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NK≠HPC

P.D. Magnus
University at Albany, State University of New York, pmagnus@albany.edu

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P.D. Magnus
pmagnus<at>fecundity.com
http://www.fecundity.com/job

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Abstract

The Homeostatic Property Cluster (HPC) account of natural kinds has become popular since it was proposed by Richard Boyd in the late 1980s. Although it is often taken to define natural kinds as such, it is easy enough to see that something's being a natural kind is neither necessary nor sufficient for its being an HPC. This paper argues that it is better not to understand HPCs as defining what it is to be a natural kind but instead as providing the ontological realization of (some) natural kinds.

Keywords

natural kinds, homeostatic property clusters, HPC, Richard Boyd, taxonomy, ontology

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It has become common in recent years to think of natural kinds as Homeostatic Property Clusters (HPCs). An HPC is a structured repetition of properties in the world, maintained by an underlying causal process. The stock example is a biological species. Members of a species are characterized by a cluster of typical features. This cluster is held together in a particular organism by the causal processes in and around its body. It has recurrent instances in multiple organisms because of the reproductive processes of the previous generation. And all the generations form the evolutionary lineage of the species.

Both the account and the term HPC are due to Richard Boyd. Nevertheless, there is no *locus classicus*. Boyd's account has been given piecemeal, in a series of papers stretching over twenty-five years (Boyd 1988; 1989; 1991; 1999a; 1999b; 1999c; 2003a; 2003b; 2010). In most of these essays, he invokes HPCs in order to establish something else as the essay's central topic. For example, he first introduced HPCs in a discussion of moral realism (1988). In a recent discussion of natural kinds, he invokes HPCs in one paragraph and refers readers to four earlier articles for 'further discussions' (2010: 216-7). A consequence of this is that HPCs as popularly received might be — and I argue are — different than Boyd's own account of them.

Hilary Kornblith, who was an early adopter, writes, 'Boyd suggests that this account of self-maintenance in organisms [i.e., homeostasis] may provide a model for all natural kinds. A natural kind is a cluster of properties which, when realized together in the same substance, work to maintain and reinforce each other, even in the face of changes in the environment' (1993: 35). More recently, Richard Samuels and Michael Ferreira write that 'philosophers of science have, in recent years, reached a consensus — or as close to consensus as philosophers ever get — according to which natural kinds are *Homeostatic Property Clusters*' (2010: 222). Understood in this way, the HPC account

provides both the taxonomic and ontological ground of natural kinds: It describes what distinguishes a natural kind from an arbitrary category (natural kinds are HPCs) and explains what it is in the world that holds natural kinds together (the causal patterns responsible for homeostasis). Call such an account, according to which the category natural kind is simply equated with HPC, an NK=HPC account.

This is how the HPC account is typically understood, but it faces an obvious and fatal difficulty. Fundamental particles do not seem to have their properties occur together in anything like the way species do. For example, the mass of the electron is a precise and unfailing feature of electrons rather than merely one that is typical of electrons. The value for the mass is simply a parameter in the standard model — a basic feature of the universe — rather than being maintained by an underlying pattern of causes. So fundamental particles do not constitute HPCs. But it would be absurd to say that *electron* did not count as a natural kind. So not all natural kinds are HPCs.[1]

This should not be taken as a reason to abandon HPCs, I argue, but instead to abandon the simplistic formula of NK=HPC accounts. To make the alternative clear, we need to distinguish two questions about natural kinds: First, what criteria distinguish natural kinds from arbitrary categories? Second, what features of the world make some categories but not others satisfy these criteria?

One might be tempted to call these the epistemic and metaphysical conceptions, respectively, but that would be a mistake. The first question is not how we might test whether some category is a natural kind. The criteria which distinguish natural kinds need not be epistemically accessible. Even if they are accessible, access will probably require checking operationalized proxies instead of the criteria themselves.

The difference between the two questions is instead one of specificity and depth. The first question is general, because it asks about natural kinds as such. It is also potentially superficial, because the characterization might be given independently of the ontology that holds the kind together. Call it the *taxonomy* question. The second question specifies what it is that satisfies that characterization. Call it the *ontology* question.

Independently of thinking about HPCs, it is worth distinguishing the two questions.

