CHAPTER ONE

NAMING ARTIFACTS: PATTERNS AND PROCESSES

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Abstract

Nouns such as knife, fork, box, and bench that name artifacts (human-made objects) are applied to diverse sets of objects that cannot be fully predicted by any single type of dimension. Explaining the complexity of artifact naming
patterns requires considering both how name extensions evolve over time and how the goal-driven nature of communication contributes to labeling choices by speakers. Because of these influences, an account of artifact naming will differ from an account of how people conceptualize the objects nonlinguistically. The complexity of naming patterns is not readily explained away by trying to limit the range of exemplars that should count in the analysis of a given name, because principled bases for limitations are lacking. The social nature of communication mitigates this complexity in language use: Interactions between speakers and addressees help ensure that artifact nouns in discourse are interpreted as intended despite the wide range of objects each can encompass. However, the complexity is further manifested in substantial variability in naming patterns for the same sets of objects across different languages. This cross-linguistic variability poses special challenges for the child language learner, learners of multiple languages, and researchers interested in understanding how language may influence thought.

1. Introduction

“Smart” phones today not only allow voice communication but take photos and video, play music, browse the web, send and receive e-mail, edit text, assist in way-finding, and launch a wide variety of other applications. A recent television ad for one such phone features the company CEO commenting, “It’s amazing we still call it a phone.” Amazing indeed, when we consider how different these phones are in their functional capabilities, appearance, and mode of transmission from the phones that have come and gone over the last 150 years, and even from those still attached by a cord to a phone jack in many households today. But it is not amazing at all in the context of a broader consideration of how names for artifacts (human-made objects) are used. In this chapter, I will illustrate the diversity of objects to which ordinary artifact nouns are extended. I will then present an account of how they come to be used in these ways. Next, I will discuss issues that arise in interpreting the examples, including whether alternative accounts are possible. I will also consider the implications of this diversity and how it arises for related areas of inquiry in cognitive psychology. By its focus on artifact naming, this chapter is most directly about language use and not about concepts. Although how people talk about artifacts is no doubt closely linked in some respects to how they think about them, each needs to be understood on their own terms, as I will argue. Implications from this discussion of language use for the psychology of concepts will be considered at several points.

Many words have multiple meanings that are quite distinct from one another. A classic example is the case of bank, which can mean both a financial institution and the ground sloping down to a creek or river.
Other sorts of examples include newspaper, which can refer to both a physical object that is read in the morning and the company that produces it (as in “The newspaper won’t allow the staff to join the union”), and running, which can refer to human locomotion, water coming out of a tap, and a movie that is in progress, along with many other types of actions. Bank is considered a case of homonymy, in which the two meanings have no apparent relation to one another (and may even have come about independently of one another; see, e.g., etymology in Oxford English Dictionary on-line http://dictionary.oed.com/entrance.dtl). The second case (newspaper) involves metonymy, in which one entity is used to stand for another (e.g., Lakoff, 1987; Nunberg, 1979), and the third (running) may involve metaphorical extensions of a word from a concrete meaning to more abstract ones. All of these cases demonstrate the great flexibility that words have to take on a wide range of meanings, and the corresponding flexibility that language users must have to use and interpret words appropriately despite the variations in what they are intended to convey on different occasions of use. Yet none of these examples quite captures the case of the modern phone. It does not seem to be homonymy, metonymy, or metaphor when you call an object small enough to close your fist around, with all its “smart” capabilities, by the name phone, and at the same time use that name for the clunky thing attached to your phone jack at home, and for Alexander Graham Bell’s 1876 brass cylinder with a flexible tube that transmitted a voice to the next room through a liquid medium (see http://en.wikipedia.org/wiki/History_of_the_telephone). These uses of the name are clearly related, and they all seem to name a concrete object, and the whole of the object, in a literal way. Likewise, it is neither homonymy, metonymy, nor metaphor allows you to use box for a small plastic container holding 100 thumbtacks that snaps shut as well as a large cardboard container with flaps that holds a computer, or that lets you use brush for both a long, thin thing with fine, soft hairs that applies watercolors and a rectangular thing with stiff wire bristles that scrapes off rust. It is these more ordinary uses of names that I will discuss. At first glance they may seem more mundane, but the naming patterns they reveal are complex and by no means trivial to explain.

