

Artifacts: Parts and Principles

Richard E. Grandy

1. INTRODUCTION AND A PUZZLE

In thinking about artifacts and concepts of artifacts, it is difficult to know where one should start let alone where one hopes to end. As always, we want to do justice to our intuitions, but there is the question of who the ‘we/our’ is and whether the intuitions are coherent. For example, there are three metaphysical principles which are widely accepted and which come into conflict. One is that in some sense of basic physical objects, objects are spatially continuous; the second is that objects are temporally continuous; and the third is that when I disassemble a bicycle and reassemble it a week later it is the same bicycle. (I am not here addressing ‘ship of Theseus’ issues,¹ I am discussing the case in which we reassemble exactly the same pieces.) We are forced in this situation either to accept that:

- The bicycle’s existence has a temporal gap, that it does not exist for the week it is disassembled, or
- The bicycle exists as a spatially scattered object for a week, i.e. during that week its location is a discontinuous spatial region, or
- To deny that it is the same bicycle, i.e. the bicycle we assemble a week later is not the same one that we disassembled.

It is easy to multiply examples, but much easier with artifacts such as bicycles, and in addition to the main question about which intuition to sacrifice, I want to explore the question of whether and why this seems special to artifacts.

¹ In Greek mythology Theseus replaced various parts of his ship during a journey until none of the original material remained. In 1655 the philosopher Thomas Hobbes (1994: 136–7) embellished the story by imagining someone following Theseus, gathering the discarded planks

and re-creating a ship from the original material, posing the question which ship is the original.

Artifacts: Parts and Principles 19 2. THE ARTIFACT-NATURAL KIND

DICHOTOMY—MUDDYING THE H₂O

Before moving further down that path, I think it will be salutary to examine the range of artifacts. One typically contrasts artifacts with natural kinds, and we usually have in mind as examples of artifacts middle-sized objects associated with sortal predicates: bicycles, cups, clocks. But this represents only a small subset of the kinds of artifacts. For example, there are many kinds of artifacts which are described by sortals but which are somewhat anomalous as ‘objects’: cities, roads, and lakes; and there are many artifacts which are not objects but substances: polystyrene, decaffeinated coffee, stainless steel. In addition there are also kinds of artifacts that involve a sortal together with a substance term: piece of polystyrene, cup of decaffeinated coffee, sheet of stainless steel.

Prima facie there is a sharp distinction between natural kinds and artifacts, but I think that on reflection this is an illusion due to thinking of natural kinds as biological and chemical kinds and artifacts as medium-sized manufactured objects. If we consider not just items to which sortal predicates apply, but also stuff, then the distinction immediately becomes much more blurred. When I say that the distinction becomes blurred, I don’t merely mean that many words have both a natural kind and an artifactual sense. Bloom (this volume) argues that ‘water’ has two meanings: in one sense it denotes a kind of artifact, in the other a natural kind. I mean that the objects and kinds of objects fall on a continuum. I will argue that while prototypical natural kinds and prototypical artifacts are a considerable distance apart on this continuum, there are no principled points, or reasons, to draw a metaphysical distinction somewhere on this continuum.

For example, consider iron. Iron, as one of the basic chemical elements, would seem to be a prototypical natural kind. Its essence seems to be given by, or determined by, the structure of the relevant atoms, and there are laws about its melting point, conductivity, magnetizability, and so on. But in fact the pure element Fe almost never occurs naturally on Earth, but is almost always found in an iron oxide that has to be chemically purified. Still, the intuition that such a substance is a natural kind is very strong. And while iron oxide may be a natural kind, it is quite a different natural kind from iron. The same is true of most of the metals, and many of the gases. Even hydrogen and oxygen are rare in their elemental form and are much more ubiquitous as components of H₂O. Kornblith (this volume) gives as his example of baptizing a natural kind the creation of a new chemical compound in the laboratory!

The thoughtful reader will already have noticed that none of the substances I mentioned a few paragraphs earlier—polystyrene, decaffeinated coffee, or stainless steel—exist in nature. But they also have essences determined by their molecular structure, and there are laws about their structural strength,

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conductivity, and so on. In this regard there seems to be no significant difference between natural kinds of stuff and some artifactual kinds of stuff.

