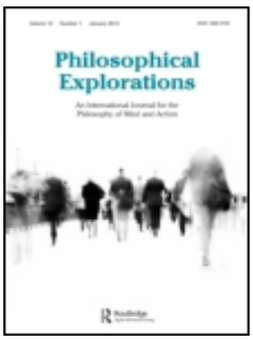

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THE ONTOLOGY OF ARTIFACTS

Lynne Rudder Baker

Beginning with Aristotle, philosophers have taken artifacts to be ontologically deficient. This paper proposes a theory of artifacts, according to which artifacts are ontologically on a par with other material objects. I formulate a nonreductive theory that regards artifacts as constituted by—but not identical to—aggregates of particles. After setting out the theory, I rebut a number of arguments that disparage the ontological status of artifacts.

Introduction

Artifacts are objects intentionally made to serve a given purpose. The term 'artifact' applies to many different kinds of things—tools, documents, jewelery, scientific instruments, machines, furniture, and so on. Most generally, artifacts are contrasted with natural objects like rocks, trees, dogs, that are not made by human beings (or by higher primates). The category of artifact, as opposed to the category of natural object, includes sculptures, paintings, literary works and performances; however, here I shall put aside these fascinating artifacts and focus only on artifacts that have practical functions. Artifacts with practical functions are everywhere. We sleep in *beds*; we are awakened by *clocks*; we eat with *knives* and *forks*; we drive *cars*; we write with *computers* (or with *pencils*); we manufacture *nails*. Without artifacts, there would be no recognizable human life.

My plan for this paper is first to propose a theory of artifacts, a theory based on the notion of material constitution that I have deployed elsewhere. Although the examples that I'll consider are laughably simple, I hope that the general theory will apply to sophisticated technical artifacts as well. After setting out my theory, I want to defend the ontological status of artifacts against philosophers—from Aristotle to Leibniz to Peter van Inwagen—who find artifacts ontologically deficient.

The Idea of Constitution

Constitution, I believe, is the glue of the material world. Constitution is a very general relation that we are all familiar with (though probably not under that label). A river at any moment is constituted by an aggregate of water molecules. But the river is not identical to the aggregate of water molecules that constitutes it at that moment. Since one and the same river—call it *R*—is constituted by different aggregates of molecules at different times, the river is not identical to any of the aggregates of water molecules that make it up. So, constitution is not identity.[1] Another way to see that constitution is not identity is to notice that even if an aggregate of molecules, A_1, actually constitutes *R* at t_1, *R* might have been constituted by a different aggregate of molecules, A_2, at t_1. So, constitution is a relation that is in some ways similar to identity, but is not actually identity. If the relation between a person and her body is constitution, then a person is not identical to her body.

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On the constitution view, reality comes in fundamentally different kinds. Each existing thing is of a primary kind. An entity's primary kind is given by the answer to the Aristotelian question: what is *x* most fundamentally? There is no 'mere thing' behind or underlying the instance of a primary kind. Every object has its primary kind essentially, and entities of different primary kinds have different persistence conditions. Constitution is a relation between things of different primary kinds. Constitution brings into existence new objects of higher-level primary kinds than what was there before. For example, when a certain combination of chemicals is in a certain environment, a thing of a new kind comes into existence: an organism. A world with the same kinds of chemicals but a different environment may lack organisms, and a world without organisms is ontologically different from a world with organisms. So, constitution makes an ontological difference.[2]

An entity cannot lose its primary-kind property and still exist: if an organism ceased to be an organism, it would cease to exist. To take another example, *being a coin* is a primary-kind property, but being *an item in a pocket* is not. An item in a pocket could cease to be an item in a pocket (say, it was taken out) without going out of existence; a coin could not cease to be a coin (say, it was melted down) without going out of existence. The mark of a primary-kind property is this: things of a given primary kind cannot survive loss of their primary-kind properties.

If *x* constitutes *y*,[3] then the identity of the resulting thing is determined by *y*'s primary kind. Primary kinds include not only kinds determined by structure or by material constituent, or by underlying essence; but also there are primary kinds determined by function. Underlying the Constitution View is the idea that what something is most fundamentally is often determined by what it can do—its abilities and capacities—rather than by what it is made of. This is obvious in the case of artifacts: what makes something a clock is its function of telling time, no matter what it is made of.

