Does the Identity of an Object Depend on Its Category?

The Role of Sortals in Thought

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Abstract

Some prominent cognitive theories have adopted an intriguing idea from metaphysics: The conditions of identity and individuation of objects come from the meaning of sortal nouns—count nouns, such as “dog” or “cup.” According to this sortalist theory, Rover's identity over time and his distinctness from Fido depend on the meaning of “dog.” This chapter first describes the sortalist view in metaphysics (Section 1) and then traces the ways in which cognitive psychologists have adapted and modified this theory in an attempt to explain empirical data—people's judgments about the nature of objects (Section 2). Sections 3 and 4 then examine some recent work in philosophy and psychology, arguing that these findings raise two related, but distinct, worries for sortalism as a psychological theory (which we call psychosortalism). Finally, Section 5 assess whether any of the original metaphysics can survive within the best cognitive theories of object concepts.

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Individual members of a natural category tend to remain members throughout their lifetime. Fido’s existence, for example, tends to coincide with his membership in the dog category, and a particular apple’s existence with its membership in the apple category. Of course, this tidy temporal relationship between existence and membership fails to hold for all categories. Fido outlived his membership in the puppy category, for example, and he may outlive his membership in the pet category if he goes on the loose. But for the type of categories that psychologists call “basic level”—dog, apple, oak, trout, and so on—members tend to stay put (see Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976, for the special status of basic-level categories). For instance, we don’t expect Fido to be able to undergo an extreme makeover that would cause him to become a cat.

A similar relation between basic categories and their instances holds in the case of artifacts, although matters are less clear-cut. You can easily imagine someone reshaping a coffee pot into a bird feeder or an umbrella into a lampshade (Keil, 1989; Leonard & Rips, 2015; Rips, 1989), and it seems possible that these transformations don’t disrupt the identity of the original object. The same thing that was formerly a coffee pot is now a bird feeder, and the same thing that was a formerly an umbrella is now a lampshade. Still, the underlying point remains: Many artifacts belong to the same basic-level category throughout their entire existence.

These mundane facts about everyday objects may encourage a strong thesis about the relation between an individual object and the basic-level category to which it belongs. Perhaps the lifetime of an object coincides with its membership in a basic-level category because the category dictates the lifetime. For instance, perhaps it is by virtue of being a dog that Fido comes to have an identity—one that begins at the time of his birth, ends at the time of his death, and traces a spatial and temporal path between these two extremes. Because his status as a dog determines his identity, Fido can’t stop being a dog without
ceasing to exist entirely. No metamorphosis or reincarnation can turn Fido into a cat, since such a purported transformation would in fact put an end to Fido and bring into existence something entirely new.

Let’s call metaphysical theories along these lines *sortal* theories. According to such views, sortals are nouns, such as *dog* or *coffee pot*, that name categories with identity-conferring properties. The key idea is that sortals have, as *essential* parts of their meaning, both criteria of identity and criteria of individuation (more on this in the next section). Of course, not all nouns qualify as sortals. For example, *pet* doesn’t for the reasons we’ve seen. So how do sortalists determine which nouns are sortals? Sortal theories (e.g., Wiggins, 2001) typically hold that sortal nouns are those that give the most fundamental answer to the question “What is it?” for the items to which they apply. In these terms, the sortal for Fido would presumably be *dog*, and the sortal for a coffee pot, *coffee pot*. Because people overwhelmingly use basic-level terms in answering “What is it?” for ordinary objects (Rosch et al., 1976), basic-level terms and sortals tend to coincide.

Our aim in this chapter is examine what happens when sortal theories are transferred from their home in metaphysics to play a new role in cognitive science. A number of developmental psychologists have taken philosophers’ arguments in favor of sortals to show that people must possess concepts—mental representations—of sortals in order to be able to individuate objects and to trace the identity of a single object over time. According to these theories, people must have the sortal concept DOG in order to tell Fido from Rover and in order to re-identify Fido from one moment to the next.¹ What we’ll try to show here is that transplanting sortal theories in this way has not been successful. Arguments based on purely metaphysical grounds don’t secure a role for sortals as parts of people’s representational apparatus. And arguments based on empirical considerations in psychology similarly fail to establish that people have sortal concepts that provide conditions of identity and individuation. Backing up these claims will

¹ Following common practice, we use words with all caps to refer to concepts (i.e., mental representations), and we will continue to use italics to name words. So we use *duck* to refer to the sortal (noun) and DUCK to refer to the sortal concept for ducks.
occupy most of this chapter in Sections 3 and 4. But first we need to say a bit more about the role of sortals in metaphysics (Section 1) and in cognition (Section 2).

## 1. Sortals in Metaphysics

One way to motivate sortal theories is to consider the way we count objects. Following Frege (1884/1968), sortal theorists claim that the number of objects that occupy a given region isn’t a determinate quantity. A particular region may contain playing cards that we could count as one stack, two decks, four suits, 104 cards, and so on. In order to pin down a definite number, a sortal (e.g., *card*, *deck*, etc.) must specify the appropriate unit. Sortals perform this task by including, as part of their meaning, *criteria of individuation* that carve out the units from the category named by the sortal. A sortal like *dog*, for example, provides individuation criteria that determine, at least in principle, how many dogs occupy Grant Park at a particular time.

In addition to individuation criteria, sortal theories often assume that sortals provide *criteria of identity* that determine which object at a later time (if any) is identical to a given object at an earlier time. The sortal *dog* dictates which dog on Thursday is identical to Fido on Tuesday. Count noun sortals, like *dog* and *coffee pot*, provide both criteria of individuation and identity, and some sortal theories maintain that these count noun sortals are the only sortals there are. Other sortal theories, however, grant that some mass nouns (e.g., *water*, *air*, or *gold*) can also be sortals: Although they do not come with criteria of individuation, they do supply criteria of identity (Gupta, 1980). According to these theories, for instance, the meaning of *water* specifies when the water in a particular glass is the same water that was earlier in a pitcher. But *water* cannot determine how many quantities of water exist in the glass, since any quantity of water comprises many overlapping subquantities, down to the molecular level.

On either view, all sortals carry criteria of identity, which according to Lowe (1998) and Williamson (1990) can take the following form:

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(1) \quad (\forall x,y) [S(x) \& S(y)] \rightarrow [x = y \leftrightarrow R_s(x,y)],
\]
where $S$ is a sortal category and $R_S$ is an equivalence relation (a relation that is reflexive, symmetric, and transitive) that is specific to sortal $S$ (see Blok, Newman, & Rips, 2007). To take the standard example, we can spell out the identity criterion for sets by saying that if $x$ and $y$ are sets then they are identical if and only if they have exactly the same members. Here, *set* is the sortal and *has exactly the same members as* is the equivalence relation (i.e., $x$ has exactly the same members as $x$; if $x$ has exactly the same members as $y$, then $y$ has exactly the same members as $x$; and if $x$ has exactly the same members as $y$ and $y$ exactly the same members as $z$, then $x$ has exactly the same members as $z$). One point to note about (1) is that, although it is not a definition for the sortal itself (nor for identity in general), it does provide both necessary and sufficient conditions for two instances of the sortal to be identical. The biconditional ($\leftrightarrow$) enforces this two-way relationship. For example, having exactly the same members is both necessary and sufficient for one set to be equal to another.\(^2\) Another point to note is that the relation $R_S$ must be non-circular. Identity is itself an equivalence relation, but replacing $R_S(x,y)$ in (1) with $x = y$ would not produce an informative criterion of identity. It doesn’t help in specifying identity conditions for dogs to know that two dogs are identical if and only if they are identical.