It appears that there is a psychological difference in the usual concepts of natural kinds and artifacts, and evidence to support and understand this is adduced by the papers in this volume by Kelemen and Carey, Keil, Greif, and Kerner, and Mandler. In this case there is an objective dichotomous difference in children's concepts or in the 'folk concepts', but in this paper I leave the psychological differences in children's developing concepts and in adult 'folk theories' to the psychologists and the editors. We know there are differences among expert concepts since in this volume Sperber (Ch. 7) questions the dichotomy and Elder, Thomasson, and Kornblith (Chs. 3, 4, and 8) accept it. Bloom (this volume) argues for

some recategorization and rethinking, but it seems that he still accepts the basic distinction. My goal is to develop the best understanding I can of artifacts and other related categories and to focus on metaphysical issues, though some issues of semantics cannot be avoided.

On the other side of the alleged dichotomy, natural kinds seem to have three features:

1. they are things, or kinds of things, that occur naturally,
2. they are subject to laws, and
3. they have essences.

That artifacts and natural kinds are disjoint is clear from the definitions. For example, Hilpinen (2004) characterizes an artifact as ‘an object that has been intentionally made or produced for a certain purpose’, so artifacts violate condition (1). However, if these categories are not exhaustive, then our conception of how different they are may change. For example, if natural kinds and artifacts are not dichotomous, then the question considered by Elder (this volume) of the ontological status of artifacts becomes more complex. While Thomasson and Kornblith (both this volume) are not concerned with the ontological status of artifacts, they address questions about the epistemic and semantic status of artifacts.

It is also important to think about a range of cases, both among artifacts and natural kinds. Artifacts range from slight modifications of naturally occurring objects, for example, stone handaxes which are constructed by chipping away some flakes from a rock, to highly iterative complex objects such as computers and airplanes. By describing some artifacts as iterative, what I mean is that they can only be manufactured using other artifacts, which typically in turn can only be manufactured ... through many iterations. I have no realistic idea, for example, how many layers there are between naturally occurring items and substances and an airplane, but am confident that it is very large. In the other direction, it is also important to have a view of the full range of biological entities. We tend to focus on the familiar middle-sized objects such as dogs and trees, but other examples are amoebas and hives of bees. And it is not only amoebas that

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3. WHY ARE ARTIFACTS PROBLEMATIC?

Why do we feel there are philosophical problems specific to artifacts? One reason, which is close to a common-sense philosophical intuition, is that artifacts — their existence and their features—depend on human interests. The second, more technical, is that it seems that if we believe something like the Kripke–Putnam story about kinds, artifacts lack essences and therefore aren't *real kinds*. This is a modern echo of Locke's distinction between *simple modes*, which the mind takes from external sources, and 'mixed modes'. Of the latter he says that 'these Ideas are called Notions: as if they had their Original, and constant Existence, more in the Thoughts of Men, than in the reality of things' (Locke 1690, bk. II, ch. XXII, 1).

3.1. Dependence

There is a crucial distinction to be made with regard to Locke's comment, and that is between 'original existence' and 'constant existence'. There are many artifacts whose continued existence depends on our thoughts and intentions. Money is an excellent example: those little pieces of paper would have no value if they were not embedded within a stable network of social expectations, intentions, and beliefs. Notice that money has evolved from barter, through forms (gold coins) in which the value was independent of the social circumstances, to paper currency whose value was dependent on the social structure, to the electronic forms whose character it is difficult to describe. Chickens and loaves of bread have an intrinsic value to almost everyone, so my accepting chickens and bread does not depend on what I believe anyone else values. Gold coins may be of no use to me, but I may still value them highly if I know that others do and I can exchange them for chickens and bread. At the final stage (so far)

my bank doesn't have any physical object or substance which is the money in my checking account (see Searle, this volume).

Thomasson (1999, this volume), in a slightly different context, made the very important distinction between dependence of origin and dependence of continuing existence or properties. The value of my paper dollar bill, both the exact amount and the fact that it has any, depends on the current attitudes of an indeterminately large number of people. On the other hand, my steak-knife owes its origin to a designer and a factory, but its current properties and functioning have been independent of the designer and factory since it left there (except when I send it back for resharpening, but we can ignore that complication).