Whether we are talking about rivers, human persons, clocks or countless other constituted things, the basic idea of constitution is this: when certain things of certain kinds (aggregates of water molecules, human organisms) are in certain circumstances (different circumstances for different kinds of things), then new entities of different kinds come into existence. The circumstances in which an aggregate of water molecules comes to constitute a river have to do with the relation of the water molecules to each other; they form a stream.[4] The circumstances in which a human organism comes to constitute a human person have to do with development of a first-person perspective. In each case, new things of new kinds, with new kinds of causal powers, come into being. An organism—but not the aggregate of cells that constitutes it—can eat its prey. A flag—but not the aggregate of pieces of cloth—may cause a veteran to cry. Since constitution is the vehicle, so to speak, by which new kinds of things come into existence in the natural world, it is obvious that constitution is not identity.

Let me defend the claim that constitution is not identity. The familiar properties of identity are reflexivity (everything is necessarily identical to itself; $\Box(a = a)$); symmetry (if $a = b$, then $b = a$); and transitivity (if $a = b$ and $b = c$, then $a = c$). Like Leibniz, Kripke and other philosophers, I take identity to be necessary, not merely contingent: if $a = b$, then necessarily $a = b$. If $a = b$, it is logically impossible for a to exist and b not to exist. Not only do a and b actually have all the same properties, but they could not differ in

any properties—even modal properties, properties that it is necessary or merely possible that an object has. This strict view of identity is the classical view.

It is obvious that constitution is not strict identity. Consider a brick house. It seems to me pretheoretically obvious that although the aggregate of bricks constitutes the house, the house does not constitute the aggregate of bricks. It also seems pretheoretically obvious that the house does not constitute itself. So, constitution is neither reflexive nor symmetric. Hence, constitution is not identity. But put aside these intuitions of mine. The interesting case concerns modal properties. Your body would still exist now even if you had just had a haircut. If you had just had a haircut, then although your body would still exist now, a different aggregate of cells would constitute your body now. It follows that your body is not identical to the aggregate of cells that constitutes your body now.

A question arises: how is it that a boat, say, and the non-identical aggregate of planks and nails[5] that constitute it at *t* share so many properties at *t*? If the aggregate of planks and nails sinks at *t*, so does the boat; if the boat is sold at *t*, so is the aggregate of planks and nails that makes up the boat. The reason that the boat and aggregate of planks and nails share so many properties is that constitution is a relationship of unity. Many properties (but not modal properties or certain temporal properties) are borrowed from a constitutional partner. An object *x* may have such a property derivatively if *x* is constitutionally related to *y*, and *y* has the property independently of *y*'s constitution relations to *x*. For example, the aggregate of planks and nails has the property at *t* of being a boat. This is so because the aggregate constitutes a boat at *t*, and the boat has the property at *t* (and at every moment of its existence) of being a boat non-derivatively.

In short, constitution is a relation that accounts for the appearance of genuinely new kinds of things with new kinds of causal powers. If *F* and *G* are primary kinds and *F*s constitutes *G*s, then an inventory of the contents of the world that includes *F*s but leaves out *G*s is incomplete.[6] *G*s are not reducible to *F*s.[7] Indeed, this conception is relentlessly anti-reductive.

Artifacts and Aggregates

Typically artifacts are constituted by aggregates of things. But not always: an anvil is constituted by a piece of heavy metal; a paperclip is constituted by a small piece of thin wire; and a 50 Euro note is constituted by a piece of paper. Nevertheless, even those artifacts (like paperclips) that are constituted by a single object are, at a lower level, constituted by aggregates of atoms. So, I'll here consider artifacts to be constituted by aggregates of things, not by a single object. Any items whatever are an aggregate; and an aggregate is determined wholly by the items in it. The identity conditions of aggregates are simple: aggregate *x* is identical to aggregate *y* just in case exactly the same items are in aggregate *x* and aggregate *y*. So, we have a principle governing the existence of an aggregate:

> (E-Agg) For any objects—call them 'the *x*s'—there is an aggregate such that, necessarily, the aggregate exists whenever all the *x*s exist.

