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The nominalist theory of natural kinds and kind essences

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Introduction

The world is divided into entities that belong to *natural kinds*. It seems that we both use natural kinds to individuate entities at the different levels of constitution of reality and make use of natural kinds in scientific explanations. Natural kinds appear to collect sets of features relevant to objects' acting in a certain way in certain circumstances. Moreover, natural kind divisions seem to be independent of us and our classificatory faculties. For instance, it is not up to us that there are different kinds of atoms, molecules and chemical stuff.

It is one of the central questions of metaphysics and ontological category theory to specify the ontological status of natural kinds. Are there natural kinds? If they exist as constituents of the world, are they sui generis entities or, say, complexes of property universals? Moreover, natural kinds are often considered to have essences that collect the properties necessary to the members of the kind. Therefore, we may ask whether there are kind essences and how they must be characterized.

In this chapter, I defend a nominalist conception of natural kinds, which denies the existence of natural kinds as separate entities. Nevertheless, there are divisions of entities into natural kinds and truths about entities belonging to a natural kind. Therefore, I accept the general view Bird & Tobin (2022) call "naturalism about natural kinds" and reject the strong error theoretic version of eliminativism about

Keinänen, M. (2025). The nominalist theory of natural kinds and kind essences. In A. Laitinen, M. Keinänen, J. Reinikainen & A. Honkasalo (eds.). *Language, Truth, and Reality.* Tampere University Press. (pp. 227–236). https://doi.org/10.61201/h5fbdk64

natural kinds (cf. Ludwig 2018). My nominalist conception denies the existence of natural kinds and thus rejects any attempt to *reduce* natural kinds to any other entity such as a set of tropes. Therefore, I label my view "the *eliminativist nominalism* about natural kinds".

The eliminativist nominalism seems to create a problem about kind essences: if there are essential properties of certain natural kind K or kind essences but no natural kinds, which entity does have these properties or essences? The problem is still more pressing if we assume (as I do in this paper) that natural kind divisions are independent of us and our classifications. What is the basis of these divisions if there are no natural kinds or similar entities possessing the kind essences? My aim here is to argue that the eliminativist nominalism can solve this problem by means of the following strategy: although there are no natural kinds, there is general talk about entities belonging to natural kinds. This talk is made true by different kinds of entities and structures of entities, which are taken as instances of different natural kinds. Moreover, having certain features or a certain kind of structure are necessary to object's belonging to natural kind K if and only if their possession constitutes both sufficient *and* necessary condition for the application of the corresponding natural kind term. As an advocate of the trope theory SNT (the Strong Nuclear Theory) (Keinänen 2011; Keinänen & Hakkarainen 2024), I take the world to be ultimately constituted by tropes, that is, thin particular natures (such as certain determinate masses, charges and lengths) in some specific locations. However, the proposed view of natural kinds is not tied to trope theory and other nominalists (e.g., substance-mode-theorists) might adopt it.[1]

In what follows, I first specify what natural kinds are and why we need a metaphysical view of natural kinds. I then present the eliminativist nominalist view of natural kinds in more detail. The article ends with a brief concluding section.

Natural kinds

Prima facie, entities and concrete individual objects in particular share natural properties like the mass of 1kg and are therefore said to belong to the same *natural class* (class of 1kg objects). As there are divisions of objects into natural classes based on their mind-independent similarities, there are analogous divisions into natural kinds. However, objects belonging to a natural kind are typically required to share several distinct features and there is some exhaustive division of objects into natural kinds. Because of bringing effective classification to reality, natural kinds are important to scientific explanations and inductive generalizations.

We can point to prima facie examples of natural kinds at different levels of complexity. Fundamental microparticles divide into natural kinds such as electron,

[1] Of course, different nominalist ontological category theories have different resources for this task. For instance, John Heil (2012) has suggested that substances and their modes are sufficient truthmakers of attributions of natural kinds to substances.

down-quark or tau-neutrino. Similarly, there are natural kinds of atoms, molecules (e.g., water molecule) and chemical stuffs (e.g., water). Also living organisms seem to divide into natural kinds such as polar bear or oak tree. In addition to natural kinds of objects, there are natural kinds of processes such as different kinds of chemical reactions.

Very different kinds of beings are members of natural kinds, but we seem to give to natural kinds similar functions. Therefore, it is fruitful to present the different types of functions given to natural kinds:

1. Natural kinds permit inductive generalizations (Bird & Tobin 2022) and have a central role in scientific explanation (Boyd 1999, 2010; Hawley & Bird 2011).
2. The members of a natural kind possess certain basic dispositional properties, and some fundamental laws of nature concern the behaviour of every member of some kind K (Ellis 2001; Lowe 2009, 2015).
3. Natural kinds determine the identity conditions of their members (Loux 1978; Lowe 1998, 2009).
4. Natural kinds are referents of natural kind terms (Kripke 1980; Lowe 2009).

