

SUBSTANCE: THINGS AND STUFFS

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1. *Substances: things*

We conceive of the natural world as populated by relatively persistent material things standing in spatio-temporal relations to each other. They come into existence, exist for a time, and then pass away. We locate them relative to landmarks and to other material things in the landscape which they, and we, inhabit. We characterize them as things of a certain kind, and identify and re-identify them accordingly. The expressions we typically use to do so are, in the technical terminology derived from Aristotle, names of *substances*.¹

The term ‘substance’ has two distinct, but importantly linked, meanings. In the Aristotelian sense, a substance (more accurately, ‘a primary substance’) is a concrete individual thing of a given kind, such as a particular human being (Socrates), a given tree (such as Gautama’s Bo-tree) or a certain stone (the Kohinoor). The general kind (the ‘secondary substance’ in Aristotle’s terminology) to which the individual substance belongs is specified by a substance-name (‘human being’, ‘pipal tree’, ‘diamond’). Individual substances are the basic objects of reference and subjects of predication in our conceptual scheme. They *are* things of one kind or another (specified by a substance-name, as when we say that Socrates *is a man*). They are *qualified* by numerous properties, specified by non-substantial predicates (for example, *is in the agora*, *is snub-nosed*, or *is a philosopher*), but they are not themselves predicable of things – Socrates cannot be said *to qualify* anything or *to be true of* anything (as opposed to *being like Socrates*, which is a relational property some rare people may have). Nor can the proper name ‘Socrates’ be said *to be true of* anything, by contrast with the identifying phrase ‘is Socrates’, which is true of the teacher of Plato, and tells us who he is.

Characterizing an individual as a thing of a given kind by using such a (secondary) substance-name answers the question of *what the thing is*. Grasp of the substance name implies knowledge of what *being a such-and-such* consists in, in so far as that is logically (or, in the extended sense of the term, grammatically) determined. The substance name provides a covering concept for statements of identity concerning individual things of the relevant kind (Tully is the same *man* as Cicero, Hesperus the same *planet* as Phosphorus, Zeus the same *god* as Jupiter). To have an adequate grasp of what a thing is, i.e. that it is a thing of such-and-such a substantial kind, is to know (in more or less detail) how to distinguish one such thing from others, typically, but by no means uniformly, how to count such things, and what kinds of change or metamorphosis any individual of the kind in question can undergo compatible with its continued existence and persistent identity. How much of such information is to be deemed constitutive of the meaning of the substance term is often indeterminate.

Substances lend themselves to hierarchical classification. Human beings are a kind of anthropoid ape, anthropoid apes a kind of mammal, mammals, in turn, being kinds of vertebrate. If a species name (such as ‘human being’) applies to an individual substance, and a generic name applies to the species (as ‘animal’ applies to human beings) the generic name

¹ Aristotle’s most accessible discussion of substance is in the *Categories*, chaps 1-5. His discussion in the *Metaphysics* is much more problematic and his hylomorphism questionable. The major contributor to modern discussion of this difficult topic is David Wiggins: see, for example, his *Sameness and Substance Renewed* (Cambridge University Press, Cambridge, 2001). I am much indebted to his writings on this theme.

also applies to the individual (primary) substance. Generic terms, no less than their subordinate names of species, signify secondary substances, i.e. are names of substantial kinds. But the species name is more specific and hence informative than the generic name.

Substances are picked out by a subclass of concrete (as opposed to abstract) count nouns. For we must distinguish between 'tinker', 'tailor', 'soldier', 'sailor', which are concrete count-nouns but not substance-names, and concrete count-nouns that are substance-names, such as 'man', 'dog', 'cabbage'. One difference is that a non-substantial count-noun may cease to apply to an individual thing, without the thing ceasing to exist, whereas a substance name cannot. So, for example, NN can cease to be a tinker or tailor, yet continue to exist and be the very same human being, but he cannot cease to be a human being and continue to exist. Another is that non-substantial count-nouns that apply to substances are themselves explained in terms of the substance-name and a phrasal characterization that is not a characteristic mark of the substance, but does define the non-substantial noun. So, a tinker is a man *who repairs pots and pans*, a tailor is a man *who makes clothes*. Concrete count-nouns such as 'man', 'horse' or 'tree', have both singular and plural forms, take numerals as adjectives, and their plural form takes the quantifiers 'many', '(a) few', 'several', as well as phrasal quantifiers such as 'a great number of' and 'a large number of'.

Artefacts (if we admit them among substances, as I shall urge we should) are similarly classifiable. A dumb-waiter is a kind of table, a table a piece of furniture of a given sort, pieces of furniture are a kind of artefact.

Scientific classification aims to be systematic, guided by clearly stateable and applicable principles of classification. These, wherever possible, aim to ensure exclusion of cross-classification, and to determine categories that are fruitful for explanatory purposes and scientific generalization. Non-scientific classification is typically less systematic, guided by a multitude of different purposes, often non-explanatory ones, characteristic of human societies. Even when the purposes are explanatory, the forms of explanation may not be those of the sciences, but pertinent to one form or another of human practice (cuisine, agriculture, manufacturing, architecture, etc.) or to societal concerns and interests (including those of morality, criminology and law). These are no less substance-invoking than the explanatory vocabulary of the sciences.