Since every *x*—every concrete thing—is of a primary kind essentially, we may identify the items (the *x*s) in an aggregate by their primary kinds. The items in an aggregate may include some items whose primary kind is *F*, and some whose primary kind is *G*, and so

on. If aggregates are to constitute various kinds of artifacts, then aggregates themselves (and not just the items in them) must be of primary kinds. We may assign a primary kind to an aggregate of *x*s of various primary kinds. Suppose that the boat called 'Boat' is constituted by a certain aggregate of planks and nails at *t*. The aggregate of planks and nails has a primary kind by courtesy. The primary kind of that aggregate is a hybrid: plank/nail. So, we have a principle governing the primary kind of an aggregate:

(PK-Agg) The primary kind of an aggregate of *x*s, where each of the *x*s is of primary kind *F* or of primary kind *G* or of primary kind *H*. . ., is the hybrid primary kind *F*/*G*/*H*. . .

Each of the items in the aggregate of planks and nails is itself an artifact. A plank is constituted by an aggregate of cellulose molecules and a nail is constituted by an aggregate of iron atoms. So, the aggregate of the planks and nails is itself constituted by an aggregate of natural non-artifactual things: cellulose molecules and iron atoms. And so on down to aggregates of subatomic particles. Although planks and nails (as well as the boat) are artifacts, the planks and nails are constituted by aggregates of natural objects. So, constitution does not distinguish artifacts and non-artifacts (natural objects). The constitution relation holds between artifacts, between artifacts and non-artifacts, and between non-artifacts.[8]

Now consider some of the distinctive features of artifacts. Most prominently, artifacts have proper functions that they are (intentionally) designed and produced to perform (whether they perform their proper functions or not).[9] What distinguishes artifactual primary kinds from other primary kinds is that an artifactual primary kind entails a proper function, where a proper function is a purpose or use intended by a producer. (Indeed, the general term for an artifact—e.g. polisher, scraper, life preserver—often just names the proper function of the artifact.) Thus, an artifact has its proper function essentially: the nature of an artifact lies in its proper function—what it was designed to do, the purpose for which it was produced.[10]

The proper function of a boat is to provide transportation on water. The proper function of an artifact is the intended function. An artifact may in fact never perform its proper function: perhaps a boat is never actually put in water, or perhaps it malfunctions (sinks on launching). The aggregate of planks and nails that constitutes a boat at *t* inherits the proper function of a boat. But the aggregate of planks and nails only contingently has the function of providing aquatic transportation, in virtue of constituting a boat at *t*. The boat has its proper function essentially; the aggregate of the planks and nails that constitutes the boat at *t* has its proper function only contingently. After some of the planks are replaced at *t*′, say, the aggregate that constituted the boat at *t* no longer constitutes it; and hence the aggregate that constituted the boat at *t* no longer has the proper function of providing aquatic transportation.

What proper function an artifact has determines what the artifact most fundamentally is—a boat, a jackhammer, a microscope, and so on. And what proper function an artifact has is determined by the intentions of its designer and/or producer. Here, then, are four conditions that I propose as necessary and sufficient for *x*'s being an artifact:[11]

(A1) *x* has one or more makers, producers or authors. Designers and executors of design (perhaps the same people) are authors.

(A2) *x*'s primary kind (its essence, its proper function) is determined in part by the intentions of its authors.

(A3) *x*'s existence depends on the intentions of its authors and the execution of those intentions.

(A4) *x* is constituted by an aggregate that the authors have arranged or selected[12] to serve the proper function entailed by the artifact's primary kind.

(A1) to (A4) are, I hope, an adequate account of artifacts. Now I want to modify my general definition of 'constitution' (given in Baker 2000) to accommodate (A1) to (A4), and hence to accommodate artifacts. I'll illustrate with a boat and an aggregate of planks and nails. The modification of the definition is to place a twofold condition on an aggregate that can constitute a boat:

(i) the aggregate must contain enough items of suitable structure to enable the proper function of the artifact to be performed—in the current example, the function of providing aquatic transportation—whether the proper function actually is ever performed or not; and

(ii) the items in the aggregate must be available for assembly in a way suitable for enabling the proper function of the artifact to be performed.

Call an aggregate that satisfies these two conditions 'an appropriate aggregate'.