Philosophers have recruited sortals to deal with a variety of problems, such as the nature of counting, individuation, identity over time, and essence. While these sortalist views are controversial, let’s suppose for now that there are nouns that furnish identity and individuation conditions and consider the ways in which psychologists have put these sortals to work.\(^3\)

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\(^2\) Debate concerns whether all identity criteria can be reduced to the form of (1) or whether, instead, some identity conditions are irreducibly “two level” (see Lowe, 1998; Williamson, 1990). Two-level criteria spell out the identity of the sortal instances in terms of equivalence relations between items to which the instances are functionally related rather than in terms of equivalence relations between the items themselves, as in (1). In both cases, however, the criteria are necessary and sufficient conditions, which is all that will concern us here.

\(^3\) Because the demands on sortals can conflict, the notion of sortal itself may be obscure (as Feldman, 1973, and Grandy, 2014, contend). In addition, sortals’ ability to handle some of these demands is not always clear cut. For example, *picture frame* arguably provides conditions for identity over time (i.e., conditions under which a later picture frame is identical to an earlier one). But does it properly individuate objects? For example, if Patricia fastens together six small picture frames in a three-by-two arrangement and gives the arrangement to her friend Paul, then the number of picture frames that Paul receives is unclear to many college students (Leonard & Rips, 2015). Most think that “both one and six” are correct answers (as opposed to: just “one” is correct, just “six” is correct, or “neither one nor six” is correct). So *picture frame* does not appear to be a sortal in the sense of providing...
2. Sortals in Cognition

This section traces the use of sortals in theories of cognitive development. Initial theories of this type stuck closely to the philosophical accounts we’ve just glimpsed. But pressure from experimental findings produced modifications that sometimes put the psychological views into conflict with philosophical ones. In what follows, we’ll use sortalism for the philosophical versions and psychosortalism for the psychological versions of these theories (following Blok, Newman, & Rips, 2005).

2.1. Psychosortalism’s Beginnings

To our knowledge, John Macnamara (1986) was the first to use sortals in the context of explanations in cognitive psychology. Macnamara’s project was to understand children’s learning of proper names by considering the theoretical constraints that the semantics of these names impose. Taking a leaf from philosophical work on sortals, he claimed that children could not correctly understand a proper name unless they already possessed a sortal concept that applied to the name’s referent. In order to learn the meaning of the name Fido, for example, children would have to possess the concept DOG (or some similar concept), since DOG provides the identity and individuation conditions for Fido.4 Without those conditions, children would have little idea that Fido applies to the whole dog rather than to one of determinate conditions for individuation—at least, not conditions to which students have easy access. We will return to problems like these in Sections 3 and 4.

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4 Macnamara (1986, pp. 132-133) uses the term principle to denote a metaphysical relation and criterion to denote a (possibly fallible) test for that relation. So a principle of identity, in these terms, is the actual relation that specifies identity for individuals [in the way \( R_5 \) does in (1)], but a criterion of identity tests whether that relation is in place. Standard philosophical use of criterion, however, is closer to what Macnamara calls a principle. See, for example, Merricks, (1998, p. 107 and Note 2, emphasis in original): “criteria of identity over time are informative necessary and sufficient conditions for identity over time. Here … ‘necessary and sufficient’ means broadly logically, or metaphysically, necessary and sufficient.” We will stick to the latter, more standard meaning of criterion in this paper and will use conditions as a synonym for criteria. When we have to refer to a test or a procedure, we’ll label it explicitly as such.
its parts or to its matter. And they would have little idea that *Fido* applies at each moment of its life rather than to some scattered moments or temporal segments.

Macnamara (1986) is clear that children do not need to formulate explicitly the identity conditions they employ. Nor do they have to use in speech the sortal that supplies these conditions before they can acquire the name for a member of that sortal category. For example, they don’t have to use the word *dog* before learning *Fido*. What they *do* have to possess, according to Macnamara, is a concept—a mental representation—corresponding to the sortal, a concept that connects to the relevant identity conditions. Macnamara believed that the representation is, at least initially, what he called a *visual gestalt type* of the sortal category. Although the description of these gestalt types is very brief, they seem to contain visual information that is general enough to categorize members of the type. In learning the name *Fido*, for example, children would recognize Fido’s “gestalt as being of a familiar type,” namely, the dog type (ibid., p. 73). Either the visual gestalt itself or a more abstract symbol corresponding to it (Macnamara suggests something like “Sortal17”) becomes part of the language of thought, where it denotes dogs. In learning the word *dog* at a possibly later stage, children come to understand the equivalence between the new term for dogs and the one they have already acquired as a visual gestalt. They learn that all and only dogs are members of the category denoted by the gestalt (or by Sortal17).

As Macnamara (1986, p. 148) points out, the referent of a sortal such as *dog* is not determined by “a set of perceptually given distinctive features, whether in the form of a list or an image.” Similarly, criteria of identity are not principally visual (ibid., p. 70): “Our intuitions of identity run deeper than perception.” We certainly allow Fido as a puppy to be identical with Fido as an older dog, despite dramatic changes in his appearance. This suggests that the visual gestalt type does not itself determine the referent of a sortal or its identity conditions. Instead, people take the referent to be whatever it is in nature that’s responsible for the sortal category, even though they usually can’t describe this “whatever it is.” The visual gestalt type provides no more than a rough guide to what’s in this category. This idea seems consistent with more recent psychological essentialist theories in which people have an unspecified “placeholder”—that is, a variable—to stand for whatever it is inside an organism that makes it a member
of its sortal category (Gelman, 2003; Medin, 1989). Similarly, according to Macnamara, “it seems unlikely that children have to represent the rule for tracing identity under the sortal dog... It may perhaps be applied by the interpreters and implicators that handle sortals and apply them to individuals” (ibid., p. 140). But for Macnamara, “interpreters” are “devices that place the mind in intentional contact with the objects that form the semantic content of some linguistic expression,” and he uses “‘interpreter’ in its semantic function to speak of what I see largely as a mystery” (ibid., p. 36).

This indirect connection between people’s representation of a category and the relevant sortal puts some pressure on the psychosortal theory. Recall that the justification for the theory comes from logical constraints. No counting of a category’s members and no tracking of a member across time is possible without a sortal to supply criteria of individuation and identity. For example, it’s impossible to count dogs or to follow them across time without the sortal dog to supply these criteria. But if the psychological representation—for example, the visual gestalt type—corresponding to the sortal provides only rough-and-ready tests or procedures, then it is no longer clear why people need to have a representation of the sortal prior to learning names for members of the category.