With respect to any substance, we can typically distinguish between properties that are essential for the thing to be the kind of thing it is and properties that are inessential (the *accidents*), even though we may be forced to recognize a degree of indeterminacy in the essential properties and hence borderline cases of being a such-and-such. An individual diamond must consist of carbon in appropriate crystalline structure, and must have a scratch hardness of 10 on the Mohs scale – these are essential properties. But it may be large or small; white, blue, red, green, or black; be set in a crown or other setting – these are accidental properties. A tree must be a perennial plant with a woody trunk; it may be deciduous or evergreen, have smooth or rough bark. But the boundaries between what to count as a tree and what to count as a shrub or bush are not, and need not be, clearly determined. How high must a mature specimen be? Must it have branches? No decision is normally necessary. To be sure, the concept of a tree is not part of botanical taxonomy. But it would be mistaken to suppose that the substance-names of scientific taxonomies are *always* sharply defined. Given the evolution of species, it is evident that the boundary lines determining one species and differentiating it from an emerging species are not always sharp, and borderline cases are commonly to be found. We shall revert to this point again below.

Since the accidents of a substance can vary without the substance ceasing to exist, individual substances, as Aristotle noted, may admit of contrary accidents at different times. So a substance the identity of which is not colour involving, for example, may have one colour now and another colour later. A living substance may have such-and-such a size and weight now and a different size and weight later. But any given substance S remains one and the same S throughout such accidental changes.

2. *Substances: stuffs*

In a different, but ordinary and familiar, sense of the term ‘substance’, a substance is material stuff of one kind or another.² It is in this sense that we speak of sticky substances and of chemical substances, and say that iron and steel, sand and water, bread and butter are substances of different kinds. Just as substances, understood as kinds of things, can be classified into genus and species, so too can substances, understood as kinds of stuffs or materials. Iron, brass and copper are species of metal; mutton, venison and beef are kinds of meat; cotton, wool and nylon are types of fabric.

Substances in the sense of stuffs are named by a subclass of concrete *non-count nouns*. For we must distinguish between concrete non-count nouns that are names of kinds of stuff, and those that are not. The latter class includes such mass nouns as ‘light’, ‘sunshine’, ‘shade’, ‘fire’, on the one hand, as well as pseudo-mass nouns such as ‘furniture’, ‘money’, ‘cutlery’, ‘clothing’, on the other.

Concrete mass nouns of the class that concern us, such as ‘wine’, ‘metal’ or ‘glass’, do not have a genuine plural form save when used generically to refer to general types (as in ‘the wines of France’ or ‘the metals of the earth’). They take the quantifiers ‘much’ and ‘a little’, and phrasal quantifiers such as ‘a great deal of’ and ‘a large (or small) quantity of’. They can be transformed into singular referring expressions by partitives that confer countability, such as ‘nugget of’, ‘pool of’, ‘grain of’ prefixed by an article or indexical, to yield ‘the nugget of’, ‘that pool of’, ‘this grain of’ that form particular-designating expressions when affixed to them. An alternative transformation is by means of quantity-designating partitives, such as ‘litre of’ or ‘pound of’, which lend themselves to a different kind of particular reference, as in ‘the litre of milk in the bottle’, ‘the pound of butter in the fridge’. Specific quantity reference here allows numerical quantification, but not countability. Five litres of S, unlike five nuggets or puddles of S, does not specify a number of things, but a quantity of (liquid) stuff.

What marks out the category of substance (stuff) nouns less formally than adjectives of quantity, and differentiates them from pseudo-mass nouns like ‘furniture’, ‘money’ or ‘cutlery’, are three further characteristics.

First, these nouns signify that of which space-occupying particulars consist. Material things, whether they be substances, partitions of stuff (such as chunks, nuggets, lumps or grains), or specific quantities of stuff (such as pints, pounds, litres), consist of stuff.

Secondly, every arbitrary division of a partition or specific quantity of a substance (stuff) yields a further partition of that stuff down to the level of *non-dissectivity*. So, for example, every arbitrary division of a chunk of gold will yield further partitions – nuggets, grains, shavings – of gold down to the atomic level (at which point dissectivity ceases, since atoms of gold do not consist of gold). Similarly, every pool, puddle or glass of water can be further divided into quantities of water, down to the molecular level. Blood, unlike water, ceases to divide into further quantities of blood at the molar level.

Thirdly, the specific quantity of stuff of which a given partition consists (the water of which the glass of water consists), as well as the specific quantity of stuff of which a given object is made (the gold of which a gold ring is made) can retain its identity *qua* specific quantity despite change of form specified by the partitive (e.g. ‘glass of’) or destruction of the object made of the stuff (e.g. the melting down of the gold ring). So, the puddle of water on the floor may be the very same water as was previously in the glass, and the gold of which the brooch is made may be the very same gold as that of which the ring was made. Quantities of stuff are, in respect of their identity, *form-indifferent* (the gold that was a ring is now a brooch), *fusible* (as when we pour two glasses of water into the same jug, which then contains the very

² For more detailed treatment, see P.M.S. Hacker, ‘Substance: the Constitution of Reality’, in *Midwest Studies in Philosophy* IV (1979) 239-261.

same quantities of water, although no longer separable or separately identifiable) and *dispersible* (as when we scatter ashes to the wind, or pour a pint of water into the sea).