One further preliminary: according to my general definition of 'constitution', if *x* constitutes *y* at *t*, and *y*'s primary kind is *G*, then *x* is in what I called '*G*-favourable circumstances' at *t*. If a certain aggregate of planks and nails constitutes a boat at *t*, then the aggregate must be in boat-favourable circumstances at *t*. Consideration of artifacts suggests that we should distinguish two kinds of G-favourable circumstances for boats, say: (i) the circumstances in which a boat may come into existence and (ii) the circumstances in which an existing boat continues to exist. The circumstances in which a boat comes into existence are more stringent than those for a boat's remaining in existence. So, let me spell out some features of boat-favourable circumstances for a boat's coming into existence.

The boat-favourable circumstances concern the relations between an appropriate aggregate for boats, designers and/or builders. For example, (i) the aggregate must be in the presence of one or more persons who know how to build a boat from the items in the aggregate, and who either intend to build a boat from the items in the aggregate or whose activity is directed by someone who intends to have a boat built from the items in the aggregate; (ii) the items in the aggregate must be manipulated by such persons (either manually or by machine) in ways that execute their productive intentions or of those directing the persons; and (iii) the result of the manipulation must satisfy the productive intentions of the persons.

Now with the notions of an appropriate aggregate and boat-favourable circumstances, we can adapt the general definition of '*x* constitutes *y* at *t*' to a boat. Call the particular aggregate of planks and nails 'Agg' and the boat 'Boat'.

Agg constitutes Boat at *t* if and only if: there are distinct primary kinds, boat and plank/nail, and boat-favourable circumstances such that:

(1) Agg is an appropriate aggregate of primary-kind plank/nail & Boat is of primary-kind boat; &
(2) Agg and Boat are spatially coincident at *t*; &
(3) Agg is in boat-favourable circumstances at *t*; &
(4) $\Box\forall z\forall t$ [(*z* is of primary-kind plank/nail & *z* is in boat-favourable circumstances at *t*) $\rightarrow \exists u$ (*u* is of primary-kind boat & *u* is spatially coincident with *z* at *t*)]; &
(5) $\Diamond\exists t\{$(Agg exists at *t* & $\sim\exists w$ [*w* is of primary-kind boat & *w* is coincident with Agg at *t*])$\}$[13]

When this biconditional holds, (A1) to (A4) are satisfied. (A1) to (A3) are satified when Agg is in boat-favourable circumstances, and (A4) is satisfied when Agg and Boat fit the definition. Boat is non-derivatively an artifact; indeed, the boat is essentially an artifact: there is no possible world in which that boat exists and is not an artifact. Agg at *t* is derivatively an artifact. Agg would not be an artifact if it hadn't constituted an artifact. Even though the planks and nails in Agg are themselves artifacts, the aggregate of artifacts is not an artifact. (No one produces an aggregate; it comes into existence automatically, and an aggregate has no proper function.) This completes a sketch of a theory of artifacts made up from aggregates of items.

Here are some advantages of this view. First, it allows for novel artifacts—objects with new proper functions. An artifact's having a proper function depends in part on the author's intentions, and not on any history of selection and reproduction as proper functions in biology are. So, prototypes of innovative artifacts have proper functions. (Vermaas and Houkes take this to be a criterion of adequacy for a theory of functions.) Second, this account allows—as it should—that a single boat may survive various replacement of planks and nails. After replacement even of a nail, Agg would still exist (assuming that the replaced nail was not destroyed), but Agg would no longer constitute Boat; some other aggregate would. (So, again, we see that Agg $\neq$ Boat.) Third, this account accords artifacts ontological status as artifacts. An artifact has as great a claim as a natural object to be a genuine substance. This is so because artifactual kinds are primary kinds. Their functions are their essences. Despite my touting the ontological status of artifacts as an advantage of the constitution view of artifacts, many philosophers would disagree. To such philosophers I now want to turn.

The Ontological Status of Artifacts

Many important philosophers—from Aristotle on—hold artifacts ontologically in low regard. Some philosophers have gone so far as to argue that 'artifacts such as ships, houses, hammers, and so forth, do not really exist' (Hoffman and Rosenkrantz 1997, 173).[14] Artifacts are thought to be lacking in some ontological way: they are considered not genuine substances. Although the notion of substance is a vexed one in philosophy, what I mean by saying that things of some kind—*F*s (e.g. hammers, dogs, persons)—are genuine

substances is that any full account of the furniture of the world will have to include reference to *F*s. I shall argue that there is no reasonable basis for distinguishing between artifacts and natural objects in a way that renders natural objects as genuine substances and artifacts as ontologically deficient.