Function 1 has motivated the discussion of natural kinds in philosophy of science. Function 2 is present in metaphysics of science and in some theories of dispositional properties and laws of nature.[2] Function 2 is most notably advocated by Neo-Aristotelians (like Ellis and Lowe), who identify natural kinds with substantial kind universals. If natural kinds perform function 2, the corresponding classification of objects into natural kinds permits inductive generalizations and has a central role in scientific explanation, that is, these natural kinds also perform function 1. By contrast, the converse need not hold. We can well consider natural kinds having a central role in scientific explanation, but these natural kinds need not have any role in fundamental laws or as bearers of fundamental properties (Bird & Tobin 2022, sec.1).

The identificatory function 3 of natural kinds is put forth by Neo-Aristotelian metaphysicians. It is associated with the parallel function of natural kind terms or sortal concepts referring to natural kinds to provide us with the identity criteria of the objects belonging to the kind (Lowe 2009, 2015). Finally, both Neo-Aristotelian metaphysicians and certain advocates of the externalist theory of reference put forth function 4. Nevertheless, function 4 is not tied to the identification of kinds with kind universals. For instance, metaphysicians reducing natural kinds to complex property universals (Hawley & Bird 2011) or sets of particulars could assign it to natural kinds as well. Besides, natural kinds functioning as referents of natural kind terms

[2] Alexander Bird (2007) claims that we need not postulate natural kinds to perform this function, but fundamental dispositional properties are possessed by objects (e.g., basic microparticles).

need not be considered to fulfil stringent criteria: one might accept relationally or conventionally identified kinds to function referents of natural kind terms (Beebee & Sabbarton-Leary 2010, 4).

This brings another important dimension of comparison between the different accounts of natural kinds. We can ask how one can answer the *naturalness question*: what should be required of a kind to be considered *natural kind* instead of being an artificial or conventionally identified kind? Brian Ellis (2001, 19–23) sets six constraints on natural kinds as contrasted with conventionally defined or accidental kinds. In addition to demanding that natural kind divisions must be mind-independent, he requires that they are sharp and not gradual. Third, every natural kind must be determined by a set of features or a structure essential to the members of the kind. Fourth, these features must be intrinsic features of the kind members, or the structure must be intrinsic to each kind member. Finally, according to Ellis, every permanent difference in intrinsic features must lead to a division of natural kinds and natural kinds must constitute a hierarchy.[3]

As Ellis himself admits, these criteria are demanding and rule out biological species as natural kinds. The main problem with Ellis' constraints is that there seem to be mind-independent kind-like divisions among entities that do not fulfil constraints two, three or four. Here biological species might be a case in point. According to some accounts, the membership of an individual in a species (considered a biological kind) is determined (at least) by its lineage and (possibly) some other extrinsic features. Since species are in constant flux, they do not have sharp boundaries or even a clearly specifiable set of kind-determining features (Ereshefsky 2010; Bird & Tobin 2022, sec. 2.1). There might be equally legitimate alternative ways to divide living organisms into distinct species (Kitcher 1984). Still, our kind terms might well track some mind-independent divisions among biological organisms.

At another end of the spectrum, natural kinds of physical microparticles, atoms and molecules have a clear set of features or a structure intrinsic to every member of the kind. They seem to fulfil all, or almost all criteria Ellis sets to natural kinds.[4] Things get more complicated if we go to the kinds of chemical stuff and chemical compounds, in particular. Take, for example, water. Metaphysicians of science do not agree on whether water has a micro-structural essence (i.e., micro-structuralism about water). While Needham (2000) argues against micro-structuralism, Hendry (2006, 2023) puts forth and defends a qualified form of micro-structuralism about water, which might be extended to some other chemical compounds.

Being a Neo-Aristotelian realist, Ellis has a clear motivation to set restrictions on the different substantial kind universals (i.e., natural kinds) he postulates. By contrast, the eliminativist nominalist about natural kinds may adopt a more

[3] Here, I have changed the order of presentation of requirements and joined Ellis' speciation requirement and hierarchy requirement into one.

[4] Since water molecules, for instance, are in constant flux as parts some portion of water (cf. Hendry (2006, 869 ff.), it is, however, contestable whether we can draw sharp boundaries for the set of the instances of the kind water molecule.

relaxed view, according to which naturalness of kinds comes in degrees. The kinds of elementary particles, atoms and molecules might be considered *perfectly natural kinds*: the members of a kind have a set of intrinsic features individually necessary and jointly sufficient for being a member of the kind. By contrast, if the membership in a natural kind is partly determined by the relations the kind members bear to other individuals, we have a less than perfectly natural kind. Another possible case of a less than perfectly natural kind is that there are sets of alternative features necessary to an entity to be a member of natural kind. If biological species are natural kinds – which is also contestable - they might have sets of alternative kind-determining features.[5] Since there are no natural kinds as constituents of reality, the eliminativist nominalist view can remain tolerant to all these cases – it suffices that there is a natural division that can be specified by means of comparatively simple criteria.