Partitions and specific quantities of stuffs, like things, may undergo *qualitative* (or *accidental*) change and yet remain the same. Just as a plant may turn from green to yellow or an animal change from being fat to being thin, so too *this* quantity of cold water may be heated, and change from being cold to being hot, and *this* slice of raw meat may be cooked. Qualitative change stands in contrast to *substantial* change. Substantial change involves the ceasing to be of the substance in question – which happens both to individual substances and to partitions and quantities of stuff. When an oak is chopped down and cut into logs, it undergoes substantial change, for the oak tree no longer exists. Similarly, when wine turns into vinegar, it undergoes substantial change, for the wine no longer exists. But there is an important difference between the two kinds of cases. In the case of the destruction of things, for example the oak tree, the stuff of which it consisted (the constitutive wood) may and often does continue to exist. But in the case of the transformation of stuffs, as in the case of the wine turning into vinegar, it is the stuff itself that undergoes essential change.

3. *Substance-referring expressions*

We classify individual things in indefinitely many ways. For some purposes, adjectival classification is useful, e.g. classifying things by colour, shape, size or weight. For other purposes, nominal classification is what is needed. Not all our classificatory nominals are substance names. A human being may be a child or an adult, a parent, a doctor, an Englishman, a stamp collector, and so forth. The concept of a human being is a substance-concept, while that of a child is not – it signifies a human being *at a certain phase* (namely childhood) in the natural development of human beings. Similar phased substance-concepts are ‘youth’, ‘adult’, ‘sapling’, as well as metamorphic phased concepts such as ‘pupa’, ‘tadpole’, ‘maggot’, ‘larva’ – concepts that signify a thing of a given kind at a phase through which every thing of that kind must pass if it survives for long enough. A human being may cease to be a child, while continuing to exist, and whereas the adult Sir Richard Roe is not the same boy as little Dick Roe, since he is not a boy, he *was* once that very boy and *is* the very same human being as him. ‘Parent’ and ‘doctor’ are not substance-concepts, since a human being can become a parent without loss of identity, and cease to be a doctor without ceasing to exist. But, avatars and gods of mythology and religion apart, nothing that is not a human being can change into one, and, mythology and fairy tales apart, a human being cannot cease to be a human being (change into a swine or a frog) and continue to exist. ‘Englishman’, ‘Frenchman’, or ‘German’ are terms by which we may classify human beings, but are not substance-concepts, since they merely signify the location of birth (or country of citizenship) of a human being. Similarly, ‘doctor’ or ‘balletomane’ are not substance concepts, signifying merely professional or favoured activities that may characterize a human being. Such terms are essentially adjectival general terms, in as much as they specify a property, indeed an accidental property, of some human beings. Substance terms do, of course, occur predicatively – obviously so when we characterise a ‘primary substance’ such as Socrates as being a secondary substance, namely a human being. Whether that warrants conceiving of *being a human being* as a *property* depends upon how one chooses to mould the vague category of *property*. There is little to be gained, and much to be lost, from failing to segregate predicates in the category of substance from other kinds of predicates that we naturally conceive of as used to ascribe properties to things.

There are, of course, many things and kinds of thing that are to be found in the world around us to which we refer by means of singular referring expressions, and by reference to which we may explain various phenomena that call out for explanation, that are not substances. We refer to rainbows, reflections and shadows, to sounds and smells, to holes, gaps, knots and lumps, to waves, currents, lakes and oceans, to valleys, passes, gulfs and deltas, to the atmosphere and stratosphere, and, of course, to the indefinite variety of events,

states and processes. These are clearly *not* substances, although they are objects of singular reference with a rough spatio-temporal location.

Other things (or better, concepts of other things) are more difficult to classify: Is an ephemeral river (that flows once every three years) a substance? (Is *ephemeral river* a substance concept?) Perhaps not. What then of a perennial river? What of a mountain? A hill? A hillock? Or a bump? If a bump is no more than a disturbance on the surface of a solid, why is a mountain anything more than a large bump? If the Kohinoor is a substance, then so too are the stones on the garden path, and if stones, why not lumps of ice, and if lumps of ice then why stop at pools of water?

Substance (thing) names are count nouns, but it is not uniformly the case that clear criteria for counting individuals are implicit in the meaning of any given substance name. Given the various forms of vegetative, asexual reproduction it is obvious that there can be no clear and unequivocal way of distinguishing one such plant of a given kind from another. There is surely no answer to the question of how many plants there are on one's lawn, even if one's lawn is nothing but grass; nor can there typically be any answer to the question 'How many daisies (not flowers, but plants) are there on the daisy lawn?' It is unclear how to count the number of individual trees in a copse grown from root suckers, and although it is easy to count the number of daffodils in a given clump in the spring, it is not clear how to answer the question of how many plants there are in the clump. So, countability characterizes many substances – but by no means all.

The concept of substance (thing) is one of the *most* general categorial concepts, and like other such concepts it is exceedingly vague and flexible. Our general categorial concepts are not akin to variables in a formal calculus taking a sharply defined range of values as their values. On the contrary, they tend to be elastic, not rigid, frayed at the edges, not sharply circumscribed. They have their uses to be sure, but one should not expect greater precision from them than they are capable of delivering – and that is not very great.