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There are gradations within the blurred region too. It seems natural to say that iron has the chemical properties and some of the physical properties it has independently of our intentions or desires. That this sample of Fe exists depends on human intentions, but not its melting point or solidity. In fact, its existence is due to the human desire to have something that has those properties. Not all physical properties of the sample are independent, of course, since its shape and mass may have been chosen to serve our purposes. On the other hand, a sample of bronze (an alloy of copper and tin), once created, has its properties independently of humans, but to some extent what those properties are depends on human intentions (since the proportion of copper to tin may vary somewhat) in a way that the properties of iron do not.

In some cases at least, the involvement of human intentions in the creation of a sample does not seem to have any effect on its status as an instance of a natural kind. Almost all of us in chemistry class combined hydrogen and oxygen to form water—not artificial water, just plain water. In fact, it is much closer to pure H₂O than what falls from the sky or pours from the faucet. So it appears that for at least some natural kinds, having the same essence is determinative and overrules the condition that the substance be created by a 'natural process'. So, to summarize our

conclusion so far in this section, either we recognize that naturalness of origin is not required for something to be a natural kind, or else we give up on most chemical elements and compounds as natural kinds.

3.2. Species

The other standard example of a natural kind is species, and there are three complications of the standard story here. The first is obvious given what was said above, and the point is made in at least two other papers in this volume. Biological entities are often manipulated by humans for human purposes, and so by the definition above these species are artifacts and not natural kinds. Sperber (this volume) cites seedless grapes (and many other examples) and Keil, Greif, and Kerner (this volume) mention square watermelons. From the point of view of a biologist, how a species (or variety) acquired some specific properties is irrelevant for predicting and explaining how the species or variety will function in an ecological niche.

A second complication is that the explanation of how our biological terms refer (independently of the descriptions we may associate with the term) assumes that our biological terms in fact refer to species. For some nouns (e.g. ‘tiger’) this is true. But for many others it is not. Dictionaries disagree over whether ‘elephant’ is a name for the pachydermate order (*OED*), the family *Elephantidae*, which includes two living species, commonly referred to as the African elephant and the Asian elephant (Merriam-Webster 2005), or whether it refers to members of those two species (*American Heritage Dictionary*, 423). It is unclear in the

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last case whether the claim is that the noun is ambiguous or that it expresses a disjunctive concept. All of these definitions are wrong, however, for in 2001 it was discovered that what had been regarded as a single species, the African elephant, is in fact two distinct species (Roca *et al.* 2001).

Other nouns which speakers regard as ‘natural-kind’ terms do not correspond to genera or families or any other biologically accepted classifications. Two examples are ‘grass’ and ‘tree’, both of which are regarded as natural kinds by ordinary speakers, but not by botanists. In these cases, speakers appear to defer to experts who disagree with the classification rather than providing a description of the essence (Atran 1990, 67).

If the Kripke–Putnam story were the correct account of reference, when it was discovered that African and Asian elephants are different species the reaction should have been to find out which species was present when ‘elephant’, or more accurately ‘ἐλέφας’, was first used, and to declare the others imposters. And the news story in 2001 should have been that many animals that were thought to be African elephants in fact were not, because they were a different species than the one that was baptized.

How common is this? I haven’t carried out a systematic random investigation, but Putnam’s favorite examples of ‘beech’ and ‘elm’ each refer to a genus, not a single species. There are approximately ten species of beech and twenty of elm. ‘Oak’ also denotes a genus, one with over 100 species, including both deciduous and evergreen members. ‘Crocodile’ names a family with about a dozen members.

Part of the Putnam account still seems correct; speakers typically don’t know details about the meanings or referents of familiar terms and defer to experts. But the experts don’t seem to defer to initial baptizers, perhaps because the latter are so difficult to locate and interrogate concerning their intentions.

The third complication is that, at least according to a large number of philosophers of biology, species don’t have essences, so even for those nouns that pick out species rather than a family or genus, the account doesn’t work in detail.

In a pre Darwinian age, species essentialism made sense. Such essentialism, however, is out of step with contemporary evolutionary

theory. Evolutionary theory provides its own methods for explaining variation within a species. It tells us that the boundaries between species are vague. And it tells us that a number of forces conspire against the existence of a trait in all and only the members of a species. From a biological perspective, species essentialism is no longer a plausible position. (Ereshefsky 2006, sec. 2.1)

There is disagreement among biologists about how to define ‘species’ and whether species are individuals, sets, or some other kind of entity (see Dupre 1993; Ghiselin 1974; Hull 1965; and Kitcher 1984). The traditional notion that a species is defined by interbreeding conflicts with contemporary notions of species—the African and Asian elephants can interbreed.

