Ontology and Explanation

Scott Mann

This paper critically assesses some recent attempts to develop and update the basic categories of Aristotle's ontology, by Jonathan Lowe and Brian Ellis. It defends these attempts in face of criticisms by John Heil, while also addressing, and responding to, some possible weaknesses in Lowe and Ellis's accounts. The paper defends Boyd's idea of higher order kinds as homeostatic property clusters.

1. Lowe

Jonathan Lowe has contributed to contemporary debate in defending a four category ontology which he sees as originally developed by Aristotle in his early work the Categories. The key discussion here seems to be that of Categories 1–3 where Aristotle talks about different sorts of predication, essential and accidental. In the former case he is concerned with properties essential to a subject's being the kind of subject it is. In the latter with properties which can change without the entity in question ceasing to exist. Some properties can be either essential or accidental depending upon the subject which is the bearer of such properties. But Aristotle also identifies properties which are never predicated of anything essentially. Shields refers in this connection to such "non-substance particulars" as "the individual whiteness manifested by Socrates at a given time" (Shields, 2007:155).

Lowe's ontology involves two fundamental categories of universals; substantial universals or kinds and property universals; and two categories of particulars, objects and tropes. A universal is "a repeatable entity, which can be borne by many different particulars, at different times and places" (Lowe, 2006:10). This presumably corresponds to Aristotle's idea of both essential and non-essential properties. Substantial universals correspond to Aristotelian essences — to those clusters of properties, or forms, which define kinds of substance. Objects are specific instantiations of such kinds, corresponding to Aristotelian substances, as complexes of matter and form; "property bearing particulars which are not themselves borne by anything else" (Lowe, 2006:10).

Tropes are properties conceived as particulars, instantiations of property universals; presumably corresponding to Aristotle's "non-substance particulars". Lowe emphasises that tropes cannot "float free" nor are objects reducible to bundles of tropes. Rather,
properties, whether thought of as universals or tropes, are “the ways objects are” (Lowe, 2006:14). An object's redness is its “way, or mode, of being coloured”. According to Lowe, this ontology is uniquely able to “account for the ontological status of natural laws by regarding them as involving ... substantial universals”. Things have particular powers and dispositions to behave in particular ways in particular sorts of situations by virtue of the kinds they instantiate. Reference to such kinds therefore explains the behaviour of the things in question in the relevant sorts of situations.

2. Heil

John Heil has criticised Lowe's ontology (Heil, 2003). He sees himself as following Locke, in particular, in refuting the reality of universals of any kind, both property and substance universals, in favour of a two category ontology of individual objects and tropes or modes. Heil sees no need for the idea of a shared universal property that makes two objects instances of the same kind, because we can instead refer to their sharing “exactly similar modes”. At the same time, he sees the idea of perfect similarity as a limiting case of imperfect similarity. Heil claims that the supporters of universals see transcendent universals as existing “outside of space and time”. And immanent universals have the equally problematic capacity to be wholly present in different places at the same time. Modes, by contrast, are “uncompromisingly and straightforwardly denizens of the empirically accessible spacetime domain, restricted to existence in one place at a time” (Lowe, 2006a).

But it is far from clear what Heil means when he substitutes “perfectly similar modes” for universals. It would seem that no two modes can ever be perfectly similar, insofar as they have different spacetime locations and are either properties of different objects or different properties of the same objects. The only ways in which modes could be perfectly similar is in being modes, rather than any other ontological category of thing, or in involving the instantiation of a numerically identical universal. But Heil rejects both the idea of a hierarchy of properties, including properties of properties, and the idea of properties as universals.

For Lowe, as for Aristotle, universals exist either as instantiated in spatiotemporally extended individuals or as real possibilities of such instantiation. Only certain combinations of properties are stable in particular circumstances. An individual can exist only as an instance of a possible kind or an aggregate of such instances. And existing things have real capacities, through their actions and interactions, to produce further things with particular properties. Living things produce more living things; human societies produce artefacts; dust clouds condense into stars.

Heil refers to Lowe identifying the power of a particular instance of aqua regia to dissolve gold as a consequence of facts about kinds. He quotes Lowe as saying that “objects derive their powers” from kinds. Heil argues that the kind concept is explanatorily redundant. In Heil’s own ontological scheme the power of a particular instance of aqua regia to dissolve gold actually derives from this instance of aqua
regia being aqua regia — in the sense of, as Heil says, “answering to the aqua regia term or concept” (Heil, 2006:16). Heil argues that there is no explanatory advantage in saying that instances of aqua regia have their gold dissolving power because they are instances of the kind aqua regia.