The nominalist view of natural kinds

As indicated above, the eliminativist nominalist view of natural kinds denies the existence of kind universals (Ellis 2001; Lowe 1998, 2006, 2009) and the identification of natural kinds with complex property universals (Hawley & Bird 2011). Moreover, this view rejects the nominalist attempts to identify natural kinds with sets of objects (Quine 1969) or abstractions from natural kind terms (Keinänen 2015). The main motivation here is categorial ontological economy: we can take care of most of the above functions set to natural kinds without postulating them as separate constituents of reality.

In order to get my nominalist view off the ground, I tentatively adopt an application theory of natural kind terms. In other words, natural kind terms are predicates applying to objects rather than singular terms referring to natural kinds.[6] We might later replace the application theory with some better account, which provides us with a more precise conception of the special identificatory function of natural kind terms. Thus, the advocate of the nominalist view can agree with Neo-Aristotelians on the epistemic role of natural kind terms in the identification of objects. However, they deny that there are natural kinds having the corresponding function to (contributing to) determine the identity conditions of objects.[7]

The eliminativist nominalist is obliged to specify in more explicit terms what is for a structure of entities to function as a *truthmaker* of the attribution of natural kind to an object. Here it suffices to lay down three principles of truthmaking, which are

[5] Another alternative put forth in the discussion about species is to assume that instead of being natural kinds at all, species are complex individuals.

[6] This view of natural kind terms as predicates applying to objects is associated with Putnam (1975) and later advocated in different forms, for instance, by Devitt (2005) and Haukioja (2012).

[7] Following Lowe (2003), I distinguish between individuation in the epistemic sense (identification) and individuation in the metaphysical sense (individuation). Correspondingly, natural kind terms can have a central role in the identification of objects.

rather widely accepted.[8] First, truthmakers are entities or pluralities of entities. We need not assume that every plurality of entities constitutes a complex entity. Second, items made true are interpreted sentences, which I call statements. Instead of statements, one might consider items made true propositions. I consider propositions problematic postulations, but much does not depend on this matter here. Thirdly, the existence of the truthmaker necessitates the truth of the statement made true. Thus, the intuition that the statement is true because its truthmaker exists is (at least partially) cashed out by means of necessitation.

The eliminativist nominalism denies that there are any such entities as natural kinds that would be referents of natural kind terms (function 4). It depends on the preferred nominalist ontological category theory what would be taken as truthmakers of the attributions of natural kinds to objects. For example, according to our trope theory SNT (the Strong Nuclear Theory) (Keinänen 2011; Keinänen & Hakkarainen 2014), only fundamental objects are trope bundles. Necessarily, if they exist, they have certain nuclear tropes as their proper parts. These nuclear tropes are also truthmakers of the claim that the corresponding object belongs to a certain natural kind. For instance, certain determinate mass, electric charge and spin tropes make true the claim that a certain micro-particle is an electron.

We can present a similar explanation for why complex objects that have certain kinds of objects as their parts necessary to their existence belong to a natural kind. Roughly, the parts related in a certain way are sufficient truthmakers for the complex object belonging to a natural kind. Here we have a recourse to the relations between proper parts, which unify the parts into a complex object.[9] This kind of account of natural kind membership is microstructural. It might perhaps be applied to the natural kinds of microparticles, atoms and molecules. I have presented this account of kind membership as a view that is committed to de re necessities; according to it, the kind determining features and natural kinds would be necessary to the members of the natural kind. The eliminativist nominalism is not committed to this claim. Depending on the nominalist ontological category theory assumed, one might take some or even all kind-determining features as contingent to the members of a natural kind. In this case, we would have only de dicto necessities involved in our account: because of having certain kind determining features, an object belongs to a certain natural kind. Moreover, having these kind-determining features constitutes the necessary condition for application of the kind term to the object. Therefore, the kind-determining features are necessary for every member of the kind.[10]

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[8] See, for instance, Rodriguez-Pereyra (2002), Maurin (2002) and Simons (2000). Some theorists (e.g., Rodriguez-Pereyra) assume that truthbearers and items made true are propositions, but I consider it as an additional commitment. Similarly, I will not consider here the later attempts to elucidate truthmaking by means of metaphysical grounding.

[9] See Mckenzie & Muller (2017) and Hendry (2023) for empirically motived answers to the special composition question: in which conditions objects related in a certain way constitute a complex object.

[10] The view that natural kinds are necessary to their instances has remained contestable. Brian Ellis (2001, sec.7.5), for instance, who advocates Neo-Aristotelian realism, denies the need to consider natural kinds necessary to their instances.