To see this, suppose for the sake of the argument that, as a purely metaphysical or logical matter, the identity and individuation of Fido depends on the sortal dog supplying criteria of identity and individuation. Suppose, too, that the psychological representation of dogs connects to these criteria only indirectly through mysterious “interpreters” and does not itself follow these metaphysical rules (or follows them only imperfectly). Then it is no longer clear why children need to have a representation of dogs prior to learning Fido. The representation (e.g., visual gestalt type) doesn’t supply the criteria. So why not assume that Fido refers to Fido without the intermediate psychological representation of the sortal? Any metaphysical carving out of Fido for purposes of individuation or identity could be done by
whatever metaphysical criteria attach to the sortal *dog*, but without children having to represent this sortal.\(^5\)

If we’re right about these difficulties, their source is the split between the metaphysical work and the psychological work that sortals are supposed to perform. The metaphysical demands seem compatible with very light commitments on the psychology side. In fact, Macnamara himself (1986, pp. 148-149) makes a similar point in connection with reference: “The strength of reference from the psychological point of view is that so little knowledge of the referent is required in the user.” Because the motivation Macnamara provides for sortals is almost entirely metaphysical, psychologists could get by with theories that short-circuit representation of sortals (and their criteria of individuation and identity), allowing the metaphysics to take care of itself, as in externalist theories of reference (e.g., Burge, 1979; Kripke, 1980; Putnam, 1975). So to justify the need for sortals in a psychological theory, we need empirical evidence that implicates these sortals in thought. Let’s look at some possible evidence of just this kind.

### 2.2. Psychosortalism’s Evolution

In commenting on Macnamara’s theory, Carey and Xu (1999, p. 318) note “a logical problem” in his proposal, related to those we’ve just discussed. They agree with Macnamara that children need sortal concepts in order to learn proper names for objects that fall under those concepts. But if a child’s sortal concept is a visual gestalt, how could the gestalt provide the appropriate guidance for the object’s individuation and identity?

Carey and Xu propose instead that an infant’s initial sortal concept is the concept of a *Spelke object*: “any entity that is three-dimensional, is bounded, and retains its boundedness as it moves through

\(^5\) Having gone this far, we might wonder whether we can account for the semantics and learning of proper names without the need for sortals even as part of the metaphysical side of the story. Why couldn’t *Fido* refer to Fido directly without the intermediary of a sortal to individuate and identify him? This last possibility seems more in line with direct reference theories of proper names (e.g., Kripke, 1980, 1981), but we don’t pursue it here.
space and time” (ibid., p. 327). Infants have the concept of a Spelke object either innately or within the first two or three months of life. They begin to gain concepts for basic-level sortals, like dog or cup, only around their first birthday, as they acquire the use of these words. Unlike Macnamara’s visual gestalt types, the concept of Spelke objects (and the later concepts of basic-level sortals) do provide criteria for identity and individuation.

Carey and Xu’s (1999) theory is based on evidence from experiments that attempt to determine whether infants can distinguish objects that they see intermittently. In one version of these experiments (Xu & Carey, 1996), infants watch objects moving behind a screen on a puppet stage. Figure 1 illustrates schematically the events that occur during an experimental trial. The infants see an object of one kind (here a toy duck) emerge from one side of the screen and then retreat behind it. They then see an object of a different kind (a cup) emerge from the other side of the screen and retreat. After a number of repetitions of these events, the experimenter removes the screen to reveal to the infants either one object (say, the duck) or both objects (the duck and the cup). Experimenters record the amount of time the infants look at the scene after the screen is removed. These looking-time results show that infants at 12 months look longer if one object is revealed than if two are revealed. The infants act as if they were expecting to see both objects they had witnessed earlier and are surprised (and therefore look longer) if only one is on hand. Infants at 10 months, however, look no longer at the one-object scene than at the two-object scene.

One variation on this experiment is relevant to its interpretation in terms of sortal concepts: If infants see both objects simultaneously in full view before these objects begin their back-and-forth traversals, then both 10-month-olds and 12-month-olds succeed in looking longer when one object appears than when two objects appear at the end of the trial.

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6 Carey and Xu (1999) use physical object as a synonym for Spelke object. But physical object is probably not the best choice of terms, because many things that people consider physical objects (e.g., houses, trees, roads) are not Spelke objects since they don’t move (as Hirsch, 1997, and Wiggins, 1997, have pointed out). We’ll therefore stick with Spelke object in what follows as a technical term for the type of entity just defined. See Spelke (1990) for an account of the research and theory behind Spelke objects.
Carey and Xu’s (1999) interpretation of this experiment follows from their ideas about when infants gain sortal concepts. According to Carey and Xu, infants at 10 months have acquired the concept of a Spelke object, but not the concepts of sortals for lower-level categories like ducks or cups. If they see a simultaneous preview of both objects, they can deploy their Spelke-object concept to discriminate them. The Spelke-object concept comes along with the information that the same object can’t be in two different places at the same time, and this information is sufficient to alert the infant to the presence of two items. But without the preview, infants cannot use the spatio-temporal cues associated with Spelke objects to disambiguate the number of objects behind the screen. Lacking sortal concepts for ducks and cups, 10-month-olds are also unable to deduce that a duck-like object can’t turn into a cup-like object, and so they don’t know how many objects to expect. By contrast, 12-month-olds do have sortal concepts for ducks and cups that provide identity conditions, and so they do know that two objects should be behind the screen. They look longer at the unexpected one-object tableau, both with a preview and without a preview of these items.

Our purpose in reviewing these findings is to see whether they implicate infants’ use of sortal concepts, as Carey and Xu (1999) contend. When infants succeed in these tasks, is it because their knowledge of sortal concepts gives them cognitive access to criteria of identity for the objects that appear in the displays? To answer this question, we need to look at two claims: (a) that older infants use concepts of sortals at the basic-level (e.g., DUCK, CUP) to figure out the number of objects in conditions without a preview of these items, and (b) that younger infants use a sortal concept for Spelke objects to figure out the number of objects in conditions with the preview. Let’s start with the performance of the older infants.

3. Basic-Level Sortals

The aim of this section is to probe the motivation for positing basic-level sortal concepts. More specifically, psychosortalists and non-psychosortalists now seem to agree that infants and adults use properties (e.g., color, size, and shape) to identify and individuate objects. If appealing to the use of this property information can adequately account for all the relevant experimental data—that is, the data that
is taken to support the existence of basic-level sortals like DOG and CUP—then positing the existence of basic-level sortal concepts is unnecessary.

To begin, consider this question: Did the 12-month-olds’ success in the Figure 1 task depend on the identity or individuation conditions of sortals such as duck and cup? As Carey and Xu (1999) note, an immediate alternative explanation is that infants’ success could be due to their taking the properties of the objects to signal their distinctness. The 12-month-olds might guess that something that’s yellow, rubbery, and duck-shaped is probably not the same object as one that’s white, ceramic, and cup-shaped. The 10-month-olds may lack the cognitive sophistication to perform this inference and so fail the task. “Although concepts lexicalized as properties do not provide criteria for individuation (we can’t count the red in this room, the big in this room, the striped in this room), in the situations we have described above [e.g., those of Figure 1], the property differences among the objects certainly do provide relevant information about number” (ibid., p. 324). Let’s call this alternative the property account to contrast it with the sortal account of the findings.