A four categorist would respond by saying that instances of kinds are distinguished by their essential natures, or defining structural features, which explain their other features — their behaviour, their development, their relations with other things. This particular thing A (this tank of aqua regia), has the power or disposition to do X (to dissolve this lump of gold), if appropriately triggered in a Y type situation (the gold is immersed in a fresh solution) because it is one of those Z kinds of thing (it is an instance of aqua regia) characterised by a particular essential distinguishing structure (it is a mixture of nitric and hydrochloric acid molecules) and reference to that structure explains the power in question (the nitric acid acting as oxidiser forms a few positive gold ions and the hydrochloric acid supplies negative chloride ions which react with the gold ions to produce a soluble gold salt Ag Cl4).

Heil tries to reject such a concept of explanation by rejecting the distinction between categorical and dispositional properties, with the latter thought of as grounded in, and explained by, the former. He argues that all properties are both dispositional and categorical. So the aqua regia is just something that has the intrinsic gold dissolving capacity. We explain the dissolution of the gold by noting that it came into contact with something with a gold dissolving capacity.

Such ideas might have appeal to empiricists. But a realist would argue that these are the things that need to be explained. Why do these instances (of aqua regia) share this power? What is the basis of this power? Heil’s shift from kind to concept reflects his idea that there are many possible ways of drawing the boundaries or dividing up the world into kinds. Our singling out some similarities for special recognition rather than others reflects our interests even though, as he says, “that which is singled out is objective and mind independent”.

3. Locke

In Book III of An Essay concerning Human Understanding, Locke followed Aristotle in attributing explanatory primacy to essences or substantial universals, in accounting for qualitative distinctions, of kinds of objects in the world as perceived. But Locke was influenced by positivistic, mechanistic and atomistic ideas of his day in understanding such explanation as typically involving reference to underlying micro-structures of imperceptible component elements. Locke advanced three principal arguments against the existence of essences in this sense. In the first instance, as intrinsically imperceptible, such essences are beyond all possibility of verification and hence without justification. In the second instance there are actually “no chasms or gaps ... in the visible corporeal World” which justify any objective classification of different — stable, qualitatively distinct — kinds of things, whose stability and distinctness stand
in need of explanation by reference to discrete essences (Kornblith, 1993:20). In the third instance, even if there were such gaps or chasms in the world as perceived, there would be no reason to prioritise a classification based upon such chasms. For there will always be other ways of dividing up the natural world, depending upon our particular human purposes and priorities.

But, as Kornblith argues, none of these arguments can be supported. In the first instance, the world as perceived does, in many areas, exhibit precisely the kinds of chasms Locke denies. This is evidenced by e.g. common biological classificatory schemes which have evolved quite independently across a range of different cultures. It is evidenced by the fact that the human race has survived and developed on the basis of what have turned out to be generally reliable inductive inferential processes grounded in just such perceived differences and regularities. Certain perceptually distinguishable kinds have turned out to be edible (or poisonous), to be good stones for making tools or building houses, to be relatively safe creatures to hang out with or dangerous creatures to avoid etc. In the second instance, just because essences, constructed in imagination to explain such differences, are not immediately perceptible, this in no wise undermines the possibility of verification by reference to novel predictions of observable consequences of the existence of such essences. Not only have a range of such essences been verified in this way, but so have previously imperceptible entities and processes become increasingly more directly observable through the development of appropriate new technologies shaped by the theories in question. In some cases such verification has confirmed the original perception based classification. In others, it has served as a principled basis for reclassification. And this points to the obvious answer to the third objection, while other sorts of — subjective — classificatory schemes are obviously possible, they lack the — objective — explanatory power of reference to real essences. We can “choose” to continue to classify whales as fishes, for some purpose or other. Their superficially similar shapes and behaviours are a common feature of adaptation to living in a liquid medium. But reference to their underlying structural differences hugely increases our understanding of their behavioural similarities and differences.2

4. Ellis

When contemporary natural kinds theorist Brian Ellis refers to the essential natures of things it is in this Lockean sense that he understands essential natures; as underlying structures or organisations of component parts which are jointly responsible for the clustering of the observable properties by which we were initially inclined to classify

---

1 As Kornblith says, “If there were real kinds in nature there would have to be chasms or gaps separating one kind from another for otherwise things differ from one another not by kind but only by degree. But when we examine nature we find that there are no such gaps” (Kornblith, 1993:21).