I shall consider five possible ways of distinguishing between natural objects and artifacts, all of which are mentioned or alluded to by David Wiggins.[15] On none of these, I shall argue, do natural objects, but not artifacts, turn out to be genuine substances. Let the alphabetic letter 'F' be a placeholder for a name of a type of entity.

(1) Fs are genuine substances only if Fs have an internal principle of activity.
(2) Fs are genuine substances only if there are laws that apply to Fs as such, or there could be a science of Fs.
(3) Fs are genuine substances only if whether something is an F is not determined merely by an entity's satisfying a description.
(4) Fs are genuine substances only if Fs have an underlying intrinsic essence.
(5) Fs are genuine substances only if the identity and persistence of Fs is independent of any intentional activity.

Let us consider (1) to (5) one at a time.

(1) The first condition—Fs are genuine substances only if Fs have an internal principle of activity—has its source in Aristotle.[16] Aristotle thinks that this condition distinguishes objects that come from nature (e.g. animals and plants) from objects that come from other efficient causes (e.g. beds). But it seems to me that this condition does not rule in natural objects and rule out artifacts as genuine substances. Today, we would consider a piece of gold (or any other chemical element) a natural object, but a piece of gold does not have an internal principle of change; conversely, a heat-seeking missile is an artifact that does have an internal principle of activity. So, the first condition does not distinguish artifacts from natural objects.

(2) The second condition—Fs are genuine substances only if there are laws that apply to Fs as such, or there could be a science of Fs—also allows artifacts to be genuine substances. Engineering fields blur the line between natural objects and artifacts. Engineering schools have courses in materials science (including advanced topics in concrete), traffic engineering, transportation science, computer science—all of which quantify over artifacts. And if we consider laws to be counterfactual-supporting generalizations, then these engineering fields are looking for laws. Even fields considered part of the natural sciences include artifactual as well as natural materials in their domains. For example, polymers are large molecules made up of repeating molecular units like beads on a string. 'Natural polymers include rubber, wool, and cotton; synthetic polymers include nylon and polythene' (Barnes-Svarney 1995: 547).[17] So, some instances of polymers (e.g. those made of nylon) are artifacts; others (e.g. those made of rubber) are natural objects. My university has a whole building devoted to Polymer Science. Since something's being of an artifactual kind does not preclude a science of it, the second condition does not make artifacts less than genuine substances.

(3) The third condition—Fs are genuine substances only if whether something is an F is not determined merely by an entity's satisfying a description—is semantic. Demonstrative reference is supposed to be essential to natural-kind terms.[18] The reference of natural-kind

terms is determined indexically; the reference of artifactual-kind terms is determined by satisfying a description.[19] For example, this is what Wiggins says:

> Artefacts are collected up not by reference to a theoretically hypothesized common constitution but under functional descriptions that are precisely indifferent to specific constitution and particular mode of interaction with the environment. A clock is any time-keeping device, a pen is any rigid ink-applying writing implement, and so on. (Wiggins 2001, 87)

Membership in a natural kind, it is thought, is not determined by satisfying a description, but by relevant similarity to stereotypes (e.g. Wiggins 2001, 11–12). The idea is this: first, Fs are picked out by their superficial properties (e.g. quantities of water are clear liquids, good to drink, etc.). Then, anything that has the same essential properties that the stereotypes have is an F. So, natural kinds have 'extension-involving sortal identifications' (Wiggins 2001, 89). By contrast, artifactual terms (like those I used earlier—'beds', 'clocks', 'knives and forks', 'cars', 'computers', 'pencils', 'nails') are said to refer by satisfying descriptions: 'A clock is any time-keeping device, a pen is any rigid ink-applying writing implement and so on' (Wiggins 2001, 87).

I do not think that this distinction between how words refer captures the difference between natural objects and artifacts.[20] The distinction between referring indexically and referring by description, with respect to natural-kind terms, is only a matter of the state of our knowledge and of our perceptual systems.[21] However gold was originally picked out (e.g. as 'stuff like *this*'), now it can be given an explicit definition: gold is the element with atomic number 79. Not only might natural kinds satisfy descriptions, but also we may identify artifacts in the absence of any identifying description. For example, archeologists may believe that two entities are both artifacts of the same kind, without having any identifying description of the kind in question. (Were they used in battle or in religious rituals?)