Carey and Xu (1999) criticize the property account based on further findings that show that even 12-month-olds fail the Is-it-one-or-two task in Figure 1 if the objects have different properties but belong to the same sortal category (Xu, Carey, & Quint, 2004). For example, if the infants see a big red plastic cup with colored dots come from one end of the screen and a small blue ceramic cup from the other, they do not look longer at the one-object scene than at the two-object scene at the end of the trial. This finding suggests that 12-month-olds’ success in the original task was not due to their use of property differences (e.g., yellow vs. white) but depended instead on the objects coming from distinct sortal categories (e.g., duck vs. cup).

The worry about this objection to the property account is that later studies have found that even infants as young as four months, can use properties to succeed in simple variants of the Is-it-one-or-two task (e.g., Wilcox, 1999; Wilcox & Baillargeon, 1998; Xu & Baker, 2005). In one such experiment (Wilcox, 1999), four-month-old infants saw a big green ball move behind the left side of a screen and, a few seconds later, a small green ball emerge from the right side, as Figure 2 illustrates. The small ball
then retreated behind the screen and, a few seconds later, the large ball emerged from the left side. The same sequence repeated until the trial ended. The screen remained in place throughout the trial. The crucial variable in this experiment was the width of the screen. In the wide screen condition (left side of Figure 2), the large and the small ball could both fit side-by-side behind the screen simultaneously. In the narrow-screen condition (right side of Figure 2), however, the screen was too narrow to accommodate both balls. If infants in the narrow-screen condition take the two balls to be distinct solid objects, they should find it odd that both fit behind the screen at the same time during certain parts of the trial. But infants in the wide-screen condition should have no difficulty understanding how both balls could fit behind the screen. In fact, infants in the narrow-screen condition did look reliably longer than did infants in the wide-screen condition. This suggests that the four-month-olds understood that the two balls were distinct, space-occupying objects that could not be in the same place at the same time. To support this interpretation, control conditions showed infants the same scenes but with another large ball replacing the small one to prevent discrimination based on size. In this situation, infants looked approximately the same amount of time in the narrow-screen as in the wide-screen condition, presumably taking the identical-looking large balls to be the same object. In short, infants seem to use the difference in size of the balls to infer the presence of two balls rather than one.

Investigators currently agree that infants can use property information—for example, size (big vs. small), shape (spherical vs. cubical), and pattern (dots vs. stripes)—to individuate objects in simplified versions of the Is-it-one-or-two task, such as that of Figure 2. (Earlier philosophical discussions of object concepts in infants seem handicapped by failing to take these findings into account; see Sarnecki, 2008). In these procedures, the property account seems correct. The failure of property differences to help infants in some earlier studies (e.g., Xu & Carey, 1996) could be put down to the complexity of the task in these studies (i.e., the procedure of Figure 1, to be discussed in a moment). The key question for
psychosortalists, then, is whether any evidence exists to implicate concepts of basic-level sortals like *duck* or *cup* in infants’ performance.\(^7\)

Xu (2005) continues to maintain that sortals play a crucial role in tasks like that of Figure 1. As just suggested, 10-month-old infants are unable to use property information in such tasks to determine the correct number of objects because complex features of the task override that information, causing the 10-month-olds to fail. One complex feature is the fact that seeing the objects move back-and-forth along the same trajectory could create the illusory impression of a single object changing its properties behind the screen (a “tunneling effect,” see Xu, 2005). A second complex feature is that infants must draw on memory to compare the events they see in the first part of the trial to the test tableau at the end (as Wilcox & Baillargeon, 1998, propose). According to Xu, however, 12-month-olds gain access to sortal concepts that override these complexities, allowing the 12-month-olds to succeed when objects cross sortal boundaries (*duck* vs. *cup*) but not when the objects fall within the same sortal (*big red plastic cup* vs. *small blue ceramic cup*).

Although this psychosortalist view seems consistent with the data, the property account can adequately explain these results too. For according to the property account, 10-months-olds can use property information to succeed on the simpler (Figure 2) task, but task complexities inhibit their use of properties on the more difficult (Figure 1) task. At 12-months, however, infants have gained enough know-how to overcome the complexities and use the property information to succeed at even the more difficult problem. This extra know-how might include an increase in working memory capacity (allowing the older infants to compare more easily the preliminary back-and-forth events with the later scene after the screen is removed; see Levine & Baillargeon, 2016) or an increase in attentional skills (allowing the

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\(^7\) You might try to argue that properties like size and pattern are effective in the simpler procedures, such as that of Figure 2, because basic-level sortal concepts for the objects (*BALL? SPHERE?*) dictate their effectiveness. For some sortals, size individuates objects, whereas for other sortals, it does not (see Xu, 2007, for a related suggestion). But this is not a tactic that psychosortalists can consistently use in explaining Wilcox’s (1999) findings, while also maintaining that infants gain basic-level sortal concepts only at 12 months. Remember that infants in Wilcox’s study were only four-months old. Psychosortalists seem forced to say that properties alone are sufficient for differentiating things (perhaps in conjunction with the higher-level concept for Spelke objects).
older infants to ignore the misleading trajectory cues). According to the property account, then, lower-level sortals play no role in explaining infants’ performance at either age; rather, everything can be chalked up to the use of property information and varying degrees of know-how. So, if psychosortalists admit that infants can use property information and acquire more know-how as they get older, it is hard to see a need to posit basic-level sortal concepts to explain this data.

In our view, the biggest remaining worry with the property account is that, at first sight, it seems to fail to explain why 12-month-olds don’t perform correctly in the Figure 1 task when the items are from the same sortal category but have different properties (e.g., big red plastic cup vs. small blue ceramic cup) in Xu et al.’s (2004) study. If 12-month-olds can differentiate a duck from a cup on the basis of their distinctive properties, why not a cup from another, distinctive-looking cup?

But as psychosortalists themselves acknowledge, cross-kind items, such as a duck and a cup, differ more in shape than within-kind items, such as a red cup and a blue one. This is crucial, since shape is a highly salient cue for children. For example, it dominates color and texture in classification tasks (e.g., Baldwin, 1989; Soja, Carey, & Spelke, 1991). Thus, if shape similarity can override the differences that distinguish the cups, the property account can explain all the relevant data without appealing to basic-level sortal concepts. Of course, additional empirical evidence is need to establish the relevant differences in salience in this experimental setup. But at the very least, we think that as things currently stand, there is no more reason to posit the existence of basic-level sortals than to prefer a more fully developed property account.

Before moving on, though, we think two further points are in order about the explanations for the Is-it-one-or-two tasks. First, in granting that properties are sometimes sufficient for differentiating objects in this task, Carey and Xu (1999) have backed away from a strong form of psychosortalism, such as Macnamara’s. Recall that Macnamara’s (1986) reason for introducing sortals in cognitive explanations was his conviction that sortals are logically necessary for individuating and identifying objects. This conviction in turn derived from the special role that sortals play in furnishing conditions for individuation and identity, a role that specifically distinguishes sortals from predicates for properties, like color and
size. Only sortals yield individuation and identity conditions. This sortal/predicate distinction is at the very heart of the sortal theories that we glimpsed in Section 1. But if infants can use properties for individuating objects in the Is-it-one-or-two task, this underlying logical motivation is undermined. The case for psychosortalism then rests on the ability of sortal concepts to earn their keep empirically as part of psychological explanations. So ambiguities about whether the property account or the sortal account is correct for the Is-it-one-or-two task raise critical difficulties for the claim that sortals play an important role in human thinking.