According to the eliminativist nominalism, there are no natural kinds as constituents of reality. Therefore, the above functions assigned to natural kinds are either left unoccupied or given to the entities the different nominalist ontological category theories might postulate. According to the SNT, the identity conditions of fundamental objects are determined by their nuclear tropes. Additionally, one might introduce rigid existential dependencies between complex objects and their proper parts and/or relations between the proper parts. These parts and/or relations between parts would be necessary to the complex objects and contribute to their individuation. My purpose here is only to illustrate how *certain* eliminativist nominalists can take care of function 3 assigned to natural kinds without postulating substantial kind universals, but not to argue for this proposal.

Similarly, according to eliminativist nominalists, we need not introduce kind universals to function as entities collecting fundamental properties, which are truthmakers of law statements (function 2). The eliminativist nominalist can maintain, for instance, that tropes or modes already play this role, and we need not postulate kind universals. However, there are difficult issues left to the nominalist in the metaphysics of laws, to which I cannot go to in the limits of this chapter. Finally, since not being *error-theoretic eliminativists* about kind-talk, eliminativist nominalists can accept the use of natural kind terms in scientific explanations and inductive generalizations (function 1).

In addition to natural kind terms having their application conditions fixed by the theoretical context in which they occur (like "hydrogen atom" or "water molecule"), there are natural kind terms such as "gold" and "water", whose application conditions appear to be fixed by some manifest criteria. Again, eliminativist nominalists must provide us with an account of such natural kind terms that is consistent with rejection of natural kinds as separate entities. Moreover, it is preferable to adopt a semantic theory that avoids strong metaphysical implications and leaves the possible commitment to de re necessities to the preferred ontological category theory.

Jussi Haukioja's (2012, sec. 3) theory of natural kind terms as *actuality dependent expressions* is the most promising available account fulfilling these constraints.[11] According to it, every general term has an *applicability role*, which specifies the criteria that an object or stuff must satisfy for a general term applying to the object. The applicability roles of such paradigmatic natural kind terms as "water" and "gold" are specified by the descriptions of the manifest features of an object or stuff. In the case of paradigmatic natural kind terms, the applicability role is realized by empirically. discovered features or a structure distinct from the manifest features. The latter determine the membership of an object or stuff in a natural kind and its manifest features (at least in the actual world). The paradigmatic natural kind terms are *actuality dependent* expressions: the same features/structure that actually realize their applicability role realize the applicability role in every possible world.

[11] Other theories of "rigidity" of general terms make more problematic ontological assumptions. For instance, Devitt (2005) commits himself to the view that natural kinds are necessary to their instances.

For instance, if a structure constituted by H_2O molecules and some other molecules and ions actually realizes the applicability role of the kind term "water", the same structure realizes the role in every possible world.

Haukioja's theory allows for alternative structures or groups of features realizing a single applicability role. Moreover, the realizers of an applicability role can contain extrinsic features of objects. The theory fits with the eliminativist nominalism about naturel kinds: instead of kind universals, there are groups of features or structures of entities which are truthmakers of attributions of natural kinds to objects and stuffs. If objects having certain features or a certain kind of structure are the only truthmakers of attribution of natural kind K to the object, these features or structure are necessary to the members of K. We need not introduce any kind essences or de re necessities to explain this, but all work is done actuality dependence; if an object having certain features is the realizer of the applicability role, this type of object realizes the role in every possible world.[12]

Conclusion

According to the eliminativist nominalist view of natural kinds, there are no natural kinds. Since there are no natural kinds, there are no natural kind essences or de re necessary properties of natural kinds. There is true general talk about the members of natural kinds and classifications of objects with the help of natural kind terms, which track mind-independent divisions. The nominalist theory is not committed to the necessity of natural kinds to their members; the nominalist ontological category theories into which the theory is integrated might be so committed, at least in some cases. Nevertheless, in many cases, the source of the necessity of certain features to the members of a natural kind might be only the fact that the kind term tracks objects having certain features or a certain kind of structure in every possible world.

The nominalist theory stresses the epistemic and explanatory functions of natural kinds and natural kind classifications (function 1). By contrast, the metaphysically heavy functions of collecting the necessary properties of the members of the kind (function 2) and determining the identity conditions of objects (function 3) are taken care of the nominalist basic ontologies. Because of its flexibility, this nominalist view of natural kinds interlocks well with the new theory of reference Panu Raatikainen (2020, 2021) defends.

[12] Haukioja (2015) adopts a conferralist view of the necessity of certain kind-determining features to the members of the kind. Roughly, because of our dispositions to use kind term, we also confer the necessity of certain features to the members of a natural kind. From the eliminativist nominalist perspective, this conferring is not required because there are no natural kinds.

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