Thus, the third condition—Fs are genuine substances only if whether something is an F is not determined merely by an entity's satisfying a description—does not distinguish natural kinds from artifactual kinds, nor does it rule out artifacts as genuine objects.[22]

(4) The fourth condition—Fs are genuine substances only if Fs have an underlying intrinsic essence—does not distinguish natural from artifactual kinds. Although some familiar natural kinds—like water or gold—have underlying intrinsic essences, not all do. For example, wings (of birds and insects), mountains and planets are all natural kinds, but none of them has an underlying intrinsic essence. Their membership in their kinds is not a matter of underlying intrinsic properties. Something is a wing, mountain or planet not in virtue of what it is made of, but in virtue of its relational properties. For that matter, something is a bird or an insect in virtue of its relational properties—its genealogical lineage.

(5) The fifth condition—Fs are genuine substances only if the character of Fs is independent of any intentional activity—is the most interesting. According to some philosophers, the 'character of [a] substance-kind cannot logically depend upon the beliefs or decisions of any psychological subject' (Hoffman and Rosenkrantz 1997, 173). Unlike the first four conditions, the fifth does distinguish between artifactual and natural kinds. An artifact's being the kind of thing that it is depends on human intentions. Conceding that the necessity of intention is a difference between an artifact and a natural object, I ask: why should this difference render artifacts deficient?

What generally underlies the claim that artifacts are not genuine substances, I believe, is an assumption that Fs are genuine substances only if conditions of membership in the substance-kind are set 'by nature, and not by us'.[23] But it is tendentious to claim that the existence of artifacts depends not on nature, but on us. Of course, the existence of artifacts depends on us: but we are part of nature. It would be true to say that the existence of artifacts depends not on nature-as-if-we-did-not-exist, but on nature-with-us-in-it. Since nature *has* us in it, this distinction (between nature-as-if-we-did-not-exist and nature-with-us-in-it) is no satisfactory basis for ontological inferiority of artifacts.

There is a venerable—but, I think, theoretically misguided—distinction in philosophy between what is mind-independent and what is mind-dependent. This distinction is theoretically misguided because it draws an ontological line in an unilluminating place. It puts insects and galaxies on one side, and after-images and artifacts on the other. Another reason that the mind-independent/mind-dependent distinction is unhelpful is that advances in technology have blurred the difference between natural objects and artifacts. For example, so-called 'digital organisms' are computer programs that (like biological organisms) can mutate, reproduce and compete with one another (*The Chronicle of Higher Education: Daily News*, 8 May 2003). Or consider 'robo-rats'—rats with electrodes that direct the rats' movements (*The New York Times*, 5 May 2002). Or for another example, consider what one researcher calls 'a bacterial battery' (*The New York Times*, 18 September 2003).[24] These are biofuel cells that use microbes to convert organic matter into electricity. Bacterial batteries are the result of a recent discovery of a micro-organism that feeds on sugar and converts it to a stream of electricity. This leads to a stable source of low power that can be used to run sensors of household devices. Finally, scientists are genetically engineering viruses that selectively infect and kill cancer cells and leave healthy cells alone. *Scientific American* referred to these viruses as 'search-and-destroy missiles'.[25] Are these objects—the digital organisms, robo-rats, bacterial batteries, genetically engineered viral search-and-destroy missiles—artifacts or natural objects? Does it matter? I suspect that the distinction between artifacts and natural objects will become increasingly fuzzy; and as it does, the mind-independent/mind-dependent distinction will fade away.

Let me conclude with a general argument for the ontological status of artifacts. An F has ontological status in virtue of being an F only if the F's existence depends on its being an F. For example, your bicycle has ontological status in virtue of being a bicycle because *it* would not exist at all if it were not a bicycle. By contrast, the items in your pocket have ontological status in virtue of being coins, handkerchiefs, keys, etc., not in virtue of being items in your pocket, because they would (and most likely did) exist without being items in your pocket. What has ontological significance in the first instance are properties—primary-kind properties. (*Item in a pocket* is not a primary kind.)

When a new instance of a primary-kind property comes into being, a new object comes into existence. A new bicycle is a new object in the world; a new item in a pocket is not. And conversely, an item in a pocket can lose the property of being an item in a pocket without going out of existence; a bicycle cannot lose the property of being a bicycle without going out of existence. So, primary-kind properties bestow, on those whose primary-kind properties they are, ontological significance.