To say that an S is a substance of a certain kind informs us of the logical character of the concept of an S rather than telling us further distinguishing material features of S-s. Cabbages and cauliflowers, cats and dogs are kinds of things, just as wine and water, iron and steel are kinds of stuffs. But the concept of a substance (thing) is not the concept of yet another kind of thing and the concept of a substance (stuff) is not the concept of yet another kind of stuff. It was a confusion of Descartes's to suggest that matter is a kind of substance, and a worse confusion to suggest that mind is another. *Matter* is simply the formal *summum genus* of stuffs. The totality of matter is not, *contra* Descartes, a kind of substance at all. 'Mind' does not signify a kind of stuff (nor indeed did Descartes think it did) – it is a count-noun, not mass-noun. In characterizing mind and matter as two kinds (the only two kinds) of substance he was cross-classifying, since count-nouns and mass nouns, if they do signify substances, do not signify substances in the same sense of the term at all and so do not signify two species of a common genus. Moreover, a mind is not a substance, a kind of entity, in any sense of the term. To be sure, what he meant was that the totality of space-matter, given the principle of conservation, and individual minds, given their absolute simplicity, causally depend on nothing other than the concurrence of God for their existence – but this too was confused and it was misconceived to appropriate the concept of substance for this purpose.)

In trying to delineate the boundaries of these categorial terms, we are not endeavouring to classify everything there is (as if the philosopher were a 'meta-physicist'), but rather to differentiate between kinds of concepts or words. (We are trying to attain a synoptic view of our conceptual scheme, of the ways in which we think and speak about objects of our experience and of ourselves as subjects of experience – not to steal a march on natural science. Of course, that does not mean that we are not *also* trying to attain a synoptic view of the formal features of substances and constitutive stuffs of which the world consists.) Given the multiplicity of needs in response to which our rich and refined languages have evolved, and given that languages are dynamic, it should be altogether unsurprising that the

boundaries between different classes of word should be blurred, that the categories of types of expression are often not sharply circumscribed.

5. *Connections between things and stuffs*

The two senses of the term 'substance', i.e. substance as a persistent thing of a certain sort and substance as stuff of a certain kind, are systematically related. For a concrete individual thing of a given kind is a spatio-temporal continuant, and is made of, constituted of, matter of some kind, i.e. a quantity of substance (stuff) or substances (stuffs) of one sort or another.

It is important not to conflate the relationship between a thing and its constitutive stuff with the relationship between the thing and its parts. The stuff of which a thing is made is neither larger nor smaller nor the same size as the thing itself, although it weighs the same. The parts of a thing are smaller than the whole of which they are parts. If a thing is wholly made of such-and-such stuff, then all the parts of the thing consist of that stuff. But if a thing is made of such-and-such parts, it does not follow that its parts are made of such-and-such parts. One may destroy the thing and its parts, without destroying the stuff of which it is made, but one cannot destroy the stuff of which a thing is made without destroying the thing itself.

It is not necessary for the continued identity of a substance (thing) that it consist of the same specific quantity of stuff throughout the whole of its existence. This is most obvious in the case of living beings. Since they metabolize food from their environment, they may change all of their constitutive matter in the course of their lives while remaining the same being.

Artefacts, on the whole, do not change the totality of their constitutive stuff, and if, under the touch of a Midas, they did so instantaneously, the continued identity of the artefact would be called into question. For it is not at all obvious that the china mug, transformed into gold, is the very same mug as hitherto. However, some of the parts of an artefact can be, and often are, replaced without loss of identity. To that extent then, change of some of the constitutive matter of which an artefact is made is compatible with its continued identity. Whether gradual replacement of *all* of the parts over a prolonged period of time is compatible with continued identity or not (as in the famous example of Theseus' ship) is arguably a matter for reasoned decision sensitive to the purposes and context for which determination of identity is required. Every rotten plank of the ship that is lovingly rebuilt on shore is identical with a plank of the original vessel, but it is clear which way the marine-insurance company should decide if the question of which ship is the one insured should arise. In this case, the identity of the artefact is not impugned by the complete change of its parts, and hence its specific (as opposed to generic) constitutive stuff, over a prolonged period of time.

Among the attributes of an individual substance, there are some that are attributable to the constitutive material of the thing, for example, its plasticity, hardness, weight, solubility or insolubility in this or that solvent, commonly also its smell, taste, and texture. So, for example, that this bronze statuette is soluble in hydrochloric acid, is hard and weighs more than two pounds is due to the fact that the bronze of which it is made dissolves in such acid, is a hard material and that the specific quantity of bronze from which it is made weighs more than two pounds. The colour of a thing is typically the colour of the exterior surface of its constitutive stuff or of any other material forming its surface (its bark, skin, peel, etc.) which may be no more than a layer of oxides or, in the case of many artefacts, a decorative or protective coat of paint, varnish, tar, etc.).

Other attributes of things are determined by the kind of substance the thing is. If it is an artefact, for example, its size, shape and parts are typically determined by the purpose of the artefact. If it is a living being, its morphological features, characteristic organs, pattern of development, and characteristic modes of behaviour are determined by the nature of the organism which it is.