2. HOW ARE ARTIFACT NOUNS EXTENDED?

I take as a starting assumption that names for artifacts generally have associated with them some elements of meaning that reflect typical, familiar, common uses. For instance, the meaning most closely associated with box might be that it is a squarish cardboard container with flaps meant for holding one or a few solid objects. These elements of meaning do not, by
themselves, account for many uses of artifact names, such as when box is applied to the plastic container with a snap lid for tacks (much less a child’s juice box holding liquid and accessed only through a straw). So the question is how the noun is extended to other sorts of objects. This question of “how,” itself, actually has two interpretations. The first is as a descriptive question: What are the observed instances and patterns of use of artifact names? The second is as a theoretical question: How can these observations be accounted for? I will address both parts of the “how” question.

2.1. What Are the Observed Instances and Patterns of Use of Artifact Names?

In this section, I will consider how the most obvious, observable properties of artifacts—their functions and their physical features—are related to the name they receive. These are the sorts of features that people generally produce when asked to describe an artifact or to list features associated with artifact names (e.g., Malt & Smith, 1984; Rosch & Mervis, 1975). Less observable factors may also contribute to naming patterns, and this possibility will be addressed in considering theoretical accounts for the patterns. I will draw on English noun uses only, although the naming patterns of English do not necessarily match the naming patterns of other languages. I will take up this cross-linguistic variation later.

2.1.1. Function-Based Extension

Many people have the intuition that artifact names must be extended based on function. Artifacts generally exist for some specific purpose (even if only decorative, but usually for more active use), and so it is not surprising that their function is central to how people think about them. As Kelemen (1999), Kemler Nelson and colleagues (e.g., Greif, Kemler Nelson, Keil, & Gutierrez, 2006), and others have pointed out, when encountering a new artifact, “What’s it for?” is likely to be one of the first and most compelling questions asked about it. Miller and Johnson-Laird (1976) took it as a given that function is more basic than form in determining artifact categories, and this sentiment is frequently echoed by others (e.g., Medin & Ortony, 1989; Rips, 1989).

Consistent with these intuitions, it is easy to provide examples of artifact nouns that are applied to objects differing substantially in form but sharing a function. Chair, for instance, is used to label objects for seating one person, whether they are large and stuffed, small and wooden, plastic and woven, or like a giant beanbag. Key is used for objects that open locks on doors, whether made of metal and inserted to physically turn a deadbolt, or resembling a credit card with a magnetic stripe that is swiped, or operating a car door from a remote location by the push of a button. Fan is used for devices to move air for cooling people, including electric box fans with
blades and Japanese paper fans. Razor is used for objects that shave hair off a person, including devices having a straight blade and operated manually, and objects having several whirling circular cutting mechanisms powered by electricity. Camera is used for boxy objects that record images on film and need to be grasped with two hands as well as for tiny things embedded in cell phones that yield digital records of a scene.

Such examples confirm that function is an important dimension along which artifact names can be extended. Yet a closer look reveals that function does not constrain the name an artifact receives in the sense of providing boundary conditions for use of a name. Artifacts with different functions sometimes are labeled by the same name, and artifacts with the same function sometimes are labeled by different names. To illustrate these two facts, I now turn to cases where form is integral to the use of an artifact name.

2.1.2. Form-Based Extension

The form of an artifact (by which I mean its shape, material, and other aspects of its physical make-up) has sometimes been characterized as a “superficial” aspect of the artifact that is secondary in importance to a “deeper” aspect, its function (e.g., Medin & Ortony, 1989; Miller & Johnson-Laird, 1976; Rips, 1989; Xu & Rhemtulla, 2005). Some researchers have argued that although early naming of artifacts may be based on form, children progress to a more mature focus on function by about age 4 or 5 (e.g., Diesendruck, Hammer, & Catz, 2003), and others have even argued that children use function from as early as age 2 (e.g., Kemler Nelson, Russell, Duke, & Jones, 2000). Nevertheless, it seems quite common for artifact names to be extended based heavily on form rather than function. Brush is used for objects with handles and bristles or hairs including variations made to smooth and untangle hair, apply paint to a surface, push snow off a windshield, scrub dirt or rust off a surface, and produce soft sounds on a drum by being drawn across the surface. Bowl is used for deep, rounded dishes made for eating liquids such as soups and also for storing solids such as fruit and serving granules such as sugar. Rake is used for objects with long handles and tines including variations made to gather up leaves, break apart thatch, dig stones from within soil, level and create patterns in soil or sand, and pull snow off a roof. Knife is used for objects with handles and blades that are sharp for cutting or dull and flexible for applying frosting to a cake, putty to a window, and spackle to a wall. Sponge is used for objects with natural or artificial sponge material that wipe dirt off surfaces (cleaning sponges), sand old coverings off (sanding sponges with an abrasive coating) or apply paint to surfaces (painting sponges). Fork is used for objects that bring food to the mouth, hold food in place (carving fork), serve from a platter by supporting on the surface of the tines (fish-serving fork), take the temperature of grilled food (thermometer fork; see http://www.williams-sonoma.com/products/7839004/index.cfm), scoop and move manure
(manure fork; see http://www.thefind.com/garden/info-5-tine-manure-fork) and make a musical note (tuning fork). In all these cases, the functions of the objects sharing a name are less similar than their forms are.