A primary-kind property bestows ontological significance only on those things that have the property non-derivatively. This is so, because if something has a primary-kind property derivatively, it may lose that property without going out of existence. For example, the aggregate of atoms in your sofa now has the property of being a sofa derivatively. But, as we have seen, the aggregate would still exist even if it did not constitute your sofa. (If your cat scratched the sofa, the sofa would still exist but be constituted by a different aggregate from the one that constitutes it now. Yet, the old aggregate would remain in existence—even though it would no longer be a sofa derivatively.) If F is an ontologically significant property, then the addition of something that is an F non-derivatively is the addition of a new object in the world; it is not just a change in something that already exists, but the coming-into-being of a new thing.

Since there are artifactual primary kinds, and since primary-kind properties generally confer ontological status on their non-derivative bearers, it is easy to see that on the Constitution View, artifacts have ontological status. The world after Gutenberg's invention of the printing press was ontologically richer than before. The addition of printing presses is an addition to what there is in the world.[26] If a printing press is destroyed—smashed by hoodlums, say—then something goes out of existence; it is not as if the thing that was a printing press just lost the property of being a printing press and acquired the property of being a pile of rubble. There is not a persisting thing that at t_1 is a printing press, and at t_2 is a pile of rubble. The atoms in the aggregate that constituted the printing press may still exist; but the printing press—that thing—does not. Similarly, when the World Trade Center towers in New York were destroyed in 2001, they went out of existence altogether; they did not just lose the property of being towers and continue to exist as non-towers. So, a complete inventory of what exists in the world must include artifacts. Therefore, on the Constitution View, artifacts—as well as natural objects—have ontological status.

Although artifacts are not ontologically deficient, the aggregates that constitute them *are* ontologically deficient. The conditions for the existence of an aggregate are too undemanding to be a genuine substance. An aggregate may exist without any structure, any function, any causal interactions. An aggregate is nothing over and above the items in it; it adds nothing to what exists. Aggregates are, as David Lewis (1991, 81) said of mereological fusions, 'ontologically innocent'. For any items—for example, my left eyebrow and your passport—there is an aggregate that consists exactly of those items. But the aggregate of my left eyebrow and your passport is nothing but my left eyebrown and your passport. Aggregates come into existence 'automatically' when the items in them do. Aggregates add nothing to what exists in the world. So, my claim that boats and other artifacts are genuine substances—with ontological significance—does not extend to aggregates of planks and nails or mere aggregates of anything else. Planks and nails are genuine objects; aggregates of planks and nails are not.

Conclusion

When Guttenburg invented the printing press, a new kind of thing came into existence: and it changed the world. It would be bizarre to suppose that such instruments of such monumental changes were not kinds of genuine substances, or lacked ontological

status. Considering the world-changing *effects* of the printing press and the telephone (and countless other kinds of artifacts), artifacts have as strong a claim to ontological status as natural objects.

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NOTES

1. I am assuming here the classical conception of identity, according to which if $a = b$, then necessarily, $a = b$.
2. For greater detail, see Baker (2000). See also the Book Symposium on *Persons and Bodies* (*Philosophy and Phenomenological Research* 2002) and Baker (2002).
3. Here and elsewhere I'll omit reference to times.
4. The identity of an aggregate is determined only by the items in it, not by their arrangement. One and the same aggregate may be of any 'shape'.
5. I want an aggregate of things of different materials to illustrate my view. I realize that some construe 'aggregate' to refer to things that are further divisible into things of the same kind—like aggregates of iron atoms. But all I mean by 'aggregate' is a collection of items. But see Lowe (1994, 537).
6. There is much more to be said about the idea of constitution. See Baker (1999, 2000, especially Chap. 2).
7. Note that this is a completely general claim. It is not 'property dualism'.
8. Organisms and aggregates of cells illustrate constitution between non-artifacts.
9. There is a lot of literature on functions. For example, see Elder (1995). See also Vermaas and Houkes (2003) which is very useful. As Vermaas and Houkes point out, some philosophers take the notion of biological function to be basic and then try to apply or transform theories of biological function, which since Darwin are non-intentionalist, reproduction theories, to artifacts. I believe that Vermaas and Houkes are entirely correct to liberate the theory of artifacts from the notion of function in biology.
10. More precisely, a non-derivative artifact has its proper function essentially. The constituter of an artifact inherits the non-derivative artifact's proper function and thus has it contingently (as long as it constitutes the non-derivative artifact).
11. In thinking about these matters, I found useful Hilpinen (1993), as well as Dipert (1993). For an insightful discussion of artifacts, see Thomasson (1999).
12. I do not want to rule out 'degenerate' cases in which a natural object is appropriated without alteration. For example, a piece of (unaltered) driftwood may be brushed off and used as a coffee table. Thanks to an anonymous referee of this journal for bringing this lacuna to my attention.
13. I am omitting as irrelevant here clause (6) in the original definition that guarantees that a material thing cannot constitute an immaterial thing. Also, the definition needs a clause to ensure that, aside from *G*, *x* has no primary-kind property of higher-order than *F*. I define