24 *Richard E. Grandy* 3.3. Lack of essence

I suspect that for many philosophers the ontological concern about the status of artifacts is connected with the contrast to natural kinds and what may appear to be a lack of essence in artifacts. On this interpretation, the problem is not with individual artifactual objects, but with kinds of artifacts. (As Elder notes in this volume, however, it may be the predominant philosophical view that no medium-sized objects exist.) I have argued in an earlier section that there seems to be no significant ontological difference between artifactual substances and natural substances. (And I have even suggested there may be no principled difference at all!) But at least some of this point carries over to artifactual objects if we look widely enough. If there is continuity between natural kinds and artifacts, then it doesn’t seem that there should be a metaphysical distinction. Dredged lakes seem no less real than natural lakes, and seedless grapes no less real than seeded ones. Two possibilities come readily to mind: one is that there is a threefold metaphysical distinction, there are the truly natural kinds independent of human interests or classification or manufacture, and then there are the conventional kinds dependent on human interests and classifications, but not on human manufacture, and finally there are those that depend on human interests classifications and manufacture.

But again this suggests a trichotomy, where the reality is much more complex. Sperber (this volume) discusses at some length the fact that many species have been shaped by human rather than natural selection, so that current domesticated dogs, cats, and many other domestic species are artifactual, that is they would not exist in their current form without human intervention. These are cases where there was, at a past historical time, a natural kind that has been rendered (at least somewhat) artificial over generations. Even in this genre there are gradations, ranging from the smaller changes in dogs that occurred rather unintentionally when they were accepted as part of the earliest communities, to the quite intentional and highly artificial changes that are produced to create and maintain pure breeds for show. Other kinds of mixed examples can be generated, for example rivers are typically dredged to make them more navigable, natural lakes are often expanded, forests are thinned, and so on. It does not seem plausible that a river changes its ontological status when it is made more navigable!

There are even more extreme consequences of the view that if human intentions are involved in the creation of some entity, then it has a lesser ontological status than otherwise. On this view, among humans there is a distinction between those whose parents intended to procreate and those who did not. Surely there is not an ontological distinction along these lines!

Artifacts: Parts and Principles 25 3.4. **The causal-historical account revisited**

Something like the Kripke-Putnam (Putnam 1975; Kornblith, this volume) account of natural kinds is now part of the general philosophical background, but I believe that some of the subtleties of that account have been insufficiently attended to. This is especially relevant to issues about artifacts, one of them being that the causal-historical account suggests that the intentions of the originator of the artifact should dominate since that seems closer to the account for natural kinds.

So let us review the argument in some detail: We are given, in thought, a twin Earth on which the substance that looks and acts like water has chemical composition XYZ, which has a quite different chemical structure from H₂O. The conclusion of the thought experiment and argument is that on Twin Earth 'water' refers to XYZ. We are given particular inhabitant Oscar_{TE} whose beliefs and language use are the subject of our discussion, and it is postulated that Oscar_{TE} is similar in his qualitative psychological states to his doppelganger Oscar on Earth. (Some less-than-careful statements of the thought experiment say that Oscar and Oscar_{TE} are molecule-for-molecule duplicates, but of course that can't be since most of Oscar's molecules are H₂O while most of Oscar's

2 TE are XYZ, and those are supposed to be chemically very different.)

Premise 1. When the reference of 'water' was fixed on Earth in, say, 1700 speakers referred to a sample of (what turns out to be) H₂O and intended to refer to it and to things that are similar-L to it.

Premise 2. When the reference of 'water' was fixed on Twin Earth in, say, 1700 speakers referred to a sample of (what turns out to be) XYZ and intended to refer to it and to things that are similar-L to it.

Premise 3. 'Water' on Earth in 2007 has the same referent as it did in 1700. *Premise 4.* 'Water' on Twin Earth in 2007 has the same referent as it did in

1700.

Premise 5. H₂O is not similar-L to XYZ.

