixed by its causal bases (its realizers). Non-actual causal bases in other possible worlds would also realize sight. The actual causal bases, in other possible worlds, might not realize sight (if their function is not cognitive, but is something else—to capture light energy, for example). So the essence of having sight is quite independent of its causal bases. The scientific explanations involving sight transcend the details of realization. The key element of those explanations is the fact that creatures with sight can gain information from their environments and this contributes to their ability to survive and reproduce. It is the functional character of this property that does the explanatory work, including explaining why it has instances.

In summary then, the argument that evolved properties are powers uses two features of such properties. First, these properties are multiply realizable. And secondly, these properties have existence as a result of selective processes, processes that select for function. Of these the second is the key, since it is that which guarantees that there is a property that has a functional essence. These are not independent, for under conditions that allow for the development of sufficient variety, the selective processes will tend to lead to multiple ways of realizing a highly adaptive trait arising. (Others have put forward similar arguments in support of a claim related to (ii), the claim that selection can show that multiply realised properties in the special sciences can be genuinely natural, sparse properties (C.F. Block 1997; Papineau 1992, 2010).

4 Mental capacities and states are powers

My final section is an extension of the preceding section. I argue that some (types of) mental capacities and states are powers also. It might appear that a straightforward argument is available that combines the claim that these capacities are evolved with a commitment to functionalism about the mental. From these it would seem to follow that such capacities are evolved functional states and so are macro properties.

That our broad psychological capacities are evolved is clear. Evolutionary psychology is contentious, but what is contentious is the claim that certain specific dispositions to believe, desire or prefer, fear, and so forth are the products of evolution acting on our ancestors in the relatively recent evolutionary past (a few hundred thousand years ago). What is not contentious is that the capacity for a rich psychological life involving belief (in general), desire (in general), and so on is evolved. It is evolution that explains why humans have that kind of psychological richness whereas sea anemones do not, while other animals have general psychological capacities that are somewhere in between or are like neither anemones nor humans.
Establishing the functionalist premise is, however, not as straightforward as simply appealing to functionalism in the philosophy of mind. For, as I explain, ‘functionalism’ in the philosophy of mind does not make use of functions in the sense that I have been discussing them hitherto. We may distinguish between a capacity (or dispositional) conception of function and a teleological conception. The former is that employed in standard functionalism in the philosophy of mind whereas the latter is the conception found in biology and philosophy of biology (and which I have been employing in the preceding section of this paper). So we will first need to argue that functionalism in the philosophy of mind ought to use the teleological conception rather than the capacity conception. With that in place we can say that the general human psychological capacities for belief and desire, etc. have the function of producing particular beliefs, desires etc. with specific contents, which themselves have functions. This is parallel to the fact that red blood cells have the function of producing haemoglobin which has the function of binding and transporting oxygen. In both cases the functions are teleological, not simply capacities or dispositions.

So in the following three subsections I discuss functionalism in the philosophy of mind and some of its problems. First, I emphasize that standard functionalism deals with capacity functions, not teleological functions. Secondly, I note that functionalism is holistic, and point out the problems that this causes. And, thirdly, I ask what kind of property functional terms refer to: common options are problematic. I will then look at the distinction between capacity and teleological functions in a little more detail before arguing that these problems of standard functionalism disappear if we adopt a teleological rather than a capacity conception of function.

4.1 Functionalism

Famously Paley (1802) imagines that we find a watch on the ground and attribute to it a designer. Imagine that we do find such an object, call it \( o \), but have incontrovertible grounds for thinking that it came into existence purely by accidental means, say by unusual processes of crystallization, with nothing like a designer involved.

One might attempt to describe \( o \)’s behaviour by attributing dispositions to its various parts. So one part may be described as having the ‘regulator disposition’ defined as ‘when turned, changes the oscillation rate of the part with the balance-spring disposition’; ‘balance spring disposition’ will have some similar definition, and so on. This gives us a useful means of explaining and predicting the behaviour of \( o \).

The term ‘function’ denoted originally the fulfilment by a person of an office they hold. It had an early metaphorical use in mathematics, when Leibniz used the term to mean a role (or office) a straight line could perform in relation to a curve, e.g. as a tangent. The term was also widened from the idea of fulfilling a role to fulfilling a purpose more generally, so anything that could be thought to have a purpose or might metaphorically or anthropomorphically be assigned a purpose could be ascribed an appropriate function. This included physiological functions of the organs of animals, from Shakespeare onwards, and later the functions of the parts of vegetables. These extensions have hardened and the metaphors have died, so there is now a clear non-metaphorical sense to the idea of the function of a part of an organism or artefact, and a distinction between the functional properties and the non-functional properties of such things. The term ‘functionalism’ was applied in sociology on the basis of an analogy between society and a machine or organism.
Its application in the philosophy of mind follows the same route, the analogy with a computer foremost—Putnam (1995) is explicit about this. Thus ‘function’ in the context of functionalism in the philosophy of mind does not have the teleological implications that ‘function’ has when used in the description of a (non-accidental, designed) watch.

Nothing in the accidental watch, a, has a function in the teleological sense, but it is natural to use the analogy with the functions of a watch since it is physically indistinguishable from a true watch. That case was chosen for that reason. But from the perspective of the functionalist approach to the mind it would be no less appropriate to choose an example where such analogies were less close. We can describe the water-cycle in functional terms: it is the function of the sun to evaporate water from the sea; it is the function of the prevailing wind to move damp air over land; it is the function of hills and mountains to make the damp air rise; it is the function of low pressure air to cause the formation of clouds and precipitation in clouds; it is the function of rivers to carry rain water to the sea. Strictly, therefore, the functionalist account of mind is just a dispositional view of mind, where the dispositions are ones whose stimuli and manifestations may be either behaviour or other mental states (i.e. other dispositions in this small general class).

4.1.1 Functionalist holism

States characterized functionally are holistic. They are defined in terms of other such states, since the latter may be their characteristic stimuli or manifestations. The ‘regulator disposition’ is defined as ‘when turned, changes the oscillation rate of the part with the balance-spring disposition’ and that ‘balance-spring disposition’ has a similar definition, and so on. The characterization of psychological states is similarly holistic. So ‘belief’ may be defined in terms of a disposition to form certain intentions when certain desires are present—one psychological kind is defined in terms of others and so on. Some hold that this holism leads to these characterizations being indeterminate. I do not think that this need be the case. There is, however, a distinct problem arising from the holism of the mental (cf. Stich 1983; Levin 2016).

Let us imagine that all humans find that doing long division gives them headaches. So the state that we name ‘doing long division’ will be one whose effects include bringing about a headache. That disposition will be part of the full functional specification of that state. That seems odd enough, but it has a serious consequence regarding multiple realizability. For it means that another species, say a species of nerdy Martians who find long division a pleasurable diversion, will not be in the same mental state as humans doing long division: there is not a state of doing long division common to both species. This problem is likely to be nearly ubiquitous and to undermine the desideratum of multiple realizability. For so long as the physical realizer of state S has some psychological consequences beyond the canonical ones, then those other consequences will be included in the functional characterization of S. More generally, all peculiarities of human psychology will find their way into the specification of mental states. Furthermore, because of the holism of the functional specifications, just some differences in psychology between species will mean that all mental state types will differ between the two species. For example, humans are prone to confirmation bias: if one believes h then one is disposed to find evidence supporting h to be more salient or more compelling than evidence
against h. That means that human ‘belief’ is not the same mental state as Vulcan ‘belief’, since like Mr Spock Vulcans do not engage in confirmation bias.

One might respond to this by circumscribing which dispositions associated with a state contribute to characterising the nature of that state. With some such discrimination belief could be the same state in humans and in Vulcans; confirmation bias would not be part of the functional characterization of human belief; instead it would be a quirk of human psychology absent from Vulcan psychology. While that is the desired outcome, what we need is a principled basis for making the distinction between those dispositions that characterize a mental state and those that do not.

4.1.2 Ontology

Returning to our accidental watch, o, which we are describing with new terminology such as ‘regulator’. To what do such terms refer? Likewise, to what do psychological predicates refer, if they too are understood as functional expressions? Three options have been suggested:

- Realizer properties: the regulator disposition = that property of o in virtue of which the oscillation rate of the balance-spring is changed (e.g. Armstrong 1973).

- Role properties: the regulator disposition = the (higher order) property of having some property in virtue of which the oscillation rate of the balance-spring is changed (e.g. Prior et al. 1982).

- Self-standing dispositions: the regulator disposition is a distinct dispositional property; although o has this disposition in virtue of its physical property responsible for adjusting the balance-spring’s oscillation rate, it is not identical to that property. Nor is it identical to the semantically complex property of having some property that does this. It is a property coextensive with the latter.

These views are intended as analogues of views in the philosophy of mind. Each has some disadvantages—in particular when considered as an account of mental properties.

The realizer view makes it clear that mental properties are causally efficacious. They are identical with physical properties that have specified causal profiles. On the other hand, this view does not allow for multiple realizability. If there were another object p that is differently constituted from o but the same in its relevant activity, it would not have the regulator property, since it does not have the physical property of o that is responsible for the regulator activity.

The role view can accommodate multiple realizability. But the locus of problem is now swapped—it looks as if the role property is not causally efficacious. Let F be the relevant physical property of o. Then F is causally efficacious. But is o’s higher order property of possessing some other property that is F-like causally efficacious? One’s worry might be causal over-determination—the causal work is fully done by F, so there is no causal work for the higher order role property to do. But even without an absolute rejection of over-determination one might wonder whether this higher order property can be causally efficacious. Just by inspection, the property of possessing some other, causally efficacious property does not look to be causally efficacious itself. This problem might be better articulated as focussing on whether the
role property is an abundant/predicatory or a sparse/ontic property. If it is an abundant property then it cannot be causally efficacious: it is no part of our ontology and so cannot do anything (the grueness of an emerald does not cause anything). But is then the role property a sparse/ontic property? It does not look as if it is. The complexity of this higher order property at least makes it look that it might not be. Abundant properties are easily generated in this way (‘the property of possessing some other property such that … ’). So we would need a good reason for accepting that it is a genuine ontic property.

The self-standing disposition view is not one that has much traction currently, although it is not entirely clear why not. Perhaps the reason is that the view that comes closest to it is Ryle’s dispositional theory of mind. One objection to Ryle’s view is that it is just too behaviouristic: the dispositions have only behaviours as manifestations and only external causes as stimuli. A modern functionalism avoids that by allowing other mental states as both stimuli and manifestations. Ryle’s dispositionalism held that dispositional ascriptions were inference tickets, which makes it seem as if dispositional ascriptions are not really descriptions at all. The self-standing view can hold that dispositional ascriptions really are descriptive.

Nonetheless, Ryle’s inference ticket view can be seen as reflecting doubt that the disposition is a real, i.e. sparse/ontic, property. And that doubt is justified. Dispositional expressions can be syntactically complex: ‘this disposition to m when s’ looks well-formed for most m and s. Most such combinations clearly refer only to only abundant properties: the famous Brazilian butterfly may, for a fleeting moment, possess the disposition to bring about a tornado in China, should it beat its wings just so. But is that an ontic property? It does not seem that it is. Of course, some such dispositional phrases may pick out ontic properties. Mellor (1974) and others have argued that we should not rule out ontic dispositional properties just on the ground that they are dispositional (and so have close relations with counterfactuals and subjunctives). But this does not tell us which if any self-standing dispositions really are ontic.

4.2 Two conceptions of function

I have just considered two problems for standard articulations of functionalism. Both problems require some means of discriminating among mental dispositions. The problem with holism demands that we distinguish between those dispositions that contribute to the functional characterization of a mental state and those that do not. The problem of which kind of property we are referring to with functional/dispositional expressions—realizer property or role property or self-standing property—looks best answered by the third of these. But this answer too needs a distinction—between those expressions that refer to a sparse/ontic property and those that do not. In this section, I provide the means of making these discriminations—in fact one distinction will do for both purposes. In the next subsection I conclude that mental states are powers.

It is a curious fact that for all the attention given to functionalism, few have asked whether the name is at all appropriate and if so how (Sober 1990 is a notable exception). Independently of functionalism in the philosophy of mind, however, philosophers, philosophers of biology in particular, have sought accounts of what functions are.

Wright (1973) holds that the concept of function does include a teleological component, and that this can be captured without direct appeal to teleological notions.
So to account for the teleological element, Wright introduces the requirement that to say that some X has a certain disposition as a function is to say that X is present because it has that disposition. In particular, Wright's view captures the intuitive idea of a function in biology. For example, the heart both moves blood around the vascular network and also makes a noise when beating. Intuitively the former is a function of the heart whereas the latter is not (Millikan 1984). According to Wright, then:

The function of X is Z iff (i) Z is a consequence of X’s being there (X does Z), and (ii) X is there because it does Z.

Philosophers of biology have subsequently sought to articulate the ‘X is there because it does Z’ explicitly in terms of natural selection. Roughly, creatures have hearts because the ability of hearts to pump blood is adaptive; making a beating sound is not adaptive and so plays no role in explaining why animals have hearts. Historical accounts of biological function have the following form:

The type O has a function F iff the fact that Os have in the past been disposed to do F has given possessors of Os a selective advantage that is part of the explanation of the current prevalence of Os.

(So: hearts have the pumping function because hearts’ past ability to pump blood was adaptive and thereby explains the widespread presence of hearts today.) We can add that some particular, such as Mary’s heart, has the pumping function because it is of the type, hearts, that have this function.

Some (Griffiths 1993; Millikan 1993; Godfrey-Smith 1994) emphasize that the ‘past’ in question must be the recent past. Vestigial organs such as the appendix have no current function. But they are there because of some selective advantage they provided in the more distant past. Others (Walsh 1996) think that it is not past advantage that is relevant, but current contribution to fitness. Hence we should prefer something like:

The type O has a function F iff the fact that Os are disposed to do F has given possessors of Os a selective advantage that maintains the current prevalence of Os.

Cummins (1975), by contrast, asserts that we need to distinguish teleological and functional explanation. Wright’s use of ‘because’ is loose. For example, many organs and processes exist because of the different functions performed by ancestral organs. At some point a mutation caused what would previously have been an arm or foreleg to become a wing. The very first wing is not there because it enabled flight. The more sophisticated accounts of biological function (such as the current fitness account just mentioned) may be able to handle this particular objection. But, Cummins (1975: 756) argues, ‘Flight is a capacity that cries out for explanation in terms of anatomical functions regardless of its contribution to the capacity to maintain the species.’ Accordingly, he instead takes the function of some part of a complex structure to be its contribution to the capacities of the whole.

For current purposes we need not adjudicate between Wright’s approach and Cummins’s. We can accept that there are two conceptions or classes of function: capacity functions (‘C-functions’), which are more or less as Cummins describes them, and teleological functions (‘T-functions’), more or less as described by Wright or the relevant philosophers of biology. T-functions for short are a subset of the C-functions. With this distinction in mind, we can assert that:
Evolved functional properties are both T-functions and C-functions.
Standard functionalism in the philosophy of mind requires mental states to be C-functions; but it does not require them to be T-functions.
C-functions need not be powers; they might be abundant dispositions or accidental dispositions.

4.3 Functionalism with functional powers

The aim of this section is to argue that some kinds of psychological states are evolved functional states, and so (by section 2) are macro powers. The argument could not appeal directly to functionalism because standard functionalism makes use of C-functions, not T-functions. We are now in a position to argue that functionalism should instead use T-functions.

Elliott Sober (1990) argues that several problems in the philosophy of mind can be solved if we adopt a teleological notion of function, when thinking about psychological states as functional. Sober notes that it is trivial to say that psychological states are functions if one thinks in terms of C-functions. One the other hand, in terms of T-functions, not all psychological properties are functional. Sober (1990: 104s) reminds us that ‘where there is [biological] functional organization, there also will be artifacts of functional organization—items that have no function at all.’ The same can be said for dispositions—the heart has the T-function of pumping blood but its disposition to make a beating noise is a by-product, and so only a C-function.

The proposed revision to functionalism, whereby the functions are required to be T-functions, thus provides an answer to the problem of holism. Only T-functions contribute to the inter-defined holistic structure of functional states. Just as making a beating noise is not a T-function of the heart, it is not part of the functional characterization of doing long division that it causes headaches or of belief that it can be strengthened by confirmation bias.

The second problem for functionalism concerned the nature of the properties referred to by our functional expressions. The proposal that they refer to self-standing dispositions (rather than realizer properties or role properties) suffered from the problem that not all such properties could be guaranteed to be sparse. That was in the context of standard functionalism where the functions may be C-functions. The current proposal is that instead the functions are T-functions. This on its own does not yet guarantee that the properties are sparse. But if we add the premise that these properties are also evolved, then we can conclude that they are sparse, for the reasons given in section 2.

So although standard functionalism does not lead to the conclusion that psychological states are evolved functional states, we reach that conclusion when we add the further premises that such states are evolved and that they are T-functions. Those premises are independently plausible. Furthermore, adding them also marks an improvement to functionalism itself, allowing it to avoid the two problems just discussed.

5 Conclusion

Let us assume that that the fundamental properties of things are all powers. It is far from trivial that any other properties are powers. First, the arguments that

Among others (Sober 1990).
would establish that the fundamental properties are powers do not extend to non-
fundamental properties. Secondly, the extant arguments, explicit or implicit, that
would take us from fundamental powers to non-fundamental powers are unsound.
My discussion emphasized the following points:

- A natural, sparse/ontic property can supervene on powers without itself being
  a power.
- Many dispositional expressions do not refer to sparse/ontic properties.
- An sparse/ontic property can be dispositional without being essentially dis-
  positional.

So any argument for non-fundamental powers must establish that a property (i) is
non-fundamental, (ii) is sparse/ontic, and (iii) is essentially dispositional. Such an
argument has to be non-trivial because the supervenience implied by (i) suggests
that the mode of supervenience will provide an account of the identity and essence
of a property inconsistent with (iii). For example, a non-fundamental property may
be constituted of fundamental ones and the essence of the former may be that con-
stitution, in which case its essence is not dispositional.

I have argued that the proposal that some evolved functional properties are pow-
ners meets the requirements (i)–(iii). They key idea here is that natural selection is
selection for function. When this gives rise to a new, functional property, that prop-
erty's nature will be independent of its realizers; instead that property's nature will
be the dispositional characteristics that played a role in selection.

I note here that a similar point will apply to properties of artefacts. Their exis-
tence will be a product of their dispositional features, not of the details of the various
possible realizers. So are artefactual functional properties also powers? My argu-
ment would suggest that they are—assuming that they are ontic. Is that a problem?
It isn't obvious that it is a problem. Perhaps the most problematic aspect would be
the proliferation of such properties—they would seem to be a lot of them. Maybe
that's a bullet that can be bitten without too much discomfort.

The central proposal of this paper is that evolved functional properties are non-
fundamental powers. I have proposed extending this argument to mental proper-
ties, for these would appear to be evolved functional properties. I noted however,
that appealing to functionalism in the philosophy of mind is not enough to establish
this, since standard functionalism employs the term 'function' in a capacity sense
whereas my argument uses 'function' in a teleological sense. Nonetheless, there are
good reasons for thinking that functionalism in the philosophy of mind ought to use
'function' in the teleological sense, for that independently avoids various problems
that may be posed for standard functionalism.

One possible consequence of this account of some non-fundamental properties
being powers is that it might shed some light on the problems of emergentism (Bird
2008). These I take to be twofold. First, what should we mean by 'emergent'? What
should a property be like to be an emergent property? And, secondly, how could
such properties exist? In virtue of what do they satisfy the defining characteristics of
emergence? An answer to the first question must show that emergent properties
are somehow both dependent on fundamental properties (otherwise they would
be fundamental and not emergent properties) but also, in some different respect,
independent of them (otherwise they would not have the novelty that is ascribed
to emergent properties, e.g. if they were reducible to fundamental properties). So
emergence is typically taken to be some species of non-reductive supervenience—though there is disagreement about whether the supervenience must be synchronic or not. Evolved functional properties may be one way of meeting the requirements of emergentism (Bird 2008; Vicente 2013). On the one hand their existence depends on lower level properties and behaviours—they are not fundamental. On the other hand they are not reducible to those lower level properties; their independence from the realizer properties provides the novelty and autonomy characteristic of emergent properties. (Whether this amounts to synchronic supervenience or not depends on whether the correct understanding of function is one that fixes on current fitness provided by the function or on past fitness.)

The picture of natural properties that arises then is this. Some natural properties are powers but not all are. At the fundamental level the natural properties are powers. Further natural, ontic properties exist that are certain (naturally caused) combinations of the fundamental properties. The latter are reducible to the former, and are not themselves powers. When we reach the level of evolved organisms, however, we do find macro properties that are also powers. Since they are evolved properties, they are loosely dependent on lower level properties. But they are not reducible to them. Rather, having a certain species of autonomy as well as being powers, they are like fundamental properties—they are ‘quasi-fundamental’ properties—the fundamental properties of the new category of evolved entities.

References


9The distribution of powers (although not of natural properties in general) thus roughly parallels what van Inwagen (1990) and Merricks (2001) take to be the distribution of objects—they are found at the fundamental level and among organisms but not in between.

10I am grateful to Tim Crane, Luke Fenton-Glynn, and Barbara Vetter for discussion and comments on to audiences at UCL and Cambridge.