5. *Substances and their substantial parts*

It should be noted that the substantial parts of an individual living substance, such as a leaf or a flower, a head or a tail, are not themselves substances. Of course, the parts may be detached from the substance of which they are parts. In that sense, the constitutive parts of a substance *can* enjoy independent existence. But, in another sense, they *cannot*. For such parts are functionally defined, and they cannot fulfil their defining function once they have become detached. The amputated leg can no longer be used by an animal to walk, and the eye, removed from the sighted animal is no longer an organ of vision. (But one need not follow Aristotle in holding that it is no more an eye than a painted eye³, since unlike a painted eye, it *was* once an organ of vision.) Furthermore, these functional parts do not long survive detachment from the organism of which they were a part. Independently of human interference, they wither or decay. Of course, human beings can graft shoots and transplant organs. But this does not significantly affect the point being made, since although these parts of an organism *are* transferable, they still only fulfil their defining function as constituent parts of a living plant or animal.

Matters are less clear with regard to parts of an artefact. Although they do fulfil a function in the whole of which they are a part, they are not *used* by the artefact of which they are a part to fulfil a function. Rather they are used by the manufacturer to construct the artefact, which may then be used *by human beings* to fulfil a function. Unlike the parts of an organism, they are created independently of the artefact of which, on assembly, they become a functioning part. They are detachable from the whole of which they are parts without detriment to the possibility of their re-employment in the same functional role either in the same artefact duly re-assembled, or in a different one. Unlike parts of an organism that grow as the organism matures, and decay when detached from the organism, they can be stored without decay or deterioration independently of the mechanism for which they are made. So it is difficult to see any overriding reason for denying that parts of an artefact can be considered as substances – *if* we resolve to consider artefacts to be non-natural substances.

Among the attributes which a substance, a concrete thing of a certain kind, has, some are actualities, such as its size, shape, colour, location, and some are potentialities or dispositional properties, such as its mobility, hardness, brittleness, solubility, inflammability. These potentialities include the wide range of active and passive powers of a substance. In the case of living things, especially animals, the active powers include their numerous different kinds of abilities (which are not dispositions) to do or refrain from doing those things they *can* do. For many of the active powers of animals, unlike those of insentient substances, are two-way powers.

5. *Substances conceived as natural kinds*

It would be mistaken to take the two very general categories of substances, i.e. things and stuffs, to be two super-categories of *natural kinds*, where natural kinds are conceived to be discovered rather than stipulated, and subject to natural laws concerning those kinds. The salient properties of natural kinds thus conceived are sometimes held to be causally determined by a real essence constituted by their microstructure or microstructural properties. The natural kind, it is argued, is defined by microstructural similarity to an ostended or otherwise located paradigm. This sample, in its role as a paradigm of the (often yet to be discovered) microstructural real essence, is conceived to be partly constitutive of the meaning of the natural kind name. Accordingly, scientific discovery holds a blank cheque from semantics, which it can fill in as science progresses.⁴ This conception of the explanation

³ Aristotle, *De Anima* 412^b 20-24.

⁴ For the view that natural kinds have an essence and are defined by reference to similarity to a paradigmatic sample, see H. Putnam, 'The meaning of meaning', repr. in his *Mind*,

of what natural kind terms mean is the contemporary heir to the venerable idea of ‘real definition’. It is rooted in Locke’s distinction between real and nominal essence, but unlike Locke, holds the real essence of a thing to be both discoverable and partly constitutive of the meaning of its name. It draws support from the discovery of the Periodic Table of elements, and from the discovery of DNA and its genetic role.

It is doubtful whether the categories found to be useful in the natural sciences are themselves natural kind terms *thus understood*. For this conception of natural kinds is a metaphysical rather than scientific one, rooted in a form of metaphysical essentialism, on the one hand, and misconceptions concerning meaning and explanation, on the other.⁵

It is an illusion that scientific discovery can disclose what the words we use, such as ‘gold’ and ‘water’, ‘fish’ and ‘lily’ really mean. For what a word means is determined by convention, not by discovery – although, of course, discovery may be elevated into convention by agreement on a new rule for the use of the word. What a word means is specified by the common, accepted, explanation of its meaning. Such an explanation of meaning functions as a rule or standard of correctness for applications of a term. Accordingly, our terms for kinds of things and stuffs do not draw blank cheques on future discoveries – for if they did, the explanations of what they mean could not also function as guides to and standards for correct use as they do. Science can discover what the structure of a gold atom or a water molecule really is and why gold and water behave as they do. It can explain how vertebrate sea dwellers evolved and distinguish many different kinds among them, or what lilies have in common with garlic, and it can then accept or reject the usefulness of these categories (*fish*, *Liliaceae*) for purposes of biological explanation and classification. However, in discovering that pure water consists of two parts hydrogen and one part oxygen in chemical combination, scientists did not discover what the word ‘water’ really means. If chemists and educated laymen now choose to define ‘water’ thus, that merely shows either that ‘water’ now has a harmlessly fluctuating meaning, or that what was inductive evidence for water has been elevated to being part of the meaning of the word in scientific parlance.