Second, basic-level concepts like DUCK and CUP could still play a role in infants’ (and adults’) decisions about whether one or two objects exist behind the screen, even if these concepts don’t have the status of sortals—that is, aren’t associated with criteria of identity and individuation. People may know as a simple matter of empirical fact that a toy duck is unlikely to turn into a cup while it’s briefly behind a screen. But a simple empirical generalization of this sort does not require anything as strong as the criteria of individuation and identity that sortals are supposed to supply. One way to see this is to note that such generalizations are often true of objects in categories that don’t qualify as sortals. For example, iPhones don’t turn into Samsung Galaxies when they move behind screens, and many adults could use this fact to make correct predictions about the number of cell phones in an Is-it-one-or-two task. But this is presumably not because they know criteria of identity and individuation for iPhones and Galaxies. Instead, facts about how easily one object could change into another depend, not on criteria of individuation or identity, but instead on the physical processes governing these items and their properties. It is not at all metaphysically impossible that Apple and Samsung could agree to produce a transformer model that would quickly convert from an iPhone to a Galaxy and back. It’s just that our beliefs about the current state of technology make it unlikely that we’re dealing with such a model. The present point is that concepts like DUCK, CUP, and PHONE can aid in individuation by supplying information of an empirical kind even if they are not sortals.

To recap, we’ve argued that psychologists can’t simply assume on purely logical or metaphysical grounds that if infants manage to differentiate two things, they must have a sortal concept to provide
conditions of individuation. Whatever work sortals do by way of individuation, they don’t seem to require people to represent them mentally, in the sense of representing the sortals’ criteria of individuation and identity. In the case of basic-level concepts, such as DUCK or TOASTER, we’ve argued that such concepts don’t have to possess the status of sortals to explain the empirical results on individuation (e.g., the results of the Is-it-one-or-two tasks of Figures 1 and 2). Could the evidence for sortal status be any stronger in the case of SPELKE OBJECT? We turn to this issue in the next section.

4. The Spelke-object Sortal

The aim of this section is to argue that although empirical evidence suggests the existence of a SPELKE OBJECT concept, there is no reason to maintain that it is a sortal concept. Because psychosortalism crucially rests on SPELKE OBJECT being a sortal concept, psychosortalism is in trouble.

To begin, recall that sortal concepts enter Carey and Xu’s (1999) account in two ways. Basic-level sortals like duck and cup are supposed to explain 12-month-olds’ advantage over 10-month-olds in the Figure 1 task. But a higher-level sortal concept, SPELKE OBJECT, explains why 10-month-olds can perform correctly in this task if they have seen a preview of the two objects. The same concept can explain how it is that people (both children and adults) can recognize something as an object even when they are unable to classify it as a member of a lower-level category. For example, suppose we look out over the lagoon and see a moving entity that might be a tractor or a horse or something else. We can still take the thing to be an object, despite not being able to identify it more precisely (see Campbell, 2006, and Goodman, 2012, for anti-sortalist treatments of such cases). The question for us is whether Spelke object is a sortal.

This issue has sparked debate between Xu (1997) and a number of philosopher critics, some accepting traditional sortal theories (e.g., Hirsch, 1997; Wiggins, 1997) and others not (Ayers, 1997). From the orthodox sortalists’ point of view, a concept at the level of SPELKE OBJECT is too abstract to provide a grip on an individual’s identity or individuation. You can no more count the Spelke objects in a
given region than count the yellow in that region. From the anti-sortalists’ point of view, of course, sortals are unnecessary at any level of abstraction. In either case, the key question in this debate seems to be this one (Ayers, 1997, p. 393):

...Xu’s argument for this common-sense conclusion [“that infants and adults can and do individuate and track unitary, coherent, bounded material objects without knowing on each occasion what kind of thing is before them”] is itself open to question, in particular the question of why she presents her own thesis in the terms of the theory she rejects, although there seems no particular reason for her to retain the philosophical assumptions embodied in those terms. Specifically, why does she interpret her own and others’ observations as evidence that infants and adults employ a ‘sortal concept’, physical object [i.e., SPELKE OBJECT], which is more general, certainly, than the concepts postulated as basic individuators by strong sortalists, but which is assigned the same kind of logical-cum-epistemological work as such concepts have been supposed to do—to ‘tell us what to count as one instance of something and whether something is the same one as what we have seen before’, and to ‘provide the criteria’ by reference to which we can decide when a thing has ceased to exist, and so forth? We have to ask why the capacity to discriminate physically unitary material objects cannot simply be regarded as a primitive function of the totality of the perceptual and agent mechanisms of the infant.

One way to take this comment is as a generalized version of the point we raised earlier with respect to basic-level sortals. Object tracking need not be the kind of skill that requires the individuation and identity criteria that define sortal concepts. Instead, infants and adults can use heuristic cues for tracking.

There is no evidence that pre-linguistic infants require something to be a Spelke object before they can track it. As Green (2016) has pointed out, both infants and adults can track unfamiliar objects that don’t happen to be “three-dimensional, … bounded, and [that] retain [their] boundedness as [they] move through space and time” (Carey & Xu, 1999, p. 327). For instance, infants can track two-dimensional figures (non-3D: Cordes & Brannon, 2009; Wynn, Bloom, & Chiang, 2002) and swarms or
ensembles of objects (unbounded: Feigenson & Halberda, 2004; Wynn et al., 2002), at least under some conditions. These findings show that we have no serious reason to think that the SPELKE OBJECT concept is necessary for infants’ successful tracking. What reason do sortalists have, then, for positing this concept at all?

Perhaps sortalists could try to explain these experimental facts by positing other mechanisms to supplement those associated with SPELKE OBJECT. For instance, perhaps they could maintain that we have special cognitive mechanisms for tracking two-dimensional (i.e., non-Spelke-object) entities. (For a similar suggestion regarding non-solid substances, such as sand, see Anderson, Hespos, & Rips, 2017, and Hespos, Ferry, Anderson, Hollenbeck, & Rips, 2016.) Assuming that we do have these additional mechanisms, perhaps sortalists could say that infants really do track some objects (though not all) as Spelke objects. That is, the mechanisms we need in order to account for the results just cited don’t also render SPELKE OBJECT otiose, in that the SPELKE OBJECT concept does play an important cognitive role in cases in which these other mechanisms are not employed.

Because this is a substantive, empirical assumption and the center of active debate (see, e.g., Green, 2016), we won’t try to resolve it here. Instead, let’s grant for the sake of the argument that infants really do attend to 3D, bounded, moving entities as such, since this will allow us to focus on our main issue—whether SPELKE OBJECT, distinguished in this way, is a sortal concept. In the next two subsections, we consider two anti-SPELKE-OBJECT arguments addressed to this issue, the first questioning whether SPELKE OBJECT is a concept and the second questioning whether it is a sortal.

4.1. Is SPELKE OBJECT a Concept?

Perhaps one could argue against psychosortalism in a simple way just by arguing that SPELKE OBJECT is not a concept (i.e., a mental representation for the category of Spelke objects—3D, bounded, moving things). Psychosortalism requires SPELKE OBJECT to be a sortal concept in order to explain the data we described earlier (e.g., 10-year-olds’ success on the Is-it-one-or-two task with a preview of the
relevant objects). But if SPELKE OBJECT is not a concept (in general), then it isn’t a sortal concept (in particular). And if it isn’t a sortal concept, then psychosortalism is false.