The ontology question can be raised without a general account of naturalness. For example, if we consider chemical elements to be natural kinds, then we can ask what unifies an element. This will tell us about elements while remaining mum on whether other things, like compounds, species, or mental states, might also be natural kinds. It is not obvious — and I suspect it is false — that natural kinds all have the same underlying ontology. So we might give one answer to the taxonomy question (by characterizing the rôle that natural kinds necessarily play in our account of the world) while giving a range of answers to the ontology question (by explaining the different underlying natures of different natural kinds). Some natural groups, like chemical elements, are unified because members of the kind have a similar composition and so behave similarly according to general, causal laws. Others, like biological species, are unified by sharing a historical source and so behave similarly because of common cause.

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[1] Many authors note this kind of counterexample; e.g. Chakravartty (2007), Magnus (2012), and Slater (forthcoming).

Katherine Hawley and Alexander Bird (2011) distinguish the two questions, calling them the 'naturalness' and 'kindhood' questions respectively. They focus primarily on ontology and argue that every natural kind is a complex universal, mereologically composed of simple universals. Yet, without an account of taxonomy, it remains an open possibility that many complex universals will not correspond to any natural kind. If unrestricted mereological realism is correct, then Hawley and Bird's complex universals would obviously outnumber natural kinds.

Nevertheless, many contemporary authors either conflate the two questions or suppose that one account must be given to answer both. If natural kinds all have *essences* in some thick sense, then that gives a general answer to the ontology question. If there is a natural kind corresponding to every essence, then this also answers the taxonomy question. So essentialism suggests that the two questions are two sides of the same coin.[2]

An NK=HPC account also collapses the two questions. This parallel might explain why many philosophers have seen the HPC approach, when applied to cases, as just a variant of essentialism.[3] Paul Griffiths writes, 'In my reading of Boyd, this causal homeostatic mechanism corresponds to the traditional "essence" of a natural kind. In the paradigmatic example of chemical elements, the causal homeostatic mechanism is a shared microstructure' (1999: 218). The willingness to include chemical elements suggests that Griffiths means this in a universal way, so as to say that there is an HPC corresponding to every natural kind. Yet, as we saw above, there is some level at which the micro-constituents of things must be what they are without an underlying causal mechanism. Even if elements are understood in terms of the homeostatic structure of atomic nuclei, electrons and quarks resist such analysis.

Dominic Murphy (2006: 338-41) raises problems in the other direction, suggesting that some HPCs are not held together by an *essence* in any interesting sense. He complains that 'even if species are picked out by a shared history, it is unclear how something's history can be its essence. … [I]f extrinsic forces are permitted to hold a kind together, then maybe chartered accountants are a natural kind, since they share properties in virtue of a historical fact — they passed the relevant exams. But now we start to wonder whether anything can be a natural kind' (2006: 340). Even if we embrace promiscuous realism and accept that chartered accountants are a natural kind, we could construct some counterexample. The minimal characterization of an HPC as a cluster of properties held together by causes allows for trivial and obscure ones, and it would be a mistake to count them all as natural kinds. If it becomes the case (as Murphy worries) that every category can be a natural kind, then we have no need for a conception of natural kinds at all.

This shows that there is something wrong with NK=HPC accounts. If HPCs provide an answer to the ontology question, we need a separate answer to the taxonomy question. There must be some way of understanding natural kinds which is more general, which can include both fundamental particles, biological species, and whatever else there might be.

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[2] This presumes that essences are a one-to-one match for natural kinds.

[3] A critic of the HPC account of species, Richard Richards treats it as kind of essentialism and thus at odds with the fact that species are historical (2010: 154-8) — despite the fact that Boyd and others are adamant that an HPC can change over time.

Perhaps surprisingly, such an understanding is already offered by Boyd. Although he offers his account as 'an alternative approach to the problem of essentialism' (Boyd 1999a: 146), it is a mistake to see it as a variant of essentialism. Boyd suggests that natural kinds are categories used in scientific accounts which accommodate the structure of the world. They figure in successful inductive and explanatory practice. He writes, 'The naturalness of natural kinds consists in their aptness for induction and explanation' (1999a: 147).[4] Some of these categories will be causally unified property clusters, he writes, making HPCs not the whole of natural kinds but instead 'a class of natural kinds' (1999a: 141) and 'an important family of natural kinds' (1991: 141). My own approach to natural kinds is similar: Natural kinds are the categories which are indispensable to successful science for some domain of enquiry, and many important natural kinds turn out to be HPCs (Magnus 2012).