It is a mistake to suppose that natural kind terms are defined by reference to unspecified micro-structural similarity relations to a paradigm. In so far as paradigms play any role in explaining the meaning of a word, as indeed they do when a word is defined by means of an ostensive definition involving a sample, they must be usable as objects of comparison to guide the application of a word. For the role of the paradigm is as a standard for the correct application of the definiendum F: something which is *this* L [and here one points at the paradigm] or is *what this* L is, is rightly said to be F, or an F. So the relevant features of the paradigm must be both known and evident – otherwise the paradigm has no normative role. But if the putative ‘similarity relation’ concerns micro-structural properties, the paradigm can play no normative, standard-setting role. For if the micro-structure instantiated by the paradigm is unknown and still awaiting scientific discovery, the paradigm can provide no guidance in applying or withholding ‘F’. But if the requisite micro-structure is known, the paradigm is redundant. For one can directly find out by appropriate chemical tests what the micro-structure of the entity under investigation is and so determine,

Language, and Reality (Cambridge University Press, Cambridge, 1975), pp. 215-71. For illuminating refutation of this conception of natural kinds from which the following discussion is derived, see J. Dupré, *The Disorder of Things* (Harvard University Press, Cambridge, Mass., 1993), Part I, and his *Humans and Other Animals* (Clarendon Press, Oxford, 2002), especially Parts I and II.

⁵ For examination of the semantic misconceptions see P. M. S. Hacker, *Wittgenstein’s Place in Twentieth-Century Analytic Philosophy* (Blackwell, Oxford, 1996), pp. 250-3, 329f.

independently of any paradigm, whether it is F or an F.

No doubt we are prone to be mesmerized by the example of the Periodic Table in chemistry and its bearing on the determination of the nature of stuffs. But it is unrepresentative; and even in this case it would be mistaken to suppose that all essential properties flow from the features determining the atomic number of what is classified. The behaviour of iron atoms, for example, is very unlike that of ferric or ferrous ions, even though all have the atomic number 26 and are rightly classified as belonging to the same natural kind. Moreover, it would be absurd to suppose that the nature of scrambled eggs or Yorkshire pudding were something that is determined, independently of their nominal essences, by the atomic numbers of their constituent elements, or that we need to wait upon scientific discoveries to find out what 'beef' and 'venison', 'paper' and 'glass', really mean or really are (as opposed to discovering what their chemical analysis is). Yet names of cooked and manufactured substances are no less substance (stuff) nouns than names of the chemical elements or of compounds that are to be found in nature.

With the triumph of Darwinism, the idea that biological species are determined by a common essence, as was supposed by Aristotelian scientific conceptions, was rejected. For the theory of evolution showed the untenability of the idea of the fixity of species, and phylogenetic classification proceeded without any such assumption – often yielding equivocal and optional results. Furthermore, the latter classification is by no means uniformly the most useful in the biological sciences, and morphological classifications are often called for to satisfy explanatory needs. But evolutionary (historical) classifications, on the one hand, and morphological (structural) classifications, on the other, generate taxa of different kinds. There is no uniquely correct and omni-explanatory classificatory scheme, and Plato's distasteful metaphor of carving nature at her joints is more apt at the butcher's than on the agenda of science. Of course, not anything goes; but how we should classify things when engaged in a given science depends upon our scientific purposes, upon the peculiarities of the thing we are investigating, and upon the features we wish to explain. There is no reason to suppose a priori that there is only one scientifically fruitful way of classifying natural phenomena.

One may grant that scientific taxonomy is fruitful. It is subservient to the explanatory enterprises of science. The fruitfulness of such a taxonomy is evident in the range and explanatory powers of the ensuing generalizations. So many of the features of things and stuffs that are individuated in terms of common-or-garden concepts are explained by scientific theories that rely on more specialized and often very different classifications. But, first, not all the things that interest us and for which we have coined general names stand in need of any explanation. Secondly, not all explanation is scientific explanation. So although many phenomena that concern us do call out for explanation, the requisite explanations may involve reference to human activities and interests, to custom, law, economics and history and may employ classifications quite distinct from, but no less useful within their domains than, those of the natural sciences. Thirdly, there is no such thing as Science, but only a multitude of different natural sciences, on the one hand, and social and human sciences, on the other. The reductive ideal of unified science is an absurdity that should have died when it was abandoned by its twentieth-century progenitors, the Vienna Circle. There is no absolute final classificatory scheme for everything there is, but only a multiplicity of taxonomies that the various sciences, natural and social, find fruitful, and the multitude of more or less unsystematic substance terms, in both senses of the word, that mankind in general finds useful for the manifold purposes that inform our lives.

7. Substances conceived as a common logico-linguistic category

It is evident that our ordinary classifications of material and animate things into substances of different kinds were not designed for purposes of scientific taxonomy or for scientific explanatory power, but for purposes of humdrum identification and reidentification relative to a multitude of different human concerns. Relative to our purposes and interests, it can

hardly be said that we err in distinguishing between onions and garlic, or between both and lilies, even though all belong to the Liliaceae, or that we have made a mistake in segregating moths from butterflies, even though Macrolepidoptera include all butterflies and some moths. Our interests and concerns are numerous and very varied. The fact that *tree* has no place in botanical taxonomy does not mean that this term is not a substance name of a natural kind of thing (taking this term now in low key). The fact that *angiosperm*, which subsumes daisies, cacti and oak trees (since they all produce seeds in ovaries) but excludes pine trees, has no place in ordinary classifications does not show anything other than the fact that the interests of botany differ from those that underlie the classifications of ordinary language.⁶

Similarly, it is clear that the logico-grammatical category of concrete mass nouns signifying stuffs of one kind or another is indifferent to whether the designated stuff is natural or not. Wine is no less of a substance than water, even though it is manufactured by human beings, and honey is as much a stuff as helium, even though it is made by bees. Wool or silk are natural kinds of stuff, but by the time we have finished with the natural material, the resultant wools and silks are very different from anything found on the back of a sheep or constituting the chrysalis of a silk worm. Bread and butter are no less kinds of stuffs than wheat (or indeed the flour that is produced from it) and milk. The general concepts of substances (stuffs) that we employ in our daily discourse were not introduced as a part of a taxonomy for scientific (e.g. chemical) purposes, they do not involve a systematic hierarchy of kinds of stuffs and they invoke very different principles of classification suited to the numerous different purposes that we have. From a logico-grammatical point of view, however, there is no significant difference between natural and manufactured stuffs.