2 Just as our ideas of the boundaries and reference of kind universals can change so can our ideas of the boundaries of some sub system within a structure of some kind. But this is a process of correction and development, not some arbitrary change of focus.
the relevant objects into kinds; or which have led to a principled, causally based, revision of such classification. Ellis argues that the essential properties of a thing are found amongst its intrinsic properties, properties which it has independently of causal relations with other things. Some kinds of thing, like fundamental particles, have no intrinsic properties accidentally. Other kinds can have intrinsic properties accidentally, as with a crystal which has been electrically charged. Ellis argues that only certain combinations of properties qualify as genuine natural kinds. Chemical elements, compounds and such aggregates of elements and compounds as pieces of metallic copper and crystals of copper sulphate qualify as natural kinds by virtue of “being categorically distinct from each other ... with no gradual transition from one chemical kind to any other” (Ellis, 2002:26–28). And such distinguishing properties turn out to be fully explicable by reference to underlying essential and intrinsic properties of atomic and molecular structure. More complex biological and social structures “fail the categorical distinctness test” and are not real natural kinds.

Ellis’s scepticism about biological kinds centres upon modern evolutionary and genetic theory which recognises that “the distinctions between the extant species are not always clear, and there are some well known cases of continuous variation between what would generally be agreed to be different species...” (Ellis, 2002:29). He is even more dismissive of any idea of social essence. He says “as we move to yet more complex systems, from biological organisms to ecological or social systems, natural kinds analyses become much less interesting. There are no natural kinds that satisfy the strict criteria applicable to chemical kinds ... Therefore, however successful the sciences of ecology, economics, sociology and the like may be in achieving their ends, we have no good reason to be realistic about the theoretical entities they employ...” (Ellis, 2002:32). Ellis has resurrected Locke’s argument about a lack of “gaps” separating one kind from another in the biological and social worlds. And while Locke rejected all essences, in part, by appeal to an empiricist methodology, Ellis has rejected higher order essences by appeal to a priori ontology.

5. Homeostatic Property Cluster Kinds

Higher order kinds are characterised by a complexity, a variability, and an intrinsic dependence upon other things at odds with too simple an essentialist account and with Ellis’s identification of essential properties with intrinsic properties only. As Aristotle

3 This possibly applies to lower order physical kinds as well. There are arguments to the effect that what are, in Ellis’s view, essential properties of physical systems, are actually relational properties. Dennis Lehmkuhl, e.g., argues that “the properties of mass, stress, energy, and momentum should not be seen as intrinsic properties of matter, but as relational properties that material systems have only in virtue of their relation to spacetime structure” (Lehmkuhl, 2011). Maudlin argues that all coherent contemporary interpretations of quantum theory (David Bohm’s ontological interpretation, and Ghirardi, Rimini and Weber’s and Perle’s spontaneous collapse theories) agree that “the physical state of the world is not separable” (Maudlin, 2007:62); meaning that it is not the case that objects situated in different parts of space “can lay claim, at a certain time, to an existence independent of one another”, (Maudlin, 2007:53). Quantum properties are essential, but they are not “intrinsic” in Ellis’s sense.
recognised, complex kinds — of living things (e.g. frogs) and social systems (e.g. feudal societies) — exist only through ongoing homeostatic (causal) interactions of their component parts, with each other and with aspects of their ambient environment. And while such components can sometimes exist in different sorts of environments or complex structures, they take on — or lose — properties and powers by virtue of their positions within particular structures.

As Richard Boyd argues, it is appropriate at this level to identify kinds with clusters of interdependent underlying and surface properties, rather than with fixed sets of underlying properties necessary and sufficient for (particular) kind membership and for causal explanation of surface properties. Kind membership depends on substantial overlap of individual properties with those of the cluster, allowing for significant variation within a kind and for change in such defining properties over time. But the causal structure of the world places significant restrictions upon what sorts of structures are stable in particular environmental circumstances, and what sort of structures can be produced by existing sorts of structures (Boyd, 1999).