2.1.3. Form and Function Together

Based on the previous two sets of examples, one might suggest that artifact names fall into two groups, with one set being extended based on function and another based on form. However, there are several arguments against this proposal. First, a single name can encompass some objects that are related to the more typical examples via form and others via function. Above, I noted that electric box fans and Japanese paper fans seem to share a name because of their shared function of moving air to cool people. However, other objects called fan function to suck water vapor, smoke, or odors out of an area and are not intended to cool anything, such as a ventilator fan in a bathroom and an exhaust fan in a stove hood. In this case, the bladed objects (the box, ventilator, and exhaust fans) all seem to warrant being called by the same name because of the physical resemblance among them. Similarly, some things called key may come in disparate forms that share a function, but others seem linked via the form. A radiator valve key, for instance, resembles a metal door key but functions to turn a valve to bleed air out of a radiator, and hex keys (see http://www.radioshack.com/product/index.jsp?productId=2062781, also known as hex wrenches) are used to turn hexagonal bolts holding parts together in all sorts of devices. Although most things called knife share some similarities of form, laser knives overlap with typical knives on the current function but are physically entirely distinct, with the laser beam as cutting device not the least of their differences (see http://www.freepatentsonline.com/4249533.html for a detailed description of the components of a laser knife).

Second, nouns sometimes seem be extended to a particular object based on resemblance on a combination of form and function. In such cases, the overlap on each dimension with the more typical features associated with the name may be only partial. For instance, things called spoon most often have closed bowls for lifting liquid to the mouth to eat, but slotted spoons have openings in the bowl, and pasta spoons have tines around the edge. Both are for lifting something while leaving the liquid behind, and for preparing rather than eating foods. Things called chair typically provide backs, seats, and legs for sitting in while doing some task (eating, reading, working, etc.) but massage chairs, dentist chairs, and electric chairs have added elements for specialized functions. In the last two cases, it is an external party that performs the task; the chair only serves to hold the recipient of the task in place. Things called blanket typically are flat, flexible, and made of breathable materials to cover a person for warmth, but picnic blankets, while being flat and flexible, cover the ground for protection from dirt, moisture, and insects and come in waterproofed versions.
Finally, even in cases where one dimension seems to be the dominant basis for extending a particular artifact name, the general correlation between form and function means that the two dimensions cannot be fully dissociated. Where form differs, some difference in function usually follows. Although the various objects called rake seem to be linked more by form than by function, their similarity of form still makes their manner of functioning more similar to one another than to, say, the manner of functioning of the things called brush or bowl. Conversely, as Petroksi (1993) points out, the saying that form follows function is only loosely true. The “general” in the statement that there is a general correlation between form and function also has an implication for the cases where function seems to be the dominant link among things called by a particular artifact name. There are many different forms by which a general function can be implemented, and names for artifacts acknowledge these differences. It is impossible to characterize the functional boundaries of artifact names without appealing to form in the process. Things called chair, bench, stool, and sofa are all for sitting on, but it is the particular form they take that distinguishes things called by each name from those called by another at least as much as any finer discriminations of function. Even distinguishing functions at a finer grain, shared function alone may not warrant use of a name if the form differs from that usually associated with the name. For instance, I observed the object shown in Figure 1 at a streetcar stop, used by passengers to sit on while waiting for the streetcar, but several observers have verified my intuition is that it is too unlike normal benches to readily be called bench¹ (see Malt & Johnson, 1992; Hampton, Storms, Simmons, & Huessen, in press, for more systematic evidence). Returning to broader characterizations of function, many types of objects function to contain—those called box, basket, bin, crate, carton, bowl, bottle, jar, and jug, for instance—and so things called by each share a broad function of containment, but again it seems to be their material and/or shape that distinguish them from one another as much as details of the function. Things called knife are typically for cutting, but many other objects with other names are also for cutting, including those called pizza cutter, paper cutter, saw, wire clippers, pruning shears, lopper, scissors, axe, sword, scapel, machete, and scythe. Things called key may broadly be for opening and things called blanket for covering, but those functions do not discriminate key from can opener or blanket from plastic wrap. To narrow the function of each enough to discriminate among them by function, the statement inevitably ends up entailing elements of form. A knife cuts by means of a single horizontally oriented blade whereas a pizza cutter cuts by means of a round blade, scissors cut by means of two blades that pass across each other, and so on. In the end,