General names of artefacts are, as suggested above, no less substance-names than general names of natural things. Artefacts are enduring features of the landscapes and cityscapes we inhabit, commonly long outlasting many of their natural inhabitants. Most of the salient objects around us are, by now, artefactual. We refer to artefacts, often locate ourselves by reference to certain kinds of them, sometimes trace the provenance of other kinds, identify and re-identify them. Material artefacts (by contrast with such artefacts as works of literature or music) consist of the stuffs of which they are made. They possess active and passive powers, and they undergo various forms of change compatible with their continued identity. Artefactual names serve to identify and reidentify a persistent thing as *that* particular thing of such-and-such a sort, they provide principles for counting things of the relevant kind, and they determine, as part of their meaning, a tolerably clear array of properties the possession of which is essential for the thing in question to be said to continue to exist. St Paul's is still the same building despite having been extensively refaced, but the Winter Palace is a meticulous reconstruction of the building destroyed by the Nazis. A table can tolerate scratches and stains and the replacement of a leg or two compatible with its continued identity, but not being chopped into small pieces to feed the fire. A motor car can be repainted, have a new set of tyres, even a new engine, and yet remain the same car, but it will not remain the same car after being squashed into a cube preparatory to being melted down. Of course, there is a fair degree of indeterminacy at the borderlines, but then that is true of concepts of natural objects too.

8. *A historical digression: misconceptions of the category of substance*

Three strands in the classical Aristotelian account were seriously misunderstood in the seventeenth-century debate concerning substance, with long-lasting effects upon philosophical reflection. Aristotelian primary substances were rightly conceived to enjoy *independent existence* in a sense in which properties do not. They were correctly conceived to be subjects of predication, *bearers of properties*. And they were sensibly held to be subjects of changing

⁶ See Dupré, *The Disorder of Things*, chap. 1.

accidents, capable of bearing contrary properties at different times, and hence *persisting through change*. The seventeenth and eighteenth century thinkers, their thoughts focussed to a large extent on the scientific revolution through which they were living and to which their philosophies were trying to do justice, knotted these simple strands into an unprecedented tangle.

The idea of substance as an independent existence was drastically re-interpreted by Descartes, removing it from its Aristotelian context and from its categorial status as a general form of our thought about material objects, on the one hand, and about their constitutive matter, on the other. For Descartes understood *independent existence* in causal, rather than logical terms. A substance, according to him, is ‘a thing that exists in such a way as to *depend on no other thing* for its existence’ (emphasis added).⁷ He held that only God is completely independent of everything else, and is therefore the only substance *stricto sensu*. In a derivative sense, minds (a plurality) and matter (a totality: the plenum, the totality of space-matter) are also substances, since they depend for their existence only upon the concurrence of God (whose sustaining activity, Descartes thought, was necessary for the continued existence of all things). But God apart, the plenum is indestructible, since the total quantity of matter in the universe is, Descartes believed, conserved throughout all change. Minds are sempiternal, since, lacking parts, they are simple, and all destruction is decomposition into, and rearrangement of, constituents. But the Aristotelian sense of independent existence was non-causal. The sense in which the properties of a thing, such as its motion, shape or colour, are not independent existences is that (with qualifications for shadows, holes, gaps, shafts of light, etc.) there can be no movement that is not the movement of some thing, no shape unless there is something that has that shape, and no colour unless there is something coloured. To say that a particular substance exists is to say that there is a thing of a certain kind somewhere, somewhen. To say that a quality exists is to say that some thing somewhere, somewhen, is qualified in a certain way. So the existence of substances was not held, absurdly, to be independent of *any other substances*, let alone of *conditions* such as heat and cold, rain and snow, as well as other atmospheric circumstances and environmental accompaniments. Similarly, the Aristotelian conception of the persistence of substances through change simply meant that particular things can change their accidents and yet persist – that, contrary to what Hume later averred, change (accidental, as opposed to substantial, change) is compatible with continued identity. It did *not* mean that there is, throughout all change, something that remains unchanged. (*That doctrine is to be found in Aristotle’s hylomorphism, in his (mis)conception of ‘materia prima’.*)

Matters were further exacerbated by Locke, who seized on the idea of substances as bearers of qualities – a thought fostered by the etymology of ‘substance’ (‘*substantia*’ – that which stands under or supports). Properties of a thing are, in Aristotle’s jargon, ‘*in a subject*’ (as we might say that they are ‘*had* by a subject’), a thought that was transmitted in the confusing jargon of ‘*inhering in a subject*’. This, in Locke’s hands, yielded the misconception of *substance in general* as something that possesses properties but is distinct from them – a bare unqualified particular, a something ‘I know not what’ in which qualities inhere.⁸ Substances, far from being conceived to be kinds of persistent spatio-temporal things, were taken to be the *substrata* of properties – something that ‘supported’, ‘united together’ the properties a thing possesses, the carcasses of the furniture of the world on which a veneer of properties is stuck. Being a mere *something* in which properties inhere, it seemed that substance ‘in and of itself’ must *lack properties*. Locke confused the bare idea of a subject of predication with the idea of a

⁷ Descartes, *Principles of Philosophy* I, 51.