From these premises it follows that 'water' refers to H₂O and not XYZ on Earth in 2007, and that 'water' refers to XYZ and not H₂O on Twin Earth in 2007. There is little discussion in Putnam of the similar-L relation. One tempting analysis is that it means 'similar in chemical structure', but of course there are different conceptions of chemical structure at different stages of the development of chemistry. And

additionally it would have been anachronistic for someone in 1700 to describe something in terms of ‘chemistry’, since the subject either did not exist or was not distinguished by that term. Perhaps it should be understood as ‘similar in atomic structure according to the natural philosophers’, but of course atomic theory was not generally accepted at that time so that would not have been a natural thing for the common speaker to think.

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So a better approach might be along the following lines: L is the relation between things when the underlying properties that explain/cause the surface features are the same according to the natural philosophers or the community that takes over from them the concern with explaining surface features on the basis of underlying properties. I have emphasized the problems in how to fill out the L in similar-L because it seems that once we see these complications both Premises 3 and 4 seem less certain. If the linguistic community continues to use as its underlying reference fixing, things similar-L as I am now recommending, the L relation may well change over time as the general linguistic community has differing views about the relevant community of experts. In addition, Premise 5 must be seen as only probable since, although our chemists would regard H₂O and XYZ as chemically different substances, their descendants may discern some similarity we currently do not see. (After all, the apparently disparate underlying structures produce the same density, freezing-point, boiling-point, and interactions with human bodies when ingested.)

One of the weaknesses in most versions of the causal-historical account of reference is that they ignore the social dimension and the other referential intentions that speakers have. The theory is more plausible with respect to proper names, since we very frequently refer to people whom we have never met. In such cases our intention is to refer to the same person as did the person from whom we first heard the name. And in many cases of unfamiliar substances or species, the same may be true. I don’t know whether I have ever encountered molybdenum and I know I have never encountered an aardvark.

However, with many other nouns we not only intend to refer as did the person before us, we simultaneously intend to refer to specific things in our vicinity. When I refer to ‘water’ I intend to use the word the way my mother did (assuming I learned it from her), but I also intend to use it to refer to the stuff in my glass, or your swimming-pool, etc. And it seems to me that in these cases where the uses and substance are widespread, the latter intentions outweigh the former. Imagine that we discover the first user of ‘water’ was in fact referring to XYZ, the only sample ever on Earth—one which was briefly introduced here and was subsequently removed by the mischievous Twin Earthians! Would we say that we have discovered that water isn’t really H₂O or that none of the stuff we have been calling ‘water’ is water?

Another thought experiment, this one less esoteric, is to consider what we would say if we discovered that the first user of ‘water’ was actually intending to refer to a cup, not its contents, but was misunderstood by the audience, which then intended both to refer as the baptizer did but also to refer to the familiar stuff. I do not think it is plausible to describe this situation as discovering that ‘water’ really refers to cups and has all along. A more likely scenario is that we would say that the initial history of ‘water’ is anomalous, but that ‘water’ refers to the familiar stuff.

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These examples have accepted the idea of a baptizer as unproblematic, but is it? The causal-historical picture of baptism may seem neat and plausible when applied to baptisms of people in Modern English. But the picture becomes somewhat less clear when we discuss an example like ‘Aristotle’, where the relevant baptism didn’t use a token of that type but perhaps ‘Ἀριστοτέλης’. It becomes much less clear if we think seriously about the history of a common noun like ‘water’. Either we draw (an apparently arbitrary) line where we determine that was the first use of ‘water’ or we follow the history further back through the use of the old English ‘*wæter*’, and then we draw an arbitrary line where it was first used, or we look further back at its ancestor ... In addition to the arbitrariness, we would face the problem that what we were declaring the first use of the

modern ‘water’ was almost certainly not thought of as a baptism by the person who used the term, but rather he or she was not intending to invent a new word but to continue to refer to what he or she had learned to call ‘*wæter*’.

We earlier were close to the qua problem (see Thomasson, this volume) of what is being baptized. In the case of water, the baptizer presumably had to intend to be baptizing the stuff in the cup, not the cup, and to either intend that the name apply to all phases of that stuff or that the name apply only to the liquid form of it. (The English word ‘water’ is ambiguous—in one sense it includes steam and ice, in the other it contrasts with ice and steam.) We saw earlier that while some biologically oriented nouns refer to species, others pick out a genus, order, or family. If the baptizing is to be unique and successful, the baptizer must intend a specific one of these options. And arguably having an intention to specify one of these requires knowing the differences among them, and I find it doubtful that most speakers of most languages know those differences.