¹ Names proposed by three respondents were leaning rail or sitting rail, butt-rest which could evolve to buttress, and resting perch or person pedestal. A fourth suggested ergonomic bench.
form seems to be integral to explaining what is excluded from being called by a certain name even when there is a strong component of shared function among things that are called by the name.

2.1.4. Conclusion Regarding Form and Function

Patterns of use of artifact names seem to entail overlap among the entities receiving a given name on both form and function. In some cases, the overlap between things receiving the same name may be most prominently on the dimension of function, and in other cases it may be most prominently on the dimension of form. However, it is difficult to find cases of artifact words where one could claim that function alone or form alone accounts for why the whole set of objects is called by a single name and why certain other objects are not called by that name. In one way or another, for any given artifact noun, it is most often necessary to appeal to both form and function to explain the full naming pattern.

2.2. How Can the Observed Instances and Patterns of Use be Accounted For?

By the focus so far, on form and function and the argument that both matter, it may sound like I am heading toward an argument for a “family resemblance” view of how artifact names are applied to objects. This is,
course, the view that Rosch and Mervis proposed back in 1975, drawing on Wittgenstein (1991; originally published in 1953) earlier analysis of the range of things called by the name game (or, in reality, a roughly comparable German term, Spiele/Spiel). In this view, an object can be called by a name if it overlaps in its features with other things called by the same name, even if it does not share any particular single feature or set of features with all other things called by that name. As a general description of the relation of objects to one another that are all called by the same name, it may not be far from appropriate. However, this view fell out of favor among cognitive psychologists in the 1980s and thereafter, who, following Goodman (1972), became concerned that it failed to explain what counted as “similar” (e.g., Murphy & Medin, 1985) and failed to capture other important aspects of how people thought about objects. Spurred in part by Putnam’s (1977) writings on essentialism and Quine’s (1969) remarks about superficial versus deep similarity within philosophy, psychologists turned their attention toward people’s understanding of the more theoretical or causal connections among features (e.g., Ahn, Kim, Lassaline, & Dennis, 2000; Murphy & Medin, 1985) and to the possibility that there might be some single type of knowledge or belief that more fully constrains what things can be called by a name than the family resemblance view implies (e.g., Bloom, 1996; Gelman, 2003; Keil, 1989; Medin & Ortony, 1989).

These later endeavors have brought to light many important aspects of how humans relate to objects, including that they seek to understand causal relations among object properties, they discriminate between more and less projectable features in inferring unseen properties, and they consider an object’s history as well as its current state in how they value it. But the wording used in these investigations of conceptual activities tends to conflate the problem of accounting for how names are used to label objects with their primary goal of characterizing people’s conceptual, nonlinguistic understanding of entities in the world. The fact that Wittgenstein’s famous analysis was actually of a German word, Spiele/Spiel, that is only roughly equivalent to English game (see http://en.wikipedia.org/wiki/Philosophical_Investigations) is rarely pointed out for the same reason that my statement of Rosch and Mervis’ (1975) proposal is in fact slightly inaccurate. Many cognitive psychologists writing about such topics in past and recent decades, including Rosch and Mervis, have tended to frame their topic in terms of concepts rather than names or word meanings per se. Thus although Rosch and others (e.g., Murphy, 2002; Smith & Medin, 1981) have used English words to identify concepts, they have more fundamentally been interested in explaining the nature of nonlinguistic representations. The presumption that words directly reveal concepts is debatable (e.g., Malt, Gennari, & Imai, in press; Wolff & Malt, in press), a point I will take up later, but the blurring of the distinction has led to loss of interest in family resemblance as it may apply to naming. For now, though, the key
point is that naming, as opposed to conceptualizing, is a linguistic phenomenon and must be considered in that context (Malt, Sloman, Gennari, Shi, & Wang, 1999).