Boyd's own account of natural kinds thus gives different answers to the two questions. It answers the taxonomy question in terms of the conditions for successful scientific taxonomy. It answers the ontology question, for many kinds, by positing HPCs. And that is consistent with examples like the kind electron which require different answers to the ontology question and with trivial HPCs which do not belong in scientific taxonomies.

This relaxed HPC account can allow for important differences in how causes can hold a kind together. Some HPCs, like a biological species, are clearly historical. Members of the kind live and die, beget new members, and so on. Moreover, any particular individual corresponds to a specific, local HPC.[5] Take the example of the human organism who wrote this paper. The literal homeostatic functions of my body have kept all the properties typical of me occurring together for decades. On such grounds, Boyd urges that there really is no strict difference between HPCs and individuals. He writes that 'by seeing the similarities between the inductive and explanatory roles played by reference to natural kinds, on the one hand, and by reference to individuals, on the other, we can see why the distinction between natural kinds and (natural) individuals is… merely pragmatic' (1999a: 163).

Other natural kinds are not historical in this way but are plausibly HPCs. Kornblith suggests that water is an HPC constituted by the causal interplay between hydrogen and oxygen atoms in H_2O molecules (1993: 37).[6] Admittedly, there are problems with treating the causal structure of water just in terms of distinct H_2O molecules. Actual water is a dynamic interplay of molecules, but allowing for the complications of water chemistry just underscores the complex causal processes involved. So water might still be said to be an HPC.[7] Regardless, water is importantly different than a biological species or an individual. Although any two members of a

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[4] This phrase, 'naturalness of natural kinds', marks this as an answer to what I have called the taxonomy question. As I noted above, Hawley and Bird even call it the question of naturalness.

[5] I discuss species and individuals as HPCs at greater length elsewhere. See Magnus (2011; 2012: ch. 6; 2013).

[6] Boyd comments that the formula 'water = H_2O' has fundamentally misled philosophers about the ontology of natural kinds (1999a: 145-6).

[7] See Magnus (2012: 184-190).

species must share an historical connection — as must any two moments in the life of this author — bodies of water on different planets might form independently of one another.

So we should distinguish two sorts of HPCs. First, there are those such that every member of the kind shares a common origin. The properties of the members are due to that connection, and the kind altogether can be seen as an individual constituted by that history. Second, there are those which lack such a history. Members might occur anywhere or at anytime, provided they are put together in the right way. Elsewhere (Magnus 2012), I have suggested that the former be called *token-HPCs* (because each member of the kind belongs to part of the same token history) and that the latter be called *type-HPCs* (because each member of the kind is held together by independent causes of the same type).

Finally, notice that HPCs construed in this way are not elements of fundamental ontology. An HPC account of natural kinds answers the ontology question in terms of clustered properties and causal regularities, but it need not say anything much about the metaphysics of properties and causes. It is consistent with saying that properties and causes are fundamental ontological categories, with reducing them to other categories, or with silence about matters of further metaphysics.[8]

So the best understanding of HPCs withdraws from NK=HPC in several respects: HPCs provide an answer only to the ontology question about natural kinds — viz., the question of what it is in the world that holds natural kinds together. It turns out that many important natural kinds, although not all of them, are HPCs. This is only a partial answer to the ontology question both because some natural kinds are not HPCs and also because HPCs need not be taken as metaphysically fundamental. That something is a natural kind is neither necessary nor sufficient for its being an HPC. Moreover, HPCs are not a uniform lot. There is an important difference between those which involve a single, shared causal history (token-HPCs) and those which do not (type-HPCs). What makes these all count as natural kinds is an independent answer to the taxonomy question.

P.D. Magnus
University at Albany, State University of New York, USA

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[8] The account thus defies what Matthew Slater oddly calls the Realist Presumption, namely that 'A realist should have to lay down a general metaphysical conception of natural kinds before going on to assess our theories' success at attuning our categories to them' (Slater forthcoming). Boyd begins with a conception of natural kinds, an answer to the taxonomy question, in terms of what can sustain successful theorizing. And he offers an account of what it is in the world that does that, an answer to the ontology question, which is not a general metaphysical conception.

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