4. INTENTIONS OR FUNCTIONS?

I have already argued that artifactual substances, at least many of them, have as essential a nature as most natural substances, and that in many cases the distinction between artifactual and natural substances is artificial and unsubstantial. But that leaves the central problem of kinds of artifactual things. In specifying the L in similar-L for artifacts there are two obvious choices, the function of the thing and the intentions of the manufacturer.

On the first choice, a kind of artifact is identified by taking a particular example and generalizing to objects created with the same intention. On the second choice, a kind of artifact is identified by taking a particular example and generalizing to objects created with the same function. Both raise problems, especially with recursive artifacts that evolve over time. For example, however we identify the inventor of the electronic computer, it is likely that their intention was to solve mathematical

equations, probably having to do with artillery trajectories. In this case, it may be that we have to have a finer set of distinctions and not consider

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‘electronic computer’ as a single kind of artifact but instead see a succession of different devices. A similar example is the airplane. (Lest you conclude that this is a special problem for artifact kinds, let me remind you that if evolutionary theory is correct there is a very analogous problem for species, one of our prototypical kinds of natural kind.)

Instead of dealing with that problem (left as an exercise for the reader), I want to address the issue of deciding between our two approaches. In many cases of prototypical artifacts the intentions and the functions will coincide. The two types of cases where it appears that they can diverge is when either the kind of artifact has functions not envisioned by the inventor or when the object fails to serve the intended function. But the first kind is an illusion which disappears if we recognize that if a kind of artifact has a function that was not intended by the original designer, then someone else recognized that possibility and so we should simply broaden our criterion and recognize that in many cases a kind of object has multiple designers/creative users.

There is a familiar difficulty of vagueness, of course, in when some kind of artifact has a new use. A single case of using my desk to open a bottle will not suffice. Something like a broad social recognition of the new possible use, along with questions of what conflicting pressures and alternative language choices are available will enter into the equation. We do know that in other respects the original intentions of baptizers, even when they were very clear and explicit, can gradually lose their force to the repeated intentions of later users. After a while Xerox machines become a subset of xerox machines, and Kleenex suffered a similar fate.

If this line of argument is correct, then setting aside the relatively small and unimportant cases of non-functional artifact kinds, we can let both designers’ intention and function play roles in indicating the similar-L

relation for artifact object kinds. For artifact substances, invented kinds of stuff, it seems to me that the properties of the stuff should determine the extension of the kind term, just as it does for ‘natural’ kinds like iron. The designer may have some functions in mind, that is, some kinds of object that are envisioned as being made from that stuff, but new kinds of material often lend themselves to myriad applications that were not envisioned.

On the other hand, artifactual objects appear to be more differentiated by function. One of the better examples may be clocks. Water clocks, sand clocks, mechanical clocks, and digital clocks are physically very different but all provide ways for humans to track the passage of time. Many writers have commented that, aside from problems of whether artifacts can have modal essences, they vary too much within a kind for inductive generalizations. This may well be because we are looking at the wrong level of abstraction. I illustrated earlier that many biological nouns that might be thought to refer to species actually refer to higher-level categories, and thus are going to support fewer inductive generalizations than you might have expected. If we make a similar analysis

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of artifacts, it may be that the proper level of artifact grain is not ‘clock’, but ‘mechanical clock’ and ‘water clock’. There are few generalizations you can make about automobiles, but many that can be made about Ford Focuses. (In some ways this point is close to one of Elder’s main points (this volume), though I arrive at it from a different direction.)

5. SCATTERED OBJECTS?

5.1. The problem and the positions

The boring, naive, and common-sense solution to my initial puzzle is that some objects, some of the time, are not spatially continuous. This view is subject to criticism from those who think no object is ever scattered, and I recognize that nothing I have said here addresses the concerns of the

nihilists who think no macroscopic objects exist. For current purposes, I will be satisfied if I can make out the case that artifacts are not worse off ontologically than other macroscopic objects. The more common criticism of the common-sense view is that it does not go far enough, recognizing only a very small percentage of the scattered objects in the universe. How one goes on to expand the category varies.