'higher-order primary-kind property' in terms of higher-order causal powers. Derk Pereboom (2002) presented a counter-example that the added clause blocks. Tomas Kakol (private communication) suggested adding a clause to the definition like this: '$\forall J$ [J is a higher-order primary-kind property than F & J does not entail $G \rightarrow \sim Jxt$]'.

14. Most famously, Peter van Inwagen (1990, 111) holds that 'there are no material objects but organisms and simples'. He proposes that we paraphrase sentences like 'there are some tables here' into sentences like 'there are some x's arranged tablewise here'. Van Inwagen would not countenance non-living natural objects as well as artifacts; he would paraphrase 'Here is a lump of gold' as 'Here are gold atoms arranged lumpwise'.

15. All the conditions either follow from, or are part of, the basic distinction that Wiggins draws between natural objects and artifacts. There is a complex condition that natural objects allegedly satisfy and artifacts do not: '. . . a particular constituent x belongs to a natural kind, or is a natural thing, if and only if x has a principle of activity founded in lawlike dispositions and propensities that form the basis for extension-involving sortal identification(s) which will answer truly the question "what is x?"' (Wiggins 2001, 89). According to Wiggins, natural objects satisfy this condition and artifacts do not. I am not claiming that Wiggins denies that there exist artifacts, only that he distinguishes between natural and artifactual kinds in a way that may be taken to imply the ontological inferiority of artifacts.

16. A substance has 'within itself a principle of motion and stationariness (in respect of place, or of growth and decrease, or by way of alteration)' (Aristotle, *Physics* 192b8–23).

17. Although nylon and polythene are of kinds determined by chemical composition, they are manufactured artificial human products, and their proper function is their use in various kinds of products.

18. This claim is similar to the notion that natural-kind terms, but not artificial-kind terms, are rigid designators. (A rigid designator has the same referent in every possible world.) However, what makes the difference between 'whale' and 'bachelor' is not that only the former is rigid. Rather, only the former term 'has its reference determined by causal contact with paradigm samples of the relevant kind'. There is no reason that the terms cannot both be rigid. See LaPorte (2000, 304).

19. Although Wiggins is an Aristotelian, this is not Aristotle's view. For Aristotle, nominal definitions are reference fixers, used to identify objects for scientific study; they contain information that a scientist has before having an account of the essence of the objects. Real definitions are discovered by scientific inquiry and give knowledge of the essences of objects identified by nominal definitions. Nominal and real definitions are not accounts of different types of entities. Rather, they are different types of accounts of the same entities. Members of a particular natural kind have the same essence (underlying structure). See Bolton (1976).

20. Aristotle would agree with me on this point, I believe. His reason for downgrading artifacts ontologically is that artifacts have no natures in themselves.

21. Moreover, indexicality should not be confused with rigidity, which does not concern how a term gets connected to a referent. For criticism of Putnam's confusion of the causal theory of reference and indexicality, see Burge (1982).

22. Joseph LaPorte (2000) points out that some kind expressions (both natural and artifactual) designate rigidly, and some designate non-rigidly.

23. Elder (1995) discusses this point. For a congenial alternative, see Thomasson (forthcoming).

24. The lead researcher, Derek Lovley, who coined the term 'bacterial battery', is a microbiologist at the University of Massachusetts at Amherst.

25. E-mail update from *Scientific American*, 23 September 2003.

26. Although I avoid the 'qua' locution, the way that I have elucidated 'Fs have ontological significance' suggests that an alternative to that expression might be 'Fs-qua-Fs have ontological significance'.

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