Returning, then, to how to characterize and explain naming patterns in particular, the family resemblance view may have some merit as a general description of the relations among things that get called by the same name, although I will suggest a refinement of it below. Function has continued to sometimes be taken as the “deeper” sort of property that constrains what things will be called by the same name and/or be part of the same concept (e.g., Asher & Kemler Nelson, 2008; Kemler Nelson, Herron, & Morris, 2002). As the earlier discussion indicates, though, the names actually applied to objects in everyday language use do not support this idea. The other chief contender for a possible constraint on artifact naming has been creator’s intended category membership (Bloom, 1996; Gutheil, Bloom, Valderrama, & Freedman, 2004). According to this idea, an artifact’s category membership, and therefore its name, will be whatever its creator intended it to be. Although creator’s intention can indeed have an important influence on artifact naming patterns, as I will discuss later, it is unlikely that it fully constrains what things a person tends to call by a given name. Creator’s intention is often unknown at the moment of using a name for an object (see Malt & Johnson, 1998). Differences between languages in which objects share the same name, which I will document later, would also pose a problem for trying to infer intention: Depending on who the creator was, the intended category may not be that which the current speaker would infer. And, empirically, current uses that differ from the original intention have some impact on name choice for artifacts (Malt & Sloman, 2007b; Siegel & Callanan, 2007). Although often worded in terms of artifact naming, this proposal has, ultimately, been deemed a view of concepts rather than of naming (Bloom, 2007). In the end, then, it seems likely that there is no single type of feature or dimension that places a strong constraint on what things can be called by a given artifact name.

Even if something along the lines of a family resemblance characterization is suitable, though, it is not very satisfying from an explanatory perspective. It does not reveal anything about how such naming patterns come about. If there needs to be only partial overlap on some dimensions with some other things called by a name, but not on any particular dimension or with any particular object, in order for an object to be called by the same name as certain other objects, then how does an object come to have one name and not an alternative? For instance, why aren’t brooms and dusters called brush? Why aren’t scalpels and scythes called knife, or putty and frosting knives called spatula or spreader? It also does not reveal anything about how the names can usefully serve language production and comprehension purposes. When someone hears brush, how does she manage to interpret it appropriately, if the intended referent can vary so greatly?
A more satisfying account of artifact naming patterns needs to say more than just that objects called by the same name have a family resemblance among them. Next, I suggest two key elements of a more complete perspective on how artifact naming patterns come about. These elements follow from taking seriously the distinction between naming as a linguistic process and conceptual, nonlinguistic aspects of how people understand artifacts.

2.2.1. Naming Patterns Are the Result of Diachronic, Not Just Synchronic, Processes

Some attention has been paid in the concepts literature to the types of sortings that people produce if they are asked to place sets of novel objects into groups. Participants tend to produce unidimensional sorts (e.g., Medin, Wattenmaker, & Hampson, 1987), although they will also produce family resemblance sorts under some conditions (Regehr & Brooks, 1995). But regardless, naming in real-world settings is not a result of seeing an array of objects all at once and trying to figure out how best to partition them to maximize resemblance within the groups. When naming an object, each speaker makes a choice about what name to apply from among those in her vocabulary, but those choices are constrained by the naming patterns she acquired from her elders, whose input shaped the child’s lexical choices to match their own conventions (Chouinard & Clark, 2003). Theirs in turn were constrained by ones they were exposed to during their own language acquisition. Because naming patterns are passed down from one generation of speakers to another, they are the product of processes operating over historical time, just as are syntax, phonology, and other aspects of language (e.g., Hock, 1991; Traugott & Dasher, 2005). When a new object enters a culture and needs to be named, the name it receives must depend on what other objects existed at that time within the culture and what contrasts among them were distinguished by name at that time. The latter would have been influenced by, among other things, contact with other languages, which can be a significant source of addition to a language’s vocabulary and an impetus for restructuring of semantic space to avoid synonymy (e.g., Clark, 2007; Millar, 2007). In short, the set of objects that come to share a name will depend on the order of input of each to the naming process and the existing landscape of names within the language at the time the object entered the culture.