For one example, Jubien (1997) opts for the obvious things plus arbitrary parts of them and then allows arbitrary mereological sums of the starting objects and their parts. Note that this brings with it temporal as well as spatial discontinuity since we can take the mereological sum of objects that exist at disparate and non-overlapping times. Quine famously opts for the view on which 'the material content of any region of space-time, however irregular and discontinuous and heterogeneous', constitutes an object (1981, 10). Cartwright (1975) also argues for scattered objects, though he does not provide a characterization of how many or what kinds he thinks exist in any detail.

Jubien uses the example of a bicycle, and Cartwright of his pipe, and in both cases it seems plausible that these constitute scattered objects when disassembled for cleaning or repair. Notice though that both the intent and functioning of these kinds of object foresees their being disassembled and reassembled. We can even think of examples of objects that are, or could be, disassembled more often than not. For example, we might have tables that, instead of folding for storage, easily disassemble and reassemble; they might spend most of their existence disassembled in our storage closet.

So those examples fit ordinary intuitions, and the rub comes in providing principled reasons for rejecting the general extension of these ideas by means of other examples and arguments. Some examples, such as Cartwright's two-volume edition of *The Nature of Existence* and Jubien's three-piece suit, seem easily disqualified as collections of objects whose function involves all of the pieces, but each of which is a separate object. Similar remarks apply to decks

of cards, chess sets, and pairs of shoes. Some of Jubien's other examples are not designed artifacts, but also do not seem to be compelling as single entities: flocks of geese, forests, and galaxies.

Cartwright and Jubien also both deploy the argument from atomic theory. 'If natural scientists are to be taken at their word, all the familiar objects of everyday life are scattered' (Cartwright 1975, 174). An important consequence (of assuming something approximating atomic theory is correct) is that 'ordinary things that are large enough to be seen with the naked eye are what philosophers call scattered (or discontinuous) objects' (Jubien 1997, 155).

There are two ways of responding to these claims. First, there is the somewhat *ad hominem* tack that if we take quantum theory seriously then it is not at all clear that Jubien is entitled to talk of 'things' at the atomic or subatomic level. Early versions of atomic theory conceived of atoms and electrons as miniature versions of macroscopic objects, but quantum theory presents a very different picture. Electrons and other 'particles' at that level don't have locations most of the time, nor velocities or shapes. Quine's quantification over 'occupied' space-time regions seems equally implausible — if most electrons don't have locations, which regions of space-time are occupied? (See Chiara and Di Francia 1995, for further discussion with respect to Quine.)

5.2. Spelke objects

A more constructive approach is to attempt to provide a principled alternative that draws a plausible boundary. My own preference is to appeal to the idea of a maximal dynamically cohesive collection of matter. This conception, or something close to it, is the notion of object that developmental psychologists are studying in infants. Xu (1997) argued that this is the (a?) meaning of object in English, but a number of serious objections were raised (in Ayers 1997; Hirsch 1997; Wiggins 1997), and the idea needs more careful reformulation; also it is probably advisable to

introduce a technical term, such as Spelke object, rather than make the bold claim Xu did that this concept captures one meaning of ‘object’ in English. (Elizabeth Spelke was one of the most important researchers in developing this area; see e.g. Spelke 1990 and Spelke *et al.* 1992.)

There are two parts to the definition: first, a collection of matter is dynamically cohesive if it moves as a unit. In other words, moving one part of the collection moves, or tends to move, the other parts. An ice-cube or an iceberg is a Spelke object; the liquid water in a puddle is not. Each volume of Cartwright’s two-volume *The Nature of Existence* is a Spelke object, the two volumes considered together are not. A pile of sand is not a Spelke object, but if we saturate it with enough superglue and let it dry it becomes one. The other important condition is maximality, the Spelke object consists of all the matter that moves together; the left half of a Spelke object is not a Spelke object. As Eric Margolis has suggested: ‘If you can pick it up with a fork, it is a Spelke object’ (personal communication).