In our view, the best way to argue that SPELKE OBJECT isn’t a concept is to show that it isn’t fit to do any important psychological work. One possibility along these lines is the idea that people possess pre-conceptual mechanisms that could produce the same results that SPELKE OBJECT is supposed to—singling out Spelke objects and tracking them—without first bringing them under a concept.

To see the motivation for this idea, consider that some well-known proposals in perceptual psychology feature similar pre-conceptual tracking devices. For instance, object files (Kahneman, Treisman, & Gibbs, 1992) and visual indexes (Pylyshyn, 2001) are supposed to be pre-conceptual representations of objects that record their spatial location as they move through the visual field. A perceptual mechanism of this type could then undercut the need for the SPELKE-OBJECT concept, as Goodman (2012) argues. The evidence supporting a SPELKE-OBJECT concept in infants can instead be taken as showing “that infants have a perceptual ability to attend to and successfully track objects on the basis of spatiotemporal information before they have developed a full-fledged system of concepts (among which are sortal concepts like cup, dog, etc., and concepts like physical object [i.e., SPELKE OBJECT; see Footnote 6])” (ibid, p. 95, emphasis in the original). This possibility also goes along with Ayers’s (1997) comment that we quoted earlier and with similar objections by Casati (2004).

Of course, if you argue against psychosortalism in this way, then you must defend the existence of a notoriously disputed border between what’s pre-conceptual and what’s conceptual. One way of drawing this distinction relies on the notion of a perceptual module (from Fodor, 1983): an information-processing mechanism that accepts sensory input and transforms the input into a mental representation, but whose workings are sealed off from the rest of the cognitive system. A perceptual module responds to input that it is specialized to detect, automatically processes the input through a series of stages, and finally outputs its final representation to central cognition. During its internal processing stages, though, representations in a module are “encapsulated”—they can’t be accessed or affected by beliefs and other
long-term information. Only after the module’s final representation enters central cognition, can other parts of cognition use it. So the module’s encapsulation provides one way to draw the line between the pre-conceptual—the work done within the module—and the rest of cognition. In line with this division, visual indexes for tracking objects are supposed to constitute a perceptual module (or, at least, to be encapsulated in the way modules are).

Given this notion, we can sharpen the argument against the SPELKE OBJECT concept. If (pre-conceptual) perceptual modules can carry out the work of tracking Spelke objects, then we have no need for SPELKE-OBJECT, understood as a general concept, for performing this task. That is, if what’s doing the work of tracking objects are purely pre-conceptual, modularized mechanisms, then posting a SPELKE OBJECT concept is unnecessary. Because object files and visual indexes are devices for object tracking, we have no need for the SPELKE OBJECT concept, provided they can do whatever work the SPELKE OBJECT concept was supposed to. Or, as Fodor and Pylyshyn (2015, p. 116) put it, “…since tracking is a reflex, which is to say that it doesn’t involve the application of a concept, the concept OBJECT need not come into the process of visual perception at all. That’s just as well, since, so far at least, no one has been able to provide a plausible account of what the concept OBJECT is” (emphasis in the original).

But how much weight will this argument bear? To see one difficulty with it, notice that the argument used the distinction between perceptual modules and central cognition to drive a wedge between what’s pre-conceptual (internal to a module) and what’s conceptual (internal to central cognition). It’s not so obvious, though, that these distinctions coincide. Why can’t we think of concepts—in particular, the purported SPELKE OBJECT concept—as embedded in a module? Spelke herself believes that the process that detects 3D, bounded, moving entities—her core object system—is encapsulated (Spelke, 2000) and “is a cognitive module in Fodor’s sense” (Spelke, 2003, p. 31), but at the same time, makes use of “representations of objects as enduring bodies over occlusion” (Spelke, 2000, p. 1234). So even if we agree that perceptual modules mark off perception from cognition, the SPELKE

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8 For further discussion of Spelke’s views on this topic, see Rips (2017).
OBJECT concept could inhabit the perceptual side of the tracks. Although modules can’t draw on concepts from long-term memory (since they’re encapsulated), they might be able to incorporate general concepts of their own, at least if we understand general concepts as mental representations that bring entities together under a single heading. By analogy, the syntactic categories—noun phrase, verb phrase, and so on—that appear in classical Fodorian language-processing modules would seem to be concepts in exactly this sense. Likewise, Fodor and Pylyshyn (2015, p. 123) assert that “processes inside the visual module would allow it to look up a particular shape type L(x) in a catalog of shape types,” which seems a fancy way of saying that the module sorts things into categories with similar shapes. So why not SPELKE OBJECT as a “modularized type” or concept?

As it stands, then, we think that the argument for denying that there is a SPELKE OBJECT concept is uncertain. On the one hand, anti-psychosortalists might be able to find a better way to distinguish pre-conceptual from conceptual representations (i.e., better than the module/central cognition split we’ve been considering) and then show that pre-conceptual representations can do the work that SPELKE OBJECT concepts do. On the other hand, psychosortalists could respond by denying either the distinction or the sufficiency of the pre-conceptual representations for tracking 3D, bounded, moving objects. Whether or not these responses will ultimately succeed is not something that we will address here (for reasons of space). Rather, our primary aim was just to draw out some of the commitments that psychosortalists will need to make in order to maintain that SPELKE OBJECT is indeed a concept.

However, even if psychosortalists are able to meet these commitments, they are not yet out of the woods. For in addition to showing that there is a SPELKE OBJECT concept, psychosortalists must also show that this concept is a sortal. In the next subsection we will argue that there is good reason to think that it is not.
4.2. Is SPELKE OBJECT a Sortal?

Even if we grant that Spelke objects are associated with a general concept, why should we think of it as a sortal concept—a concept that comes along with criteria of individuation and identity? In discussing basic-level concepts like DUCK and CUP, we noted that these concepts could still play a role in identifying things, even though they don’t possess criteria for identity in the sense of (1). Seeing a duck disappear behind a screen and a cup emerge from the other side is a good reason to think the screen covered two different items. But that’s because we can infer from our ordinary empirical knowledge that a duck turning into a cup is awfully unlikely. Our aim in this subsection is to persuade you that the same is true of SPELKE OBJECT. Any role it plays in individuation or identity is heuristic rather than necessary—that is, it doesn’t have to provide criteria of individuation and identity to perform these functions.

If SPELKE OBJECT is a sortal concept, then the criterion of identity it imposes on objects is presumably occupying the same spatio-temporal path. This seems to be the criterion that Xu and Carey (1996) and Xu (2005) appeal to in explaining their findings. Showing infants the duck and the cup together before the start of the trial provides them with the fact that these two objects occupy different spatial positions and must therefore be different objects. Not showing them the preview leaves them thinking that the objects are on the same trajectory as they go back and forth behind the screen and are therefore the same object.9

Similarly, in a well-known experiment by Spelke, Kestenbaum, Simons, and Wein (1995), four-month-old infants sat in front of a stage, looking at two screens separated by empty space, as shown in Figure 3. In the one-object condition, the infants saw a cylinder begin at one side of the stage (let’s say

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9 Fodor and Pylyshyn (2015, p. 37) point to a circularity problem for Spelke objects: “We’ve tried hard, but without success, to convince ourselves that the concept of a TRAJECTORY is more basic than the concept of a PHYSICAL OBJECT; isn’t it true by definition that a trajectory is the path of an (actual or possible) physical object through space?” In what follows, we take sameness of trajectory as the criterion of identity for Spelke objects, rather than as part of the definition of SPELKE OBJECT itself. But we note that Fodor and Pylyshyn’s problem could still arise if movement-as-a-whole, which is part of the definition, presupposes movement of an object. Fodor and Pylyshyn’s criticism is made very briefly (we’ve just quoted the entire argument), and we won’t attempt to pursue it here.
the left side), move behind the left-hand screen, move between the left-hand and right-hand screens, move behind the right-hand screen, emerge at the far right, and then reverse direction (see Figure 3a). This action was repeated for as long as the baby cared to look. In the two-object condition, everything was the same, except that the cylinder never appeared between the screens (see Figure 3b). (The babies saw actual 3D objects, not the 2D images of the figure.) As an adult, you would probably infer during these habituation trials that one object was going back and forth behind the screens in the one-object condition, but two objects were going back and forth in the two-object condition, and the infants appeared to come to the same conclusion. Spelke and colleagues tested them in one of two kinds of test trials, both with the screens removed. In one test trial, the infants saw a single cylinder going back and forth, as in Figure 3c. In a second test trial, the babies saw two objects, as in Figure 3d. If the infants have adapted to the idea of one object going by during the habituation trials, they should be surprised to see two objects during the test trials, and they should look longer during the two-object test trials than during the one-object test trials. If the infants have adapted to the idea of two objects going back and forth, they should be surprised to see only one object during the test trials, and they should look longer during the one-object than during the two-object test trials. In other words, if the babies have used continuity of the spatio-temporal paths of the objects during habituation to make the right inference about how many objects were in play, they should be surprised if the wrong number of objects turns up in the test trials. And that’s exactly what Spelke and company found: On the test trials, babies looked longer if the wrong number of objects appeared than if the correct number of objects appeared. So it looks as if 4-month-olds can determine how many objects are around, just from the spatio-temporal paths of the items.

These results suggest that if SPELKE OBJECT is a sortal concept, its criterion of identity is spatio-temporal. Filling in the terms of the schema in (1) gives us:

(2) For all \(x\) and \(y\) that are 3D, bounded entities that retain their boundedness as they move (i.e., are Spelke objects), then \(x = y\) iff \(x\) and \(y\) are on the same spatio-temporal path.
Psychosortalists must maintain that (2) is psychologically real—that people consult (2), or some equivalent principle, in judging whether two Spelke objects are the same. That is, psychosortalists must maintain that for any Spelke objects, people will judge that they are identical just in case they judge they are on the same spatio-temporal path.\(^\text{10}\)

4.2.1. Troubles with the Sufficiency of Spatio-temporal Continuity

The property experiments (e.g., Wilcox, 1999) that proved problematic for basic-level sortals also provide counterexamples to (2). Consider an experiment like that of Figure 2, but in which the two spheres are replaced by a sphere with dots and a same-size sphere with stripes. At 7.5 months, infants are able to succeed at this task, looking longer in the narrow-screen condition than in the wide-screen condition. They infer from the markings that the spheres are distinct and so unable to fit behind the narrow screen at the same time. However, if the spheres have identical markings (e.g., both are striped), then infants look an equivalent amount of time in the two conditions. According Carey and Xu (1999), infants of this age don’t have lower-level sortals to individuate the two spheres, and this means the only sortal available to them is that for Spelke objects. But if the criterion of individuation for Spelke objects is the one in (2), it fails to explain the infants’ performance. In the narrow-screen condition, the spatio-temporal path is the same when the two spheres have different markings as when they have the same markings. So the spatio-temporal path can’t explain why infants differentiate the spheres in the former case but not in the latter one.

\(^{10}\) One qualification to (2) is that it fails in the forward direction for animate objects (Kuhlmeier, Bloom, & Wynn, 2004). If \(x\) and \(y\) are people who have different trajectories, they aren’t necessarily counted as distinct for the situation in Figure 3b. Spelke and Kinzler (2007) think these cases are handled by a different core module for agents. But this means we should supplement (2) with a further restriction on Spelke objects, perhaps:

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(2') \text{For all } x \text{ and } y \text{ that are 3D, bounded entities that retain their boundedness as they move and are not agents, } x = y \text{ iff } x \text{ and } y \text{ have the same continuous spatio-temporal path.}
\]

We’ve already distinguished Spelke objects from things like non-solid substances that might belong to some other module. However, those items don’t fit the original definition of Spelke object, whereas people (and most other agents) do. So the italicized restriction seems to be a necessary modification of that definition. However, since this qualification does not affect our argument, we’ll stick with the simpler formulation in (2).
A simple variation of this experiment is likely to yield the same conclusion for adults: Imagine, for example, two amorphous but identically-shaped objects that you can’t identify as members of any basic-level category (perhaps because they are too far away). If they move on the same Figure 2 pathway, but one is dotted and the other is striped, you may be surprised when they both seem to be behind the narrow screen at the same moment. Again, the criterion of identity for SPELKE OBJECT in (2) can’t explain your reaction.

We take Wilcox’s (1999) result to show that the Spelke-object concept isn’t a sortal. Moving spheres qualify as Spelke objects in anyone’s book; so the schema in (2) clearly applies to them. But (2) incorrectly predicts that infants should respond in the same way when confronted with spheres having different markings as with spheres having same markings. More specifically, even if people judge that the spheres have the same spatio-temporal path, they do not always think that those spheres are identical. And if this is the case, then the sufficiency claim in (2) is false. Thus, these results suggest that SPELKE OBJECT does not provide a criterion of identity and that it is, therefore, not a sortal concept.

Perhaps psychosortalists could respond by denying that “same spatio-temporal path” is the right criterion of identity for Spelke objects. But because this criterion is the one investigators have used to explain many earlier results—for example, the Spelke et al. (1995) finding in Figure 3—we don’t see that they can ignore it here. Alternatively, psychosortalists could try out the idea that infants believe the dotted and the striped spheres are on different spatio-temporal paths since the narrow screen interrupts infants’ view of it. If so, then the infants could conclude from (2) that two spheres are in play. But this would again interfere with the explanations for infants’ performance when the two spheres have the same markings. Here, infants seem to think only one sphere is in view.

A more reasonable explanation for Wilcox’s (1999) finding, we think, is that infants believe that a single sphere is unlikely to pick up two different decorative patterns when it is briefly out of sight. So there are probably two spheres rather than one at hand. This explanation goes along with the suggestion by Carey and Xu (1999) and Xu (2005) that infants can sometimes use property information to determine the number of objects within a scene. As we mentioned in Section 3, though, if infants can use properties
to differentiate things, then there is no logical pressure to suppose that sortal concepts are required to explain these acts of individuation. Section 3 argued that basic-level concepts don’t have to be sortals in order to explain why older infants think toy ducks don’t change into cups while behind a screen. The present section suggests that the evidence for sortals is no stronger in the case of Spelke objects.

4.2.2. Troubles with Necessity of Spatio-temporal Continuity

Wilcox’s (1999) study shows that the sufficiency half of (2) is incorrect: Sharing the same spatio-temporal path does not entail identity. But we also doubt that the necessity half is correct. If two objects are identical, do they necessarily share the same spatial-temporal pathway? A number of philosophers have offered hypothetical counterexamples directed against this possibility (e.g., Armstrong, 1980; Hirsch, 1982; Nozick, 1981; Shoemaker, 1979; see Rips, Blok, & Newman, 2006, for discussion), but let’s consider a more concrete case for which we can provide some experimental backing (Leonard & Rips, 2015, Experiment 3).

Suppose that on Monday there is an assembled table, which we’ll nickname “Timmy,” in the dining room. On Tuesday the table is taken apart and the pieces are moved to the living room. On Wednesday, the pieces are resembled. Here are the key questions: Does Timmy exist on Tuesday and, if so, is Timmy a Spelke object? Does Timmy exist on Wednesday and, if so, is Timmy a Spelke object? With respect to the former, most participants said that Timmy did exist on Tuesday but was not a Spelke object (defined for them as “a bound, coherent, three-dimensional physical entity that moves as a whole”). And with respect to the latter, most participants said that Timmy did exist on Wednesday and was a Spelke object. So participants agreed that Timmy exists from Monday to Wednesday, but goes from being a Spelke object on Monday to a non-Spelke object on Tuesday, and then returns to being a Spelke object on Wednesday. (Of course, the participants in this experiment were adults and so had available the basic-level sortal table. But most participants also said that Timmy was not a table on Tuesday and went back to being a table on Wednesday. In other words, their judgments about whether Timmy was a table followed their judgments about whether Timmy was a Spelke object.)
Depending on what psychosortalists want to say about whether there is a spatio-temporal path that connects Timmy on Monday to Timmy on Wednesday, they seem to be faced with a dilemma. Psychosortalists can either say that people judge there to be a spatio-temporal path that connects the Monday Timmy to the Wednesday Timmy, or else they can deny that people make this judgment. If they deny that people make this judgment, then we have a counterexample to the necessity claim in (2): People judge that Monday Timmy and Wednesday Timmy are identical even though they do not judge that there is a spatio-temporal path that connects them.

But if psychosortalists say that people judge that there is a spatio-temporal path that connects the Monday Timmy and the Wednesday Timmy, then it is hard to see how they can explain the data in psychosortalist terms. That is, it is hard to see how they can appeal to the SPELKE OBJECT sortal to explain how Timmy can exist on Monday, Tuesday, and Wednesday (which they must maintain, given that on this horn of the dilemma we are supposing that people judge that there is a spatio-temporal path that connects Monday Timmy to Wednesday Timmy). To see why, notice that if people judge that there is a spatio-temporal path that connects Monday Timmy to Wednesday Timmy, then they must judge that this path also connects the Monday Timmy to the Tuesday Timmy. But people do not think that Tuesday Timmy is a Spelke object (rather, they think it is just a collection of unbounded chair pieces). Thus, (2) does not apply, since (2) requires both $x$ (Monday Timmy) and $y$ (Tuesday Timmy) to be Spelke objects. So (2) is silent about whether people will judge that $x$ and $y$ are identical, and psychosortalism is therefore too weak to explain all the relevant data.

Of course, as in the case of concepts of ducks and cups, a SPELKE-OBJECT concept can provide information that allows people to distinguish objects. The discontinuous path of the items in Figure 3b is likely to be a clue that two cylinders are present, in line with the notion that Spelke objects usually don’t have discontinuous trajectories. What we are denying is that this kind of information amounts to a criterion for identity or individuation as in (2). So although a Spelke-object concept doesn’t provide criteria (i.e., necessary and sufficient conditions) for identity and individuation, it can sometimes provide
evidence in favor of identifying or individuating things. That’s fine with us. Our quarrel is with sortal concepts, not with the SPELKE-OBJECT concept.

Taken together, then, the arguments from Sections 3 and 4 suggest that it is unnecessary to posit either basic-level sortal concepts or the SPELKE OBJECT sortal concept to accommodate and explain the relevant data. Thus, we take these arguments to undermine the main motivation for psychosortalism.

5. Conclusion

Metaphysics can inform cognitive science by providing possible models of how people think about things. In particular, metaphysics can suggest cognitive theories of object individuation and identity, part-whole composition relations, relations between material substances and objects, and many others (see Rips & Hespos, 2015, for a review of some connections of this kind). We wouldn’t expect, however, that every metaphysical theory would translate into a successful cognitive one, and we have tried to make the case here that sortal theories are among metaphysics’s less successful export commodities.

The initial reason why psychologists took up sortal theories was the conviction that singular thought about an individual was impossible unless people possessed a mental representation for a sortal that included that individual. We suspect this was a wrong turn at the start. As far as we can see, cognitive theories of reference to individuals only require a representation of the individual and the right sort of causal connection between the individual and the representation; they do not require the additional representation of a sortal to which the individual belongs. We can successfully refer to Fido (at least according to externalist theories) provided we have a Fido concept that’s on the receiving end of a causal arrow from Fido. But we don’t also need the concept DOG to mediate this connection. Indeterminacy arguments can suggest otherwise. What guarantees that our concept FIDO picks out Fido and not summed Fido parts? Doesn’t something have to carve out Fido in a way that differentiates these possibilities? Maybe. But it’s hard to see how this something could be another mental representation—the concept DOG—which presumably has much the same problem with indeterminacy of reference.
Despite the fact that sortal concepts aren’t necessary for singular thought, some psychologists continue to assume that they are necessary and continue to suppose that when people correctly distinguish objects, sortal concepts are responsible. They interpret the results of experiments, such as those illustrated in Figures 1 and 3, as evidence that children possess sortal concepts, either at the basic level (e.g., DOG) or at a higher level (that of SPELKE OBJECT). However, the findings from further studies (e.g., Wilcox & Baillargeon, 1998; Wilcox, 1999; Xu & Baker, 2005) undercut this interpretation. The essential feature of sortal concepts is that they provide criteria for identity and individuation in the sense of (1) or (2). But children’s use of property information to distinguish objects in tasks like that of Figure 2 violates these criteria. Infants distinguish spheres with different patterns of markings, even though they are Spelke objects and are on the same spatio-temporal path, contrary to (2). Because psychosortalists believe that infants of this age do not possess sortal concepts other than SPELKE OBJECT, sortal concepts are unable to explain infants’ ability to discriminate and identify things.

Here’s our final list of disclaimers: We don’t deny that basic-level concepts and the SPELKE OBJECT concept are relevant to identity and individuation or that they have distinctive and important roles to play in cognition. And we also don’t deny that the psychological experiments motivated by the idea of sortal concepts have provided substantive information about the nature of infants’ thinking. What we do deny is that there is any reason to believe that people have a distinguished class of concepts (basic-level ones, SPELKE OBJECT) that supply (necessary and sufficient) criteria for resolving questions of identity and individuation.
References


Figure 1. The events in Xu and Carey’s (1996) Is-it-one-or-two task. See the text for an explanation of these events.
Figure 2. The events in Wilcox’s (1999) study of object discrimination. See the text for an explanation of these events.
Figure 3. The events in Spelke et al.’s (1995) study of object discrimination. See the text for an explanation of these events.