It’s true, as Ellis observes, that there are intermediate historical steps between biological species, as well as variation within populations. But only certain structures of interdependent genotypes and phenotypes can survive and combine to produce viable offspring in particular situations. And if Eldredge and Gould are correct, then most species exhibit little net evolutionary change for most of their geological history.

Such complex homeostatic systems exist only in and through ongoing interaction with complex environments, so that their essential properties include relational properties. As Aristotle recognised, plants and animals exist only so long as they take in nutrients and excrete waste products; animals only so long as their ongoing perception-guided movement around that world allows them to find food and mates, escape predators etc. Human societies exist only though ongoing interaction with the natural world, through agriculture, construction, manufacture etc. Both populations of living things and human societies have been destroyed through damaging the external conditions of their own existence.

Aristotle identifies people as “by nature socio-political animals” meaning that they can only function or flourish as human beings within a socio-political structure of some kind — considered as an organised totality of political organisations, economic relations and civil society associations. As Shields says, “Aristotle sees an intimate, symbiotic connection between human nature and socio-political association” (Shields, 2007:53). He identifies the polis, or state broadly conceived, as a structure existing prior to the individual, shaping all aspects of individual development, and itself having developed “in an organic sort of way from simpler forms of communal organisation” (Shields, 2007:385).

Such interactions are therefore essential to plants, animals, humans and human societies being the kinds of things they are. More complex structures, with new and emergent kinds of powers, (conferring new powers upon their component entities) come into being and continue to exist only within pre-existing complex structures, which shape, cushion, sustain and protect them, even as they themselves contribute to
the maintenance (or degradation) of the structures in question. In basing his account upon what he takes to be essential features of chemical kinds Ellis simply fails to consider the essential features of higher order kinds.

6. Social Systems

Some of the essential attributes of life are unique to living things — cells containing DNA, growth and development, reproduction and evolved traits. Others are shared with other sorts of complex systems — self-regulation of internal conditions, responsiveness to their environments, and energy transfer between such systems and their environments.

Different sorts of living things exercise these functions in different ways, through different sorts of bodily structures and metabolic processes. These different sorts of structures and processes themselves provide the basis for distinguishing different biological domains, as higher order (kinds of) kinds. Amongst the eukaryotes — with cell nuclei and organelles — the plant and animal kingdoms are distinguished by the photosynthetic food production of the former, as against the ingestion of food by the latter, amongst other things.

As Aristotle recognised, just as biological systems are distinguished by specifically biological “emergent” powers or functions over and above the physical and chemical powers of their component compounds, so are human social systems similarly distinguished by specifically social emergent powers and functions, over and above the biological powers of their component living systems — plants, animals, people. This includes economic functions of organised production and distribution of goods and services (mediated by developing social and material technologies), political functions of social integration and dispute resolution (the making and enforcing of laws and border protection), and ideological functions of distribution and updating of (organised and developing systems of) beliefs and values. Just as essential biological functions are exercised by different sorts of biological structures in different sorts of organisms, so are such social functions exercised by different sorts of social structures in different sorts of human societies. In the modern world, state structures, private business organisations and civil society groups play more or less significant roles in exercising these three essential functions. Principled typologies of social forms highlight the differing roles of particular social structures in relation to the three essential social functions.

Ellis argues that the absence of biological and social kinds precludes realistic interpretation of any biological or social theory seeking to explain appearances by reference to underlying essential structure. In fact, real explanatory and predictive power on the part of a theory is typically evidence of the operation of real causal processes and mechanisms. Variations of the homeostatic property cluster model for complex kinds,
including the interplay of genotypic and phenotypic elements, receive substantial support from the explanatory and predictive progress of biological science. And other such HPC models receive rather more support from the progress of social scientific research than is typically acknowledged.5

Bibliography

Boyd, 1999

Ellis, 2002

Heil, 2003

Heil, 2006

Kornblith, 1993

Lemkuhl, 2011

Lowe, 2006

Lowe, 2006a

Maudlin, 2007

Shields, 2007

But the fact that we can say this, supports the realist position. We have ultimately determined which models are correct. And most models with a successful record of knowledge generation have turned out to be at least partially or approximately correct.

I have in mind here, particularly, historical materialist social science, which highlights the causal primacy of the institutions fulfilling economic functions in shaping the operation of institutions involved in political and ideological functions. In the modern world, the economic function — allocation of resources and control of production and distribution — can be carried out by state power, by capitalist corporations, by social powers of civil society or by some combination of these.