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A perfectly rigid sphere would be a paradigm example of a Spelke object; a blanket is a poor one. There are problems of vagueness with this definition—however dynamically cohesive some collection of matter is, there is a conceivable force that would rip it asunder. It is unclear whether a soap bubble floating in the air is a Spelke object, nor at what stage in the freezing of an ice-cube it becomes a Spelke object. Some artifacts, for example jars with lids, come apart easily when a very specific force is applied but resist coming apart under considerably greater forces in all other directions. I am attempting to deal with these and other problems elsewhere, but ask your forbearance while I attempt to at least partially unpack some of the desirable consequences of this notion. Let me note in passing that many of these issues of vagueness also afflict paradigmatic natural kinds, like cats (Lewis 1993).

However desirable Jubien objects or Quine objects may be for a nicely rounded-out ontology, there are features of Spelke objects that neither of

the others have in general. Given that a and b are parts of a Spelke object at t and that a is moving in a particular direction at t , it is highly probable that b is moving in the same direction at t . (A more careful formulation would raise the probability by incorporating a suitable clause for spinning objects.) Given that a and b are both part of a Quine object or a Jubien object and that a is moving in a particular direction, we have no reason to think that b is moving in the same direction.

Our interest in such facts depends on—well—on our interests. Sometimes we want to move furniture, avoid oncoming traffic, pick up an (unsliced) loaf of bread, or kick a soccer ball. So how we use the information about Spelke objects depends on us and our aspirations and fears and other sentential attitudes; we care because the information is useful. But it is objective information. In a world without humans there would be fewer Spelke objects, but those that existed would still have the same properties and be subject to the same laws of motion. If a tree falls unseen and unheard in the forest, it falls as a Spelke object.

This suggestion lets us bypass the question of continuity at the atomic level; continuity is not part of the definition. Perhaps, one might argue, the interior of the atom does not truly contain empty spaces because of the fields present there, but I prefer not to tangle with those issues for lack of competence. However, it is a deep physical fact that almost all Spelke objects appear continuous at the macroscopic level, and so it is not surprising that previous definitions that have attempted to capture something like this notion have appealed to continuity.

Given the importance of discerning and tracking what is and is not a Spelke object in the environment, it is not surprising that from a very early stage infants can track a (small) number of Spelke objects both visually and in memory. In one variation of the common experiments, a toy duck or cup is placed on a table in view of the infant, and then a screen is placed to obscure the object. Shortly after, when the screen is removed, very young infants are surprised if there is no object there, or if two objects are there. But they are not surprised if the duck

has been replaced by a cup. Similar results can be obtained with up to about four objects. So at this stage children seem to categorize and remember things as Spelke objects and not as items in more specific categories.

To demonstrate the importance of maximal cohesiveness, similar experiments were also carried out by pouring one or more piles of sand on the table, obscuring them from view, and covertly changing the number of piles. Changed numbers of piles of sand did not surprise the infants. On the other hand, when the experiment was done in yet another variation, this time with piles of sand which had been superglued into Spelke objects (i.e. the child saw the object being moved cohesively onto the table), they had the same expectation of numeric constancy as they did with a cup or duck (Huntley-Fenner, Carey, and Solimando 2002).

The ability to discern and remember maximal cohesive objects in the perceptible environment is very basic in humans, as witnessed by the fact that it is present very early in infants. Its roots are undoubtedly older than humans as the ability has been shown to be present in cottontop tamarins and rhesus monkeys (Sulkowski and Hauser 2001; Uller, Hauser and Carey 2001; Hauser *et al.* 2003).

6. CONCLUSION

I have attempted to develop the conceptual machinery of Spelke objects in the hopes of constructing a coherent and persuasive case that we can make sense of the disassembled bicycle as a spatially discontinuous object without being forced to accept all mereological sums of objects as objects. The objects which we naturally regard as maintaining their objecthood while spatially dispersed are those which can be reassembled and resume their function. Indeed, in many cases artifacts are *intended* to be disassembled periodically for maintenance or cleaning. These objects are not Spelke objects while disassembled, but their components are. We can mark out as a significant category the category of Spelke objects plus those

entities which are for some part of their existence discontinuous and not Spelke objects if and only if those objects are at an earlier (and later?) stage a Spelke object which was designed to be disassembled and reassembled or whose functioning is facilitated by being disassembled and reassembled (along with some cleaning, sharpening, or whatever). On this criterion, the bicycle of paragraph one of my introduction and Cartwright's pipe are spatially scattered objects for portions of their careers.²