As a result of the order- and time-dependent process, chains may form where each link in the chain is motivated at the time it occurs, although the connection between distant elements of the chain may later be hard to

\[1\] Most languages encompass several or more dialects or variations used by sub-communities of languages users, and naming patterns may differ across these. For brevity, I will refer to “languages” but this term should more accurately be interpreted as meaning some specified group’s version of the language. See, for instance, Kempton’s (1983) discussion of subcultural variation in use of Spanish pottery terms.
see. Alexander Graham Bell’s early telephone evolved year by year into
two more advanced objects having new forms, new modes of voice transmis-
sion, and greater capabilities. The corded phone spawned cordless phones,
and those spawned cell phones, and now there is the “smart” cell phone
with astonishing capabilities unrelated to the original function of transmit-
ting voices across distance. (See Lakoff, 1987, for examples of chaining for
word classes other than nouns.) Where someone to sort pieces of commu-
nication technology from across history without knowing the evolutionary
paths among them, they might tend to group the early phone with a
telegraph machine and the modern smart phone with a computer, but
that is not how the names used for each came to be. (See Petroski, 1993,
for an interesting discussion of how knives and forks changed over time,
shifting functions to the extent that the fork took over the knife’s original
function of bringing food to the mouth by spearing or heaping it on the
blade surface.) These sorts of phenomena are better approximated by
laboratory categorization models that permit order-dependent construction
of clusters (e.g., Heit, 1992; Love, Medin, & Gureckis, 2004) rather than by
the majority which assume simultaneous consideration of all exemplars in
creating groups.

Because naming patterns are established over historical time, they, not
only their referents, also evolve. Elements of the chain can drop from
current knowledge, making naming choices nontransparent to current
speakers. For instance, it is hard to imagine why milk, eggs, ice cream,
and cigarettes (and, for some people, yogurt and cottage cheese) all come in
containers called carton when the forms and specialized functions of these
containers are so different. The answer seems to be that it is because carton
used to refer to containers made out of a certain material (pasteboard)
dtl). As time passed and the material shifted to plastic or foam for some
products, the name nevertheless remained the same, making its use non-
transparent to current speakers. Someone once suggested to me that carton
refers to containers holding fixed quantities, such as a gallon or a dozen.
There appears to be no truth to this conjecture but it illustrates the extent to
which current speakers have lost a sense of the original motivation. In sum,
it is impossible to understand how artifacts are named without considering
diachronic as well as synchronic processes.

2.2.2. Production and Comprehension Involve Social Processes,
Not Just Individual Ones
The second key to understanding artifact naming patterns is to consider the
social nature of language use. Individuals doing things alone don’t need
language. Language exists for social purposes; it helps accomplish activities
such as sharing information, planning joint activities, teaching and learning,
entertaining, and so on. Thus language use entails individual acts that are
performed as part of joint action (Clark, 1996). There are at least two aspects of the social nature of language that help explain how artifact naming patterns come about and how communication can be successful despite the complexity of name uses. First, naming is goal-driven, and second, speakers and addresses work together.

2.2.2.1. Naming is Goal-Driven Naming is goal-driven, both in terms of the enduring patterns of usage that are adhered to across many contexts, and in terms of the choices that are made on the spot in a given context when more than one name is possible for an object. A central goal of naming in ordinary discourse is to refer (meaning, when writing, for the writer to get the addressee to understand what kind of thing she has in mind; when speaking, if referents are physically present, to get the addressee to successfully pick out the intended referent from among possible ones). But naming can have other goals as well, such as conveying affect or focusing attention on certain attributes of the object. Calling a building *hut* versus *hovel*, or *house* versus *McMansion*, highlights different properties of the objects and indicates something about the speaker’s attitude about the object (Malt & Sloman, 2007b). Within a particular interaction, the name chosen may depend on the immediate goals of the speaker as far as what attributes to highlight or attitude to convey (Malt & Sloman). Across the longer term, names for novel objects are often proposed by the manufacturer or marketer of the object and then adopted into general use by the public. The name the manufacturer or marketer puts forward is likely to be carefully designed to highlight certain attributes (and even encourage the adoption of certain attitudes) by either affiliating the object with those called by an existing name or by contrasting it with them. For instance, plastic juice boxes, even when shaped like a bear (see Malt et al., 1999 for illustration) presumably were labeled *box* to emphasize their potential as a replacement for a disposable juice box. The basket-maker Longaberger has labeled a wide variety of products as *basket* that might otherwise be called *tote*, *woven bag*, *handbag*, *bin*, or *hamper* (see http://www.longaberger.com/ourProducts.aspx) presumably to highlight their affiliation with the Longaberger material and style. On the other hand, the new name *spork* was spawned (and is now used by a number of manufacturers; see, e.g., http://en.wikipedia.org/wiki/Spork) presumably to contrast with both spoons and forks and highlight the ability of the new type of object to perform as both. The name was chosen even though the deviation of sporks from typical spoons is no greater than from, say, a grapefruit *spoon* with a serrated edge for cutting and no greater from typical forks than, say, a fish-serving fork. *Scork* has followed, the only motivation for the contrasting name apparently being the desire to signal the incorporation of a can opener into the handle design (see http://www.gearforadventure.com/Vargo_Stainless_Steel_Scork_p/1480.htm). Such goals can result in object names that deviate from those that would be constructed
if an array of objects were simply sorted into groups according to some generic similarity metric.