⁸ Locke, *An Essay concerning Human Understanding*, II-xiii-17-20, II-xxiii-1-6, 15, 37, III-vi-21.

bare subject of predication.⁹ The former is the perfectly coherent thought of something, as yet unspecified, which ... The latter is the incoherent idea of a thing without qualities. The idea that qualities are *collectible*¹⁰ (other than, in a Pickwickian sense, by words) is an altogether misleading metaphor, as are the thoughts that they can, like twigs, be *bound together* or, like billboards, be *supported*.¹¹

Small wonder that Hume washed his hands of the morass, declaring the very idea of material substance an ‘unintelligible chimera’ and that of a spiritual substance ‘absolutely unintelligible’.¹² But nothing could have been further from Aristotle’s mind than this Lockean confusion. An Aristotelian (primary) substance was anything but a bare particular – it was a persistent thing of a given kind, with an essence determined by its essential properties, a subject of accidents that may change without affecting the identity of the substance. To specify only the qualities of a thing will, Aristotle insisted, tell us *what the thing is like*. But if we want to know not what it is like, but *what it is*, we must be told, by specification of a secondary substance, what kind of thing it is.

Descartes, opposing the scholastic Aristotelian tradition, had declared that there are only two kinds of substance. Berkeley held that there is only one kind. Spinoza insisted that there is only one substance, Leibniz held that there are infinitely many. And Hume denied that there are any substances at all (unless one counts each idea and impression as a substance). More than a century of philosophical reflection had reduced the subject to incoherence.

Kant sapiently attempted to rehabilitate the concept of substance. He did emphasize a point of fundamental importance, namely that the concepts of substance, agency and causation are intimately interwoven.¹³ Unfortunately, however, he married the legacy of Descartes to the confusions of Locke. For like Descartes, he associated substance in experience with what is ‘abiding in its existence’, and misguidedly identified it not with the relatively abiding familiar things around us, but with the supposed permanent totality of matter in space (unlike Descartes, he differentiated matter from space). ‘In all change of appearances’, he wrote, ‘substance is permanent; its quantum in nature is neither increased nor diminished. ... the substratum of all that is real, that is, of all that belongs to the existence of things is *substance*; and all that belongs to existence can be thought only as a determination of substance.’ Substance, he held, ‘as the substrate of all change, remains ever the same’, it is ‘something *abiding* and *permanent*, of which all change and co-existence are only so many ways (modes of time) in which the permanent exists.’¹⁴ So, like Descartes, Kant thought of the various individual material substances (in the classical sense of the term ‘substance’) that we encounter around us as no more than passing modes of the underlying substrate of all change. Elsewhere, echoing Locke and compounding confusion, he averred that ‘in all substances the

⁹ A point nicely made by David Wiggins in his ‘Substance’, in A.C. Grayling ed., *Philosophy – a Guide through the Subject* (Oxford University Press, Oxford, 1995), p. 227.

¹⁰ Ibid, IV-vi-7.

¹¹ Ibid., II-xxiii-4

¹² Hume, *A Treatise of Human Nature*, I - iv - 3 and I - iv - 4.

¹³ Kant, *Critique of Pure Reason*, B 249-50. For a helpful discussion of the flaws in Kant’s treatment of substance, see P.F. Strawson, ‘Kant on substance’, repr. in his *Entity and Identity and other Essays* (Clarendon Press, Oxford, 1997), pp. 268-279.

¹⁴ Ibid. B 224, 225, 226.

true subject – namely that which remains after all the accidents (as predicates) have been removed – and hence the *substantial* itself, is unknown to us; ...¹⁵

There is irony in all this, since what Kant needed in order to undermine the empiricism against which he warred and to establish the conditions of the possibility of an objective spatio-temporal framework within which objects of experience can be distinguished from the experience of objects was precisely the notion of Aristotelian substances as the *relatively* abiding, but impermanent, independent objects of our experience. Such objects of reference and subjects of predication perfectly adequately fulfil the Kantian requirements necessary for the unity of time, on the one hand, and of a stable background against which we can apprehend change, on the other. That such objects of experience themselves come into existence and pass away does not impugn the unity of the spatio-temporal framework in which we encounter, identify and re-identify them – as long as they do not all pass away simultaneously. Nor does the demand that in every change some thing should persist require that something should persist through every change. All that is necessary is that there be Aristotelian substances among phenomena.¹⁶

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¹⁵ Kant, *Prolegomena to any Future Metaphysics*, §46.

¹⁶ I am grateful to John Dupré, Hanjo Glock and David Wiggins for their comments on an earlier draft of this paper.

Abstract

The categorial concepts of substance (thing) and substance (stuff) are described, and the conceptual relationships between things and their constitutive stuff delineated. The relationship between substance concepts, other count-nouns, and natural kind concepts is examined. Artefacts and their parts are argued to be substances, whereas parts of organisms are not. The confusions of seventeenth and eighteenth century philosophers who invoked the concept of substance are adumbrated.