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Two directions for teleology: naturalism and idealism

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Abstract Philosophers of biology claim that function talk is consistent with naturalism. Yet recent work in biology places new pressure on this claim. An increasing number of biologists propose that the existence of functions depends on the organisation of systems. While systems are part of the domain studied by physics, they are capable of interacting with this domain through organising principles. This is to say that a full account of biological function requires teleology. Does naturalism preclude reference to teleological causes? Or are organised systems precisely a naturalised form of teleology? In this paper I suggest that the biology of organised systems reveals several contradictions in the main philosophical conceptions of naturalism. To integrate organised systems with naturalism's basic assumptions—that there is no theory-independent view for metaphysics, and that nature is intelligible—I propose an idealist solution.

Keywords Naturalism · Evolutionary biology · Function · Idealism · Kant

One of the characteristic features of contemporary evolutionary biology is the analysis of function. At first glance this may strike the outsider as odd. To claim that a frog's tongue exists for the sake of catching flies (Schwenk 2000) or that the purpose of the fragile second penis of a male earwig is to snap off inside its mate to prevent foreign insemination (Kamimura and Matsuo 2001) seems to present living things as artifacts designed by an intelligent being. If biology is concerned with organisms and living systems, that is, with things that do not owe their construction to an agent, why do biologists refer to a designer's intentions? Sober (2000) argues that the artisanal language

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of function is warranted in biology, for the evolutionary process bears an analogy with intelligent design. Nature selects traits that, over evolutionary time, fashion an organism to meet environmental demands as a designer chooses materials and form to construct an object for a particular task. Here the analogy ends. Evolution explains once and for all the staggering fit that organisms have with their environments *without* reference to non-physical forces. Sober (2000, p. 86) explains the difference between art and evolution in terms of naturalism: the common 'feature of all extant philosophical accounts of what the concept of function means is that they are *naturalistic*.' This is to say that function talk avoids the Scylla of teleology, which appeals to final causes, and the Charybdis of intelligent design, which appeals to a designer, examining the appearance of design as an effect of generalizable laws such as natural selection on characteristic traits in population sets.[1]

Over the past twenty years an increasing number of biologists have argued that function analysis alone cannot account for the complex organisation of living systems. These biologists refer to multiple levels of causation to explain how organisms are part of the domain of physics and yet capable of interaction with their constraining environment through causally efficacious principles of organisation. The two main conceptions of function analysis—etiological and Cummins functions—are fashioned to show us that function talk is entirely reducible to the efficient domain of causation studied by physics.[2] This entails that the existence of purpose-like features is accidental. When examined as a function of an organised system, however, a function is a necessary part of a self-directed whole that works toward a particular goal, such as the preservation of the system. Kauffman (2013, p. 5) argues that functions are not merely ascriptions of purpose-like behaviour that result *a posteriori* from external forces but genuinely causal features that *a priori* seek to sustain and propagate the existence of an organic system. Organisms actively bias their future states, and thus cannot be explained according to 'prestatable' conditions. Barbieri (2008, p. 578) explains that

[1] Mayr (2004) proposes that function analysis is precisely the naturalised causal paradigm that teleological and intelligent design views mistake for the supernatural. He identifies five ways of conceiving of teleology, four of which remain within the limits of naturalism: teleomatic processes, teleonomic processes, purposive behaviour, adapted features, and cosmic teleology. Mayr explains that the first four teleological forms are entirely consistent with the efficient direction of forces characteristic of an artisanal model of nature. Because the fifth refers to non-physical phenomena such as 'perfection' and 'trend[s] in the world toward progress'—phenomena that lie outside the physical order of causal entailment—it fails to meet the criterion for 'genuine science without any occult properties' (Mayr 2004, p. 60).

[2] On the one hand, etiological functions explain the function of a trait by reference to the history of how it evolved. The presence of a function is grounded on two conditions: (1) that the function is a consequence of the presence of the trait, and (2) that the function is the efficient cause of the trait. Millikan (1984, p. 17), who provided one of the definitive accounts of etiological functions, states that a trait is a 'proper function' if it positively influenced the natural selection of the trait. Cummins functions, on the other hand, explain the function of a trait by reference to the trait's role in the operation of a biological system. Cummins (1975) recognized that any notion of function that aims to explain the presence of a part in an overall system carries implications of designed artifacts. Yet for this reason he argues that the notion of function must be considered as a useful heuristic device in empirical science but must not purport to explain the presence of the parts. To name the function of a trait is to ascribe to the trait a capacity in which we are interested because of its contribution to the capacity of a system. While the two views differ significantly and have their own well-noted difficulties (see Sober 2000, p. 85f.), both attribute the presence of the function as the efficient cause of the trait, and thus claim that function is entirely reducible to the laws of physics.

organic systems are 'made of two independent worlds,' one that is physical and subject to efficient causality and another that consists of relations and meanings. Mossio and Bich (2014) reject causal dualism and instead propose two modes of interacting with a single causal domain: 'organisational closure' and 'thermodynamic openness'. Organisms are organisationally closed to the extent that they are a 'form of self-determination realised through a circular network of process and components that continuously maintain the living system as a unity,' and yet thermodynamically open to the extent that they 'are traversed by a continuous flow of energy and matter.'

Does naturalism preclude reference to causes that cannot be reduced to the level of efficient causation, or is the new research into organised systems precisely a naturalised form of teleology? Naturalism is generally held to be the thinnest of theoretical commitments that is equivalent to *respect for science* or *responding to the facts* (see De Caro and Macarthur 2008). It is the commitment to avoid lazy explanations that appeal to agents or causes that do not exist in the domain studied by the natural sciences. For Sober, this is equivalent to the physicalist thesis that all causation is the efficient causation of physics. Yet several philosophers have argued that physicalism is not as theoretically thin as first assumed. Chalmers (1997, p. 39) rejects physicalism as a necessary component of naturalism on the grounds that it is *disrespectful* to science; it renders biological properties as mere epiphenomena of physical properties. Chalmers aims to respect what the physical sciences tell us about nature *and* what biology tells us about systems. He proposes a naturalistic form of dualism in which 'biological properties are supervenient on physical properties.' Naturalistic dualism is the thesis that biological and physical properties, such as consciousness and brain states, are ontologically distinct and yet 'biological facts about our world are logically determined by the physical facts' (Chalmers 1997, p. 39).

While naturalism is at the very least a theory motivated by respect for science, the work of developmental systems biologists suggests that the 'respect' naturalists give to science is not so much for the sciences we see in practice as for an ideal version of science as a unified body of inquiry. By claiming that organisational closure manifests end-directed behaviour, the biology of developmental systems does not only break with Sober's reductive naturalism. It also breaks with Chalmers' dualistic naturalism, which denies causal efficacy to the biological. Is such a research program thus non-naturalist? Or can naturalism include a scientific program that explodes causality beyond the physical?

This paper has two aims. The first is to show that contemporary research of organised systems problematizes the respect for science claimed by philosophical naturalists. The incompatibility of organised systems with the leading theories of naturalism reveals something about those theories: they are in fact motivated by a robust metaphysical claim, a claim that does not refer to natural facts, as do the claims of natural science, but rather to the set of all facts, to what there is in nature and therefore what can be a legitimate item of natural science. This metaphysical claim is prior to but not independent of natural science; one's theory of naturalism directs not only one's account of the relation between the various sciences but also one's methodology when it comes to a specific scientific domain. The problem developmental systems biology poses to the naturalist, I suggest, demonstrates that we cannot avoid metaphysics when it comes to science.

The second aim of this paper is to outline the kind of metaphysics up to this task. I suggest that while naturalism entails metaphysics, it does not entail a first-order metaphysical program that dictates to the sciences what there is in the world. Rather, the metaphysics of naturalism emerges from a dialectic between scientific practice and second-order reflection on thought's relation to the objects of inquiry. Thus it should not surprise us that we have to keep negotiating our metaphysics in conversation with scientific practice as both fields develop over time.

I begin by examining three accounts of function analysis with the aim of discerning the account of naturalism implicit to each view (Sect. 1). I identify three such accounts: object naturalism (Sect. 2), subject naturalism (Sect. 3), and speculative naturalism (Sect. 4). The question of 'placing' functional claims in nature assists us to see that certain contradictions emerge in all three theories. In response to these contradictions I propose an idealist alternative (Sect. 5), not the stereotype of idealism, which conducts metaphysical inquiry prior to natural science, but transcendental idealism, which begins with an origin wherein metaphysics and science are entangled. Transcendental idealism begins from the insight that natural science cannot answer the metaphysical question about what there is in the world, including questions about the basic level of causation or whether a comprehensive explanation is possible at all. Yet it refuses to abandon science for a theory-independent position. Idealism resolves the contradictions of naturalism by integrating its basic assumptions: that there is no theory-independent view for metaphysics, and that nature is intelligible.

1 Placing teleological behaviour

Aristotle (1984, p. 1013a23ff) famously proposed a fourfold account of causation, consisting of material, formal, efficient, and final causes. Philosophers generally lay out the causes through the example of an artifact:

> the material cause is the bricks of which it is made, the formal cause its blueprint, the efficient cause is the mason's knowledge and skill, and the final cause the need for human shelter. (Chase 2011, p. 519)[3]

The characteristic feature of Aristotle's theory is irreducibility; to provide an account of an object is to identify the natures and potentials at work in a given process, meaning that each potential is required for a full account of an item's being-there (Gotthelf 2012). What we see in the above presentation of Aristotle's four causes is that causation operates in two directions. While material, formal, and efficient causes *entail* their effect, final causation seems to be *entailed by* its effect. This suggests that the future is somehow able to influence the present (Chase 2011, p. 520). For this reason Aristotle's account of final causation has attracted scorn since the time of Galileo and Descartes: it advocates a theory of nature as a sphere imbued with self-causing agency. This theory clashes with the picture of nature characteristic of modernity, which introduces

[3] Henning (2009) argues that the standard way of explaining Aristotle's causes through the example of an artifact, as Chase does, is misleading, for it equates Aristotle too closely with the artifact model of nature characteristic of modern science. I accept this point; here I simply want to highlight the directional difference between efficient and teleological entailment.

a hierarchy to causal explanations with efficient causation as the fundamental cause. Compared to the demonstrability and repeatability of efficient causation, final causes seem unverifiable and anthropomorphic.

According to many philosophers of biology, function analysis is reducible to the efficient model of causation studied by physics. To make this case, such philosophers require an account of how the apparently purposive behaviour described by function analysis differs from the full-blown teleology of final causation. While 'function' makes a weaker claim than 'purpose' or 'end', for it can refer to things that do not 'behave' or 'act' but simply 'happen' (the function of the spanner that accidently fell into the works was to stall the entire mechanism), the assertion that 'the function of a frog's tongue is to catch flies' is at least structurally equivalent to more explicit teleological formulations such as 'the frog's tongue exists for the sake of catching flies' or 'the purpose of the frog's tongue is to catch flies.' Each formulation contains an assertion that X is Y, where Y is a relation that is entailed by its effect (that the spanner had the function of stalling the mechanism is only true once the mechanism was stalled).

One such account is what I will call the *stand-in* view. The stand-in view adopts what Lewens (2004, p. 2) calls an 'artifact model' of nature: it talks 'of organisms as though they were designed objects.' This is evident in Mayr's (1988, p. 60) notion of teleonomatic behaviour: 'Teleonomatic (that is, programmed) behavior occurs only in organisms (and man-made machines) and constitutes a clear-cut difference between the levels of complexity in living and in inanimate matter.' Proponents of this view note that the evolutionary process bears similarities to the process of intelligent design. Nature selects traits as a designer chooses materials and form to construct an object for a particular task. Yet because there is no actual designer, the stand-in view accounts for the use of the artisanal language of function in terms of analogy. This analogy is explained through a distinction between two different domains of reference—biology and physics—one of which is reducible to the other. Sober (2000, p. 24) explains this in terms of the hierarchical principle of modern science: that 'everything in biology *can* be explained by physics.' The business of biology is to examine living systems, which—on the stand-in view—are collections of matter subject to efficient laws of entailment. The function talk of biologists is therefore non-cognitive: it is not concerned with representing what there is in the physical order. Instead, it provides an instrumental analysis. The stand-in view entails that function ascriptions 'should not be taken as literally true, but rather as constituting useful devices for interacting effectively with the biological' (Dupré 2001, p. 7). Here we must be careful to identify the precise meaning of the reducibility of biology to physics. To say that everything can *in principle* be explained by physics is to say that an ideally complete physics would account for all biological phenomena. To say that everything can *in practice* be explained is to say that we can account for all biological phenomena with the physics we already possess. Given that explainability in practice is empirically false (at least for the time being), Sober proposes an in principle version and accepts that biological methodology is simply different from physics. Function analysis 'stands in' for an analysis of physical processes while we do not have one. There is 'no reason why functional concepts cannot characterise systems that are made of matter and nothing else' (Sober 2000, p. 86).

Several philosophers of biology have questioned the guiding analogy of the stand-in view, and advance instead what I will call the *heuristic* view. These philosophers argue that the artifact model confuses evolution, a population-level and statistical phenomenon, with intentions, purposive actions conducted by individual entities. In contrast, the heuristic view accounts for function ascriptions 'as claims about contributions to fitness' (Lewens 2004, p. 4); functions do not describe a process reducible to physics but simply talk about the process in a different way. Thus the heuristic view rejects the idea of causal hierarchy implicit to modern science and replaces it with linguistic domains that serve different functions. Following Cummins (1975), proponents of the heuristic view recognise that any notion of function that aims to explain the presence of a part in an overall system carries implications of design. To avoid this implication, they consider function talk as a useful heuristic device to draw our attention to a particular, non-physical feature. To name the function of a trait is to ascribe to the trait a capacity in which we are interested because of its contribution to the capacity of a system.

Lewens presents a version of this view in *Organisms and Artifacts*. Function ascriptions, he claims, do far less work than has been assumed by the etiological programs of Mayr and Sober. Lewens' revised version of Cummins functions entails that function ascriptions are claims that certain items appear to us *as if* they were purposely designed. One 'proceeds under a principle that organisms have been perfectly designed for the maximisation of fitness,' and yet this 'endeavor is heuristically modest': it 'organises and directs our inquiry to teasing out the details of how some system is orchestrated, but whose truth is not essential to the inquiry itself' (Lewens 2004, p. 43). The difference between the stronger language of 'purpose' and the weaker use of 'function', on Lewens' account, is that purpose entails a necessary rather than accidental relation (for example, it was part of the spanner's nature to bring works to a stall rather than its accidental presence in the works). The language of function simply reads into nature ideas that we are familiar with from the context of our own agency as humans, providing a heuristic guide with which to pursue research of efficient causal connections.

A third view of function ascriptions has recently gained attention; I will call this the *realist* view.[4] For the realist, the stand-in view is right to see history as an *explanans* for the existence of a function. The problem is how this history is conceived. The realist charges the stand-in view guilty of historicism, for it reconstructs the development of functions as artifacts—as fabricated for a pre-given goal—irrespective of the broader system of which they are a part. Abandoning the artisanal view of nature, and yet refusing to retreat from the language of intentions, the realist examines the development of the system as the condition of the possibility of functions. For example, Moreno and Mossio (2015, p. xxi) argue that functions 'operate because they are embodied in the complex organisation of organisms.' While functions may not be objects to which we can refer, function ascriptions are nevertheless truth-apt, for they refer to the features of organised systems that are causally active in nature. The 'organised' character of organisms is understood in terms of multiple domains; not the linguistic domains of

[4] Proponents of this view generally endorse a variant of Developmental Systems Theory (DST), including biosemiotics, niche construction, and complexity theory, which focus on themes including self-organisation, spontaneous pattern formation, dissipative systems, and morphogenesis.

the heuristic view but rather *causal* domains. The domain of genetic variation and selective pressures operate on a population through efficient causes. Yet the individual domain of closure is also causal, encompassing the localised idea of 'organisation' that allows an organism to *interact* with its environment (see Piaget 1967). While artifacts differ from accidental aggregates of matter, they can still be fully accounted for by efficient causes (the 'intention' is external to the artifact; it is in the designer's mind). Organisms, on the other hand, are characterised by a dynamism between closure—they are closed to the exhaustive entailment of efficient causality—and openness—they are nevertheless traversed by a continuous flow of material causality, of energy and matter (see Rosen 1972). The dynamic relation between organisms and their environment is one of interaction. Function ascriptions are thus seen to refer to purposive features of organised systems that are irreducible to the physical.

The three views I have outlined agree on one point: organic life *appears* to us as purposive. Talk of function is thus appropriate to describe the constitutive parts of organic systems. The difference lies in how this language is understood. The stand-in view accounts for purposive language in terms of the design analogy, and concludes that—because there is no designer—function ascriptions stand-in for physical explanations we hope are forthcoming. The heuristic view accounts for purposive language as a description of fitness, and concludes that function ascriptions are guides for further inquiry. The realist view takes purposive language to refer to features that depend on the existence of a system. Function ascriptions explain the existence of the part in terms of a circular causal regime between part and whole; they are an irreducible part of scientific inquiry.

Debate between these views is longstanding and fraught with difficulties. And my characterisation, if anything, oversimplifies matters; the heuristic view is compatible with both reductionism and causal pluralism, and, like the stand-in view, the realist view can also be understood in terms of etiological functions (though for the realist, the system *explains* the development of a function).[5] As Lewens (2004, pp. 4–6) notes, the function debate often feels 'fruitless', 'frustrating', even 'boring', not simply because there is little sign of consensus but more seriously because it is reduced to conceptual analysis filled with thought experiments so abstract from biological practice that one forgets what is really at stake. I agree with Lewens to the extent that I do not believe that the debate can be solved through conceptual analysis alone. However, while Lewens' pragmatic response aims to deflate the discussion, I propose to undertake a what I call a 'second-order' analysis; to examine the implicit assumptions about what exists in nature undergirding each view, assumptions that frame what kind of items can appear in natural science and in what way. To be clear, I do not suggest that these accounts of function explicitly endorse a specific variant of naturalism. Rather, my aim is to discern the conception of nature that enables each account. I suggest that the stand-in view accounts for the task of biology on the basis of what Huw Price calls 'object naturalism', the view that only physical objects exist in nature. The heuristic view identifies a contradiction in object naturalism, and instead pursues a 'subject' form of naturalism, the view that the human subject (the scientist and her interests) is also part

[5] See Mossio and Saborido (2016).

of nature.[6] The realist view shows that subject naturalism, while an improvement on object naturalism, is also contradictory. This leads us to search for an alternative, one that does not slide into Chalmers's naturalistic dualism, which denies causal efficacy to the biological, or back into the occult forces rejected by modern science. While I consider speculative naturalism as one such alternative, I conclude by arguing for an idealist framework.

2 Object naturalism

To discern the view of naturalism assumed by the stand-in view I will use the notion of 'placement problems' employed by philosophers of mind (see Blackburn 1993). According to Price (2011, p. 230), placement problems arise when concepts that we intuitively use to navigate experience seem 'hard to "place" in the kind of world described by science.' Identifying these problems assists us to discern one's view of naturalism, for they emerge through a clash between our everyday use of language and 'a presupposition about the ontological scope of science—roughly, the naturalist assumption that there is a world as studied by science.' When some topic of human discourse—let us use an non-scientific example for a moment, say morality—seems difficult to place in the world as studied by science, we are forced to 'to accept the existence of moral aspects of reality distinct from the aspects of reality described by science, or to conclude that science has shown that moral talk is in error, in failing to connect with anything in the external world' (Price 1997, p. 248). The first view—moral realism—is unacceptable to the naturalist, for it denies the global domain of the natural sciences. Yet the latter view—expressivism—is also problematic on naturalist grounds. To see how expressivism about non-scientific items is problematic for the naturalist, let us break down this position in terms of a global claim that the physical-energetic domain is all that there is and a local claim about non-physical domains:

> *Global physicalism*: The domain of physics is all-inclusive. Thus physics makes theoretical assertions about nature that are truth-apt.
> *Local expressivism*: Assertions that that refer to non-physical causal paradigms are non-theoretical; they are not truth-apt for they do not refer to anything in the world.

According to Price, naturalists characterise their position as anti-metaphysical, for they reject any recourse to 'immaterial ingredients'. Expressivism violates this position, for it contains a metaphilosophical claim that does not escape metaphysics. Price (2011, p. 230) calls this metaphilosophcial claim the 'bifurcation thesis', the idea that terms that refer to the physical-energetic domain are truth-apt while all others are not.

Noting that both moral realism and expressivism seem incompatible with naturalism, many philosophers have proposed noncognitivism as an alternative. Noncognitivists argue that if our reference to non-physical items such as moral claims—or function ascriptions—'is not in the business of describing reality—if its linguistic

[6] I place Lewens in the subject naturalist camp, for instance, for in his book *Organisms and Artifacts* he is silent on the question of metaphysics in general and causal pluralism in particular.

function is quite different—then we can leave it in place, without conflict with the ontological lessons of the naturalistic view' (Price 1997, p. 148). Upon first glance noncognitivism seems attractive to the naturalist: it shows that there are no purposes, functions, or goals to be accommodated within the natural world, and the cost of this escape—the notion of linguistic function—is acceptable on naturalist terms.

This is the structure of Sober's reductionist theory. Sober (2000, p. 21) proposes a version of physicalism, the view that 'all living things are physical objects.' Physicalism is a reductive or hierarchical version of naturalism, for it entails that 'the domain of biology falls within the domain of physics' (Sober 2000, p. 24). This can be called *object* naturalism, following Price, for it examines nature as a discrete object directly available for inquiry. While they are implicit to Sober's account, object naturalism in fact contains two claims, one ontological and one epistemological. In terms of ontology, it claims that 'all there *is* is in the world studied by science' (Price 2011, p. 185). For Sober, this claim is even more restricted: all there is is the world studied by physics. In terms of epistemology it claims that 'all genuine knowledge is scientific knowledge' (Price 2011, p. 185). Again for Sober, this is the restricted claim that all genuine knowledge can be accounted for by physics. Object naturalism can thus be defined in terms of two claims, global physicalism and local noncognitivism:

> *Global physicalism*: The domain of physics is all-inclusive. Thus physics makes theoretical assertions about nature that are truth-apt.
> *Local noncognitivism*: The domain of biology is located within the domain of physics. When biologists refer to non-physical causal paradigms such as intention, the function of their assertions is not to make theoretical claims about nature but to serve some other use.

Object naturalism is the assumption that the linguistic items in question—such as 'function' or 'purpose'—'stand for' or 'represent' something *non-linguistic*: this assumption 'grounds our shift in focus from the *term* 'X' or *concept X*, to its assumed *object*, X' (Price 2011, p. 189). Thus it does not claim, as would the expressivist, that function talk is illusory but rather that when biologists refer to non-physical items they are not in the business of telling us what there is in nature.

Yet noncognitivists have difficulty accounting for the distinction between cognitive and noncognitive assertions they claim to find in language. This difficulty can be understood according to Carnap's (1950) argument that there is no absolute, theory-independent, ontological viewpoint available to our theory construction. Carnap identifies the semantic difference between 'internal' and 'external' statements to show the difference between assertions that occur *within* a theoretical framework that is determined by a specific set of principles and assertions *about* such frameworks. While the internal statement is theoretical or truth-apt given the principles operative in a given framework, an 'alleged statement of the reality of the framework of entities is a pseudo-statement without cognitive content' (Carnap 1950, p. 31). In the case of Sober's naturalism, this is to say that the assessment of biology's use of teleological language cannot be assessed from *outside* a theoretical framework nor from *within* the framework of physics. According to Carnap (1950, p. 31), the acceptance of a claim such as 'the use of purposive language in biology does not refer to anything in nature' simply 'cannot be judged as being either true or false because it is not an assertion.

It can only be judged as being more or less expedient.' This is to say that ontological questions about the entities examined by a particular theory must be posed *within* that theory; they cannot be posed externally. Carnap's thesis disallows the external ontological question of what there 'really' is in the world, denying the possibility of first-order knowledge of the totality of what there is. Noncognitivism turns on such an external ontological claim, and thus violates its own initial impulse, that is, to construct a non-metaphysical theory of nature.

3 Subject naturalism

By identifying a contradiction within object naturalism, Price's goal is to outline an alternative account of language that is not self-undermining and does not require us to deny parts of experience that seem obvious. As we have seen, object naturalism entails that all human language about non-objective phenomena—morals, metaphysical concepts, biological functions etc.—are nonfactual and do not make claims about what there is in nature. For Price, object naturalism undermines the very space wherein we can negotiate and manage our claims, for any discussion about theory on a second-order level is noncognitivist and therefore not a matter about we can disagree or come to any consensus. In this sense object naturalism ultimately undermines itself as a form of theory; it begins from the human freedom to reach out from experience to make sense of the whole, and yet by subordinating that freedom to an alternative paradigm—to physicalism, for example—it obfuscates the conditions of its own possibility.

To preserve a space in which we can negotiate, manage, and contest our claims, Price proposes a version of naturalism he calls 'subject naturalism'. Subject naturalism begins from the freedom of human language and approaches the task of providing a theory of naturalism on a second-order level. This is not to free theory construction from science but rather to conceive of the freedom of language alongside the idea that 'we humans are a part of nature,' which is to say that we must 'begin with what science tells us *about ourselves*' (Price 2011, p. 186). In contrast to the object naturalist, who attempts to free herself from science in order to make a global claim about what there is in nature, the subject naturalist aims to *assimilate* philosophy to science: 'Science tells us we humans are natural creatures, and if the claims and ambitions of philosophy conflict with this view, then philosophy needs to give way.' From this stance, the problem with object naturalism is that it is 'bad science': in the attempt to secure the authority of science it forgets that humans are a part of nature and makes a claim from a supposedly non-theoretical position (Price 2011, p. 199). Such a claim cannot appear as an item of natural science. It reaches out beyond the facts to make what Carnap labels an 'external' claim.

To avoid the self-undermining nature of object naturalism, subject naturalists reject the bifurcation thesis, which entails global physicalism and local expressivism, and posit instead a *global* form of expressivism:

> *Global expressivism*: Global claims about what there is in nature are non-theoretical assertions that are not truth-apt and do not refer to anything in the world.

Unlike the noncogntivist, the subject naturalist does not claim that the language of reductionist science is truth-apt and that other language is simply a stopgap. Instead, the subject naturalist rejects 'the metaphysical issues altogether' and advances a 'no metaphysics' or 'quietist' view (Price 2011, p. 234). Thus she replaces the hierarchical conception of causes for the linguistics of domains.

The subject naturalist position is implicit to Lewens' heuristic view of function talk, and, I suggest, motivates his critique of the stand-in account of function. Lewens is not concerned with the question of reduction, for it drives the stand-in view's overblown use of the design analogy. Rejecting local noncognitivism, Lewens (2004, p. 43) argues that 'truth is not essential to the inquiry itself.' This is not to say that there is *no* truth-apt language in biology. Rather, it is to affirm that first-order claims about 'what there is in the world' are non-theoretical, and thus cannot be substantiated from the view of science. Language that operates *within* a certain domain, however, refers to objects that are subject to the truth conditions unique to that domain. This is why Lewens' heuristic view claims to be 'modest'; global expressivism is not concerned with reductive questions of causal hierarchy but rather with establishing conditions of fitness as it appears in a specific domain; through the methodological lens of function analysis. By remaining silent in regards to the whole, Lewens' aim is not to place normative concepts such as 'function' and 'purpose' *in* nature but to develop a pluralism about linguistic use. Thus he proposes a

> heuristic that ignores the characteristic forms of question encouraged by the artifact model, preferring to look directly at the physical principles that underlie development. … Pluralism at the level of heuristics is the most attractive option. (Lewens 2004, p. 76)

Here Lewens cites D'Arcy Thompson, who argues that 'mechanism and teleology are interwoven together, and we must not cleave to the one nor despise the other; for their union is rooted in the very nature of totality' (Thompson, in Lewins 2004, p. 77). However, while accepting Thompson's attempt to maintain both mechanism and teleology, Lewens rejects his idea of 'totality' and instead advocates, following Price, a pluralism of research domains grounded on specific properties. For the pluralist, function ascriptions are 'descriptive', 'cognitive', 'belief-expressing', and yet 'functionally distinct' from physical science: 'they do a different job in language' (Price 1997, p. 252).

Despite their similarities, Lewens' heuristic account of function differs from Price's subject naturalism on an important point. For Price, subject naturalism provides a plausible resolution to the tensions between science and non-scientific phenomena. For Lewens, on the other hand, function ascription is precisely a *scientific* practice. Because the initial motivation for Price's theory is to free human linguistic practices from scientific reduction, he is not concerned with considering science as a plurality of domains but rather with science as one domain amongst many, and moreover, one with a certain level of authority.[7] Yet if science itself is made up of various domains, each

[7] Of course, as several philosophers have shown, functional pluralism can be applied to scientific domains to show that the linguistic function of terms such as 'causation' and 'explanation' are realized in terms of principles that are distinct to each scientific domain (see Amundson and Lander 1994).

of which operates according to its own principles, and if *some* biologists make non-reductive causal claims, then Price's idea that normative assertions 'are functionally distinct from *scientific* descriptions of the natural world' would be false—*unless* we were to grant one scientific sphere the status of 'real science'. As we noted earlier, to avoid object naturalism's theory-independent claim, subject naturalists propose to 'begin with what *science* tells us about ourselves.' Yet if there is a plurality of scientific domains—and I do not see how subject naturalists could avoid this conclusion—how do we decide which is most worthy of our attention? By denying the claim that any domain has ontological priority, and by arguing that semantic analysis is the only legitimate standpoint from which to reflect on the variety of linguistic uses, subject naturalists remove the possibility of attributing priority to *any* domain. And if we have no means to decide upon which science to listen to, especially when we have competing explanations, then we have no means to justify why we ought to begin from what science tells us about ourselves in the first place.

The inability of subject naturalism to provide a normative conception of explanation—its silence in regards to *value*—alerts us to a dialectical contradiction within the theory. A dialectical contradiction occurs when a theory's motivational structure is incompatible with its manifest propositions.[8] The original motivation for the construction of an alternative theory to object naturalism was to preserve a space wherein we can negotiate, contest, and refine our claims. Such a space is presumably worth preserving because truth or freedom has value worthy of maintaining. Moreover, the existence of this value is what originally motivated the subject naturalist to reject object naturalism. Yet after establishing this starting point, the subject naturalist affirms the finite practices of science over the human capacity to reach out beyond the physical-energetic domain to the whole—a capacity that cannot appear as an object of natural science. Thus subject naturalism undermines our commitment to the normative practices that govern linguistic function, for the adoption of a semantic stance in regards to the normative practices that govern linguistic function purports to be value-free (see Redding 2010, p. 274). While Price initially aims to secure non-scientific discourses from the reduction of object naturalism for the sake of human community, his theory fails to tell us why it might be worth the effort.

Price's critique of object naturalism is convincing to the extent that it shows us that the global claim of physicalism contradicts the actuality of theorising. Yet his revised account of subject naturalism is unsatisfying, for it is silent in regards to the epistemic values that originally led us to question object naturalism. And this problem remains also for Lewens' heuristic account of function: it cannot account for the capacity of non-reductive language to capture our experience. Such an account requires a commitment to epistemic values such as intelligibility against the constrained domain of physical-energetic causation. To be 'silent' in regards to the whole, or to simply 'ignore' the artifact model, cannot assist us to build a theory of naturalism that avoids this dialectical contradiction. In the following section I turn to Thomas Nagel's spec-

[8] Here I build on Gabriel's (2011, p. 20) critique of 'liberal naturalism', which corresponds roughly to what I have been exploring as subject naturalism. Gabriel argues that by reducing human freedom to that which can appear as an object of natural science, subject naturalism 'only succeeds as a theory by failing to reflect on the consistency of the conditions of itself as a theory.'

ulative account of naturalism, which aims to preserve epistemic value by extending the concept of nature to encompass our subjective experience.

4 Speculative naturalism

In *Mind and Cosmos* Nagel (2012, p. 36) builds an alternative theory to object naturalism on the same starting ground as subject naturalism: the idea that 'we humans are parts of the world.' Like subject naturalism, the aim of Nagel's (2012, p. 14) theory construction is to free the human community from 'attempts to reduce the true extent of reality to a common basis that is not rich enough for the purpose.' Yet rather than saving the intentional dimensions of human experience from reduction through a form of global expressivism, Nagel aims to place normative concepts *in* nature. In this sense he attempts to remain consistent with the initial impulse of theory construction: to defend the irreducibility of reason to external, *a posteriori* principles. Thus he advances a radical concept of nature that does not defend present linguistic practices but rather outlines a program for a future science devoid of placement problems.

Nagel begins from the observation that all theories are grounded on the assumption that nature is in some sense intelligible to our inquiry. He calls this the 'ideal of intelligibility'. The ideal of intelligibility is the assumption on which every pursuit of knowledge anticipates that the world 'can be not only described but understood' (Nagel 2012, p. 17). The fact that we prefer simpler explanations over more complicated ones, that we drive for less and less arbitrary accounts of natural events, is not an aesthetic preference or the result of habit but a rational *a priori* that 'is itself a part of the deepest explanation of why things are the way they are.' For object naturalists, this idea is assumed but ultimately denied; physicalism is the commitment to a concept of nature as an efficiently entailed sphere, and yet this commitment excludes non-physical items such as reason and minds. For subject naturalists, the ideal of intelligibility motivates the initial theory construction and yet vanishes within the quietist solution. The subject naturalist's commitment to global expressivism denies the transcendental application of epistemic values across the various domains. While Nagel (2012, p. 16) would agree with the subject naturalist to the extent that he accepts that the proof for intelligibility certainly lies beyond the bounds of natural science (as it is presently practiced), he argues that the theory of naturalism—if it is to be consistent—must account for the ideal of intelligibility *within* nature. In this sense Nagel's theory aspires to be both speculative *and* a form of naturalism: it favours a 'form of neutral monism over the traditional alternatives of materialism, idealism, and dualism' (Nagel 2012, p. 5) and yet assumes that science is the best way of learning about the world. Speculative naturalism thus conceives of itself as a theoretical science that makes first-order claims about what there is:

> *Monism*: Nature is a single and intelligible domain. Thus claims about nature are theoretical and truth-apt.

Nagel argues that monism is a necessary assumption of naturalism given the ideal of intelligibility. A monist account of this ideal would 'explain the appearance of mental life at complex levels of biological organisation' according to 'properties that explain

not only [the universe's] physical but also its mental character' (Nagel 2012, p. 56). 'Natural teleology,' he explains, 'would mean that the universe is rationally governed in more than one way—not only through the universal quantitative laws of physics that underlie efficient causation but also through principles which imply that things happen because they are on a path that leads toward certain outcomes' (Nagel 2012, p. 67). The task of speculative naturalism is thus to explain variation as 'non-accidental' and yet to pursue 'the ideal of discovering a single natural order that unifies everything on the basis of a set of common elements and principles' (Nagel 2012, p. 7). To explain the variety of human experience without producing unwanted problems of placement, Nagel's speculative solution invokes hitherto undisclosed scientific features of the universe that will unveil the unity of the explanatory domains.

Nagel's speculative account of nature has, perhaps unsurprisingly, received a great deal of criticism.[9] Speculative naturalism criticises the current practices of the sciences on theoretical grounds, placing the burden on natural scientists to search for supposedly teleological laws, recommending that scientists pursue both neurophysiological and evolutionary research with a 'utopian long-term goal in mind' (Nagel 2012, p. 69). However, while Nagel's reductionist critics argue that his normative conception of science denies the value-free basis of scientific naturalism, his position in fact mirrors their own. On the one hand, reductionists pose a monistic conception of nature that excludes *a priori* rationality. On the other hand, Nagel poses a monistic conception of nature in which the human mind must be able to integrate mental phenomena into the natural order.

The basic problem of speculative naturalism is not that it outsources a philosophical problem to natural science. This is symptomatic of a deeper problem, namely, that it slides back into the analytic contradiction of object naturalism. As the subject naturalist claims, the task of freeing human experience from reduction requires a version of Carnap's thesis, the idea that there is no non-theoretical position available from which to say what there is in nature. Nagel spectacularly violates this thesis and advocates a utopian picture of nature that aims to include the ideal of intelligibility by which the concept of nature originally arose. For this reason he overlooks contemporary research into development systems, which has laboured for more than twenty years to develop an empirical account of organisation.

While speculative naturalism shows us the importance of the ideal of intelligibility for overcoming the problematic conclusions of reduction, it also demonstrates how a purely *a priori* commitment to this ideal can lead to lazy philosophy that legislates natural science according to principles that lie exclusively in philosophy's speculative jurisdiction. In the following section I consider an idealist theory that examines the conditions under which we gain knowledge of nature. Unlike object and subject naturalism, idealism does not claim theoretical neutrality or a non-theoretical 'respect for science'. And unlike Nagel's speculative naturalism, it does not provide a first-order, non-scientific theory of nature. Rather, idealism asks how we might think about nature given the contradictions that arise in previous theories.

[9] For example, Leiter and Weisberg (2012) labels Nagel's book as a 'broadside,' and Daniel Dennett supposedly claimed that it 'isn't worth anything—it's cute and it's clever and it's not worth a damn.' Nagel (2012, p. 7) himself pre-empts that his argument will 'strike many people as outrageous.'

5 Idealism

Transcendental idealism is the view that dialectical instability is essential in the development of our theory construction as we refine our understanding of nature in conversation with experience. In this sense it is the very rejection of George Berkeley's immaterialism, which provides a first-order theory of nature that reduces matter to the status of ideas in the mind of God. As Kant argued in *Critique of Pure Reason*, transcendental idealism begins from the idea that nature as a whole cannot appear as an object of cognition:

> *Idealism*: Nature is non-theoretical and thus cannot appear as a fact of first-order (i.e. truth-apt) inquiry.

Transcendental idealism thus prefigures Carnap's thesis. Opposed to Berkeley's first-order claim that nature simply *is* God's ideas, it is a second-order theory that reflects on thought's relation to objects as such. From this second-order level—the level of our theory construction—Kant argues that even our best scientific practices do not disclose unconditioned knowledge of nature understood as the single domain of what there is. This is simply to say, as Massimi (2008) recently argued, that 'there are no ready-made phenomena.' Rather, natural science features as a part of experience constituted by finite beings whose knowledge is formally conditioned. The unity of nature does not feature as an object of inquiry but is made possible by the regulative principle of reason Kant calls 'systematicity', which guides us to unify particular cognitions and to form contingent aggregates into discrete unities interconnected in accordance with laws. Thus unlike subject naturalism, transcendental idealism is not silent in regards to epistemic value. And yet unlike speculative naturalism, it does not render this value dependent on nature as a whole. The task of Kant's idealism is rather to discern the conditions that enable our experience of nature as an ordered domain about which we can make truth-apt reference.

In *Critique of the Power of Judgment* Kant shifts his focus from our knowledge of objects to our capacity to judge organic systems. While his first *Critique* demonstrated that our experience of ourselves as moral agents is irreducible to the domain studied by natural science, his third *Critique* aims to demonstrate the irreducibility of two specific programs in the experimental sciences concerned with the causality of systems. Here Kant is not concerned with explaining the 'fit' of organisms with their environment on a species level across evolutionary time; he attempts this elsewhere.[10] The task prior to the science of adaptation for Kant is to examine our reflective capacity to judge contingent aggregates in nature as unified systems by virtue of their manifest purposiveness. His critique of this capacity identifies two ways that judgment is able to unify aggregates into discrete unities: designed items and organised systems. In general terms, a purpose [*Zweck*] for Kant is 'the object of a concept insofar as the latter is regarded as the cause of the former' (5:220).[11] To judge something as purposive is to say that we think of 'the object itself (its form or its existence) as an effect … through

[10] See Kant (2000b). I explore Kant's account of adaptive fit in Cooper (2017).

[11] Citations to *Metaphysical Foundations* and to *Critique of the Power of Judgment* are to Volumes 4 and 5 of *Kants gesammelte Schriften*, Akadamie Ausgabe, following the Cambridge University Press translations.

a concept of the latter.' A product of design—an artifact—has a purpose to the extent that we think of its form as the effect of an idea in the mind of a designer. An organic item, on the other hand, is not contingent on any external idea but exits as a 'natural purpose' (*Naturzweck*). Kant explains that 'a thing exists as a natural purpose if it is cause and effect of itself' (5:371). This circular structure involves 'descending as well as ascending dependency,' which is to say that it deserves 'the name of a cause of the same thing of which it is an effect' (5:372).

Kant elaborates the difference between artistic and organic purposiveness through considering the self-propagation of a tree from several different angles. First, while an individual tree might generate another tree according to known natural laws, thus existing as an effect, on the level of the species it is also a cause: the species 'unceasingly produces itself, … continuously preserves itself, as a species' (5:371). When we consider the tree as a self-propagating thing we view it as both cause and effect of itself. Second, the singular tree in question 'also generates itself as an individual.' On the one hand the tree can be regarded as an 'educt': its generation can be accounted for through 'the components that it receives from nature outside of itself.' Yet on the other hand the tree is also a 'product': it 'prepares the matter that it adds to itself with a quality peculiar to its species, which could not be provided by the mechanism of nature outside of it, and develops itself further by means of material which, as far as its composition is concerned, is its own product.' Kant's point is that a natural purpose is something that features as a part of the 'mechanism of nature'—the efficient field of laws presented by Newtonian physics—and yet is organisationally closed; the tree actively self-constrains its growth according to species-specific principles. Thus it is both educt and product, continuous with the domain of efficient causes and yet irreducible to it. Third, any one part of the tree 'also generates itself in such a way that the preservation of the one is reciprocally dependent on the preservation of the other' (5:371). Drawing from Blumenbach's research on grafting, Kant notes that the eye from the leaf of a tree that was grafted into the twig of another brings forth a new growth of its own. Every twig or leaf can thus be considered as a self-sustaining unit in itself. Kant's point is that the different parts of the item must depend on one another for the continued existence of the system, and therefore cannot be fully explained without taking the whole into account and its self-propagating (*sich fortpflanzend*) purpose.

Kant maintains that our capacity to differentiate between organisms and artifacts allows us to grasp the function of 'fitting deviations' (*schickliche Abweichungen*) in a system (5:374):

> For if one adduces, e.g., the structure of a bird, the hollowness of its bones, the placement of its wings for movement and of its tail for steering, etc., one says that given the mere *nexus effectivus* in nature, without the help of a special kind of causality, namely that of purposes [*Zwecke*] (*nexus finalis*), this is all in the highest degree contingent: i.e., that nature, considered as a mere mechanism, could have formed itself in a thousand different ways without hitting precisely upon the unity in accordance with such a rule. (5:360)

Without the help of 'a special kind of causality,' fitting deviations are contingent in regards to the efficient laws of inorganic nature, for we can easily imagine situations

in which they could have been otherwise. When considered as a part of an organised system, however, fitting deviations are necessary for self-preservation:

> nature … organises itself, and in every species of its organised products, of course in accordance with some example in the whole, but also with appropriate deviations [*mit schicklichen Abweichungen*], which are required in the circumstances for self-preservation. (5:374)

Kant's aim is to show that it is only on the grounds of the principle of organic purposiveness that we are able to judge the specific parts of a whole to be self-preserving, suitable for the maintenance of life. Darwin's theory of natural selection as an external, efficient force cannot account for this necessity, for, as Thompson (2007, p. 131) notes, 'it does not address the endogenous self-organisation of the organism.' Darwin's theory assumes the existence of organised beings capable of self-propagation; it does not explain organisation, but rather *which* organised systems are selected on the basis of fitness. Kant's account is much closer to Bernard's (1865) notion of conservation of the internal *milieu* than it is to Darwin. Like Kant, Bernard accounts for natural adaptation according to physiology before considering history.

The distinction between organisms and artifacts helps us to situate Kant's position in light of the stand-in, heuristic, and realist views of function discussed above. Advocates of the stand-in view are expressivists about function. By viewing organisms on the analogy with artifacts, they maintain that the material parts are logically independent of and temporally antecedent to the whole they determine. Natural selection, combined with genetics, thus does all the explanatory work when it comes to evolution. For advocates of the heuristic view, organisms are what Kant terms 'relatively purposive'. Relative purposiveness, for Kant, is the usefulness an effect has as a means to some end (think back to the spanner falling into the works). Kant considers examples such as rivers and snow: we might say that the function of a river is to spread nutrients or snow to protect seeds from frost (5:365). Such effects are relative to our analysis; they say nothing about the inner constitution of rivers or snow but rather direct further inquiry into the interdependency of the broader system. Intrinsic purposiveness, on the other hand, belongs to an effect considered directly as a purpose. Here the organism again serves as the paradigmatic example, for organisation accounts for effects. On Kant's account of the organism, the parts are determined by their presence in the whole and bear functions they would not have independently of it. While a machine can be explained by analysing the function of its parts, organisms reciprocally determine the form and combination of their parts. This is why Kant famously concludes that 'the organisation of nature is therefore not analogous with any causality that we know' (5:375). Here Kant's specific account of knowledge is important: what can be known is that which can be constituted as an object of thought or postulated through practical reason. The form emergent in organisms is resistant to any analogy with objects of knowledge or with our own agency, for organisation does not feature *a priori* in our constitution of objects or spring from practical reason. Rather, it emerges from our reflection. Thus we say too little about nature if we call an organised product 'an analogue of art' and too much if we call it 'an analogue of life'. The causality of natural purposes is irreducible to anything we know; it is not constituted but rather studied, reflected upon, appreciated.

At first glance it seems that the epistemic limits Kant placed on our experience of organised systems is anathema to contemporary biology. Mayr (1988, p. 58) charges Kant guilty of 'defeatism' about biology, for Kant 'was unable to provide a causal explanation' of organised beings. Zammito (2006, p. 755) argues that because Kant reformulates 'the issues of biology as "regulative" rather than "constitutive", that is, as descriptive (heuristic) rather than explanatory (scientific),' his work at best anticipates a Cummins account of function (see also Richards 2000; Kreines 2005; Breitenbach 2009). On this reading Kant shows us why we use teleological language and yet make no claim about nature at all.

Yet several realists about function talk frame their approach in continuity with Kant. Kauffman (2013, p. 5) refers to 'Kantian wholes' to designate complex structures made up of parts that bear real functions: causal roles that intend to sustain the existence of the whole. For Kauffman, Kantian wholes 'exist in the non-ergodic universe above the level of atoms,' that is, in a natural domain that is not entirely physical. Mossio and Bich (2014) argue that, for Kant, 'teleology is grounded in a *specific* kind of circular regime, that we have labelled self-determination.' Kant's account of self-organisation consists of 'a network of mutually dependent components, each of them exerting a causal influence on the condition of existence of the others, so that the whole network is collectively able to self-maintain.' For John Dupré (2001, p. 180), Kant's notion of systems provides an account of autonomy capable of explaining how self-determination can feature as a part of the efficient domain of physics and yet remain causally robust.[12] The limits placed on theoretical cognition leads Kant to reject the doctrine of causal completion without reducing causality to semantics, thereby opening the possibility of action from a principle broader than predetermined necessity.[13]

Kant's account of function polarises contemporary philosophers of science. At first glance it seems that Kant's famous *als ob* formulation, as Lewens (2004, p. 43) claims, maps onto the 'as if' qualification attributed to function ascriptions by the Cummins approach. Opposed to the determinate judgment of cognition, which explains a thing's causality, teleological judgment is regulative and therefore does not raise a problem of placement. Yet this reading does not square with the above discussion of Kant's view. Lewens presents Kant's account of mechanism and teleology as asymmetrical and hierarchical: Kant's constitutive account of nature as subject to the categories entails that all objects of thought are bound to mechanical law, while his account of reflective judgment allows for a speculative estimation of a causality conceived through a loose analogy with our own purposiveness as moral agents. While it is true that Kant's account of causality in the Second Analogy of *Critique of Pure Reason*

[12] Dupré would no doubt resist being associated with an idealist position. Dupré (1993, p. 1) oscillates between a naturalist method that affirms the unavailability of a theory-independent view for metaphysics ('I place myself firmly in the philosophical tradition that sees empirical, often scientific, inquiry as providing the most credible source of knowledge of how things are'), and a robust metaphysical position that assumes the very position rejected ('The most general doctrine I shall advocate is pluralism … a doctrine I refer to as "promiscuous realism" … Thus my thesis will be that the disunity of science … reflects accurately the underlying ontological complexity of the world, the disorder of things' [Dupré 1993, pp. 6–7]). My suggestion is simply that idealism would help Dupré develop these two positions into a consistent theory.

[13] For similar treatments of Kant, see also Roqué (1985), McLaughlin (1990), Weber and Verela (2002).

is concerned only with the efficient entailment of time-ordered experience, Kant's project in *Critique of the Power of Judgment* approaches causality not as constitutive of objects but as regulative of our scientific reflection on them. Kant is concerned with the so-called 'experimental sciences', sciences interested in natural laws that cannot be known *a priori* and thus require empirical reflection in conversation with theory. This model of science is much closer to the biology in practice today than the 'proper science' of Kant's *Metaphysical Foundations*.[14] Experimental sciences are governed by principles specific to their own domain, and feed back to our second-order reflection of nature as a whole. Because our investigation is governed by the expectation that nature is intelligible, the conflict of two explanatory principles is problematic, as Kant demonstrates in the antinomy of teleological judgment (§§70–71). This antinomy lies between a principle that governs our research of the domain of mechanical laws ('All generation of material things and their forms must be judged as possible in accordance with merely mechanical laws') and one that governs our examination of organised beings ('Some products of material nature cannot be judged as possible according to merely mechanical laws (judging them requires an entirely different law of causality, namely that of final causes)'). Yet far from solving the antimony through showing the asymmetry and hierarchy of mechanism over teleology, Kant's point is to show that *neither* mechanism nor teleology is identical with causality (see McLaughlin 1990): 'reason can prove neither the one nor the other of these fundamental principles, because we can have no determining principle *a priori* of the possibility of things in accordance with merely empirical laws of nature' (5:387). Each principle governs a particular research program and cannot be generalised to constitute nature understood as an object of knowledge.[15]

In *Critique of the Power of Judgment* Kant steps back from the analysis of causation in the Second Analogy, where temporal events are understood in terms of the constitution of appearances according to a necessary law. He is less concerned with explaining events experienced *in* time as explaining the existence of items that seem to have developed *through* time. This element is 'inexplicable' (*unerklärlich*) in a mechanical research program (§74), which is uninterested in self-propagation. The strength of the claim made by mechanical and teleological judgments alike leads us to the generalizing impulse to reduce one to the other. Yet because both positions, when globalised, are dialectically unstable (hence the antinomy), and because Kant maintains the regulative principle of intelligibility, we are pushed to the second-order level of theory to discover that purposiveness and mechanism are antinomical only when we attempt to grasp nature as a whole on the first-order. This is precisely the motivation for entering the idealist metaphysical framework.

[14] In *Metaphysical Foundations*, Kant argues that because the fields of 'experimental physics' examine chemical and organic items through examples, they cannot contain necessity and are thus 'figurative' or 'improper' sciences (*uneigentliche Wissenschaften*) (4:470). This is to say that they do not deal with their object 'wholly according to *a priori* principles' (4:468). In *Critique of the Power of Judgment* Kant returns to the experimental sciences, granting them a scientific status to the extent that they do bear necessity, for they operate according to principles acquired through reflection. See Cooper (2017).

[15] If anything Kant suggests that our mechanical grounds should be 'subordinated' to teleological principles, and yet this only serves our reflection on nature as a system and does not to constitute knowledge (5:414). See Ginsborg (2006).

Kant's idealist solution warrants a shift from the question of hierarchy to one of domains. Darwin's great contribution to the science of evolution was to show that design could arise without an intelligent designer, focusing biology's attention to the accidental traits that emerge from population-level, statistical analysis. In Kant, however, we find a far more sophisticated conception of design in which the self-organisation of the organism, including its physiology and activity, are central to the analysis (see Thompson 2007, p. 210). Kant's Newtonian conception of matter and his rudimentary understanding of heredity are indeed limited, and a refined account of genetics and the use of computational modelling are required to understand the mechanics of organic systems. Yet what the idealist approach brings to bear on contemporary work in the biological sciences is the idea that the organisation proper to living beings is irreducible to mechanical explanation. This is to say that neither genetics nor computational modelling can fully explain organic systems, for neither give attention to the organisational system in which genes are expressed and behaviour is actively constrained by inner principles that bias future states. On the idealist view, natural selection is not the single law that explains organic diversity, but an emergent consequence of organisation. This is to say that natural selection requires reproduction (what Kant called 'self-propagation'), and reproduction requires organised beings. The idealist view allows us to maintain the principle of intelligibility that governs our search for the best causal theory, yet this principle features as part of our second-order inquiry, the order of our theory construction, and does not warrant a global claim. On the first-order level—when we are engaged in molecular biology or function analysis—we are not concerned with nature as a whole. Rather, we examine discrete features of a particular domain bounded by our best investigative methodology in conversation with theory.

To be clear, my reading of Kant's idealism does not entail that each domain can operate free from the insights of other domains. Such a claim would deny causal interaction across domains, thus featuring as a first-order claim to the totality of what there is in nature. And neither does it assume that the difference between domains is merely semantic. Rather, domains for Kant are separated according to feedback between experience—approaching nature with particular conditions—and second-order reflection—discovering those conditions through experience.[16] In this way we not only learn about the items of inquiry when we do science; we also learn about ourselves. It is precisely the failure of reductive accounts of nature to explain self-organisation that leads Kant to the second-order level of our theory construction. His conclusion is as counterintuitive as it is compelling: only on the theory of idealism can we be realists about experience.

[16] This is evident in the opening pages of *Critique of Pure Reason*, as Kant (1999 p. Bxii) sets up his project in terms of Baconian experimental philosophy, and in particular, in terms of Copernicus' discovery of the heliocentric model of the heavens. Yet Kant's account of organised systems in *Critique of the Power of Judgment* intensifies the feedback between experience and second-order reflection. As Paul Guyer (2001, p. 262) notes, 'the basic reason for discussing organisms at all was precisely that these are objects within our experience that can prompt us to take this twofold view of nature' wherein efficient causation and organised spontaneity coexist.

6 Conclusion

To defend a realist account of function talk is not to defend the language of folk biology from physical reduction. Neither is it to command scientists to alter their research in search for a hitherto undiscovered region of causality that underpins both efficient and final causation. Rather, it is to note that methodological differences affect the way that things appear for our analysis. This is to say that no single method of inquiry accounts for all that there is; science is not the study of a totalisable realm of objects that exists independently of cognition.

Idealism denies the possibility of a theory-independent view for metaphysics and yet maintains the principle of intelligibility. It shows us that no single science can provide an exhaustive account of what there is in the world, for experience discloses the world in different ways. Idealism does not entail that all modes of inquiry are equally valid or correct, but rather that the selection of the best mode of inquiry depends on what aspect of nature is under examination. Multiple inquiries might be correct in different ways; they need to be evaluated according to their specific principles. Unlike object naturalism, which reduces function talk to physics, and subjective naturalism, which views function as a useful mode of description, idealism rests on and is governed by the view that things are intelligible in terms of properties specific to a domain of experience. In this sense idealism provides the best theoretical framework to account for function talk: it entails that we do not begin with a single domain of facts but rather an origin wherein metaphysics and science are dynamically entangled.

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