2.2.2. Speakers and Addressees Work Together Speakers and addressees work together to ensure that the intended message of an utterance is interpreted as it was meant to be (e.g., Clark, 1996, 2006). As Clark (1996) points out, language evolved in the context of face-to-face communication; conversation is its most basic and universal form. Comprehension is aided by the active engagement of parties in the interaction, occurring most readily in conversation but with similar processes carrying over to written discourse.

One such process or device that has been proposed is the use of common ground (e.g., Clark, 1996, 1998; Clark & Marshall, 1981), whereby the parties to a discourse exploit what they know about what each other knows to choose their words and help guide their interpretation of the others’ words. This common ground can include precedents established between them in the course of their interactions (e.g., Clark & Brennan, 1991; Clark & Wilkes-Gibbs, 1986). So, for instance, if one person has referred to her Longaberger purchase as her new basket, her conversational partner is likely to call it the basket in return (and not the tote or the woven bag), knowing that this is the term that picks out for her friend the item they intend to discuss. There has been some debate over exactly how to describe the kinds of processes underlie adherence to conversational precedents (e.g., Horton & Gerrig, 2005a,b; Shintel & Keysar, 2009). Regardless of details, it is inevitable that common ground and conversational precedents are exploited in designing utterances. Adults adjust their vocabulary in speech to children and teachers do to learners, individuals take into account which of their language subcommunities (fellow surgeons, fellow dance enthusiasts, or fellow South Dakotans) they are addressing (Clark, 1998), and speakers can track what names have been used with what conversational partners within the bounds set by normal memory limitations (Horton & Gerrig).

Other devices are also available to help in coordination. In conversation, the role of speaker and of addressee usually alternates frequently, which helps achieve mutual understanding as each can monitor and correct the interpretations of the other. Addressees indicate their interpretation of information through questions or comments (“Yes, I see” or “This one, right?”) as well as through nods, facial expressions (satisfied, surprised, quizzical, etc.) and movements such as picking up an object or gesturing or moving toward it (e.g., Barr, 2003; Clark, 1996; Clark & Brennan, 1991; Clark & Fox Tree, 2002; Clark & Krych, 2004; Kelly, Barr, Church, & Lynch, 1999). Speakers and addressees go through an iterative process in which the participants repair, expand on, or replace a referring expression until they reach a version they mutually accept (Clark & Brennan; Clark & Schaefer, 1989; Clark & Wilkes-Gibbs, 1986), and speakers may even
correct interpretations regardless of whether addressees request further information. For instance, when an instruction to pick up an object is ambiguous about the intended referent, there is often a further interaction to refine interpretation, with listeners either asking for clarification or else reaching for an object and then being corrected by the speaker (or both) (e.g., Barr & Keysar, 2005; Clark & Wilkes-Gibbs). Speakers also produce signals in their speech stream that help addressees differentiate among potential object referents. When speakers formulate descriptions of new referents, their utterances contain longer hesitations and are more likely to contain a filled pause (such as “ummm”) (Barr, 2003), and other flags such as pronouncing the as THEE rather than THUH (Arnold, Tanenhaus, Altmann, & Fagnano, 2004). Addressees are able to make use of these speech patterns to help narrow in on intended referents; when they heard a description of a new referent preceded by such signals, they are better at understanding the description than when such signals are not available (Arnold et al.; Barr).

Finally, when an addressee is faced with interpreting a bare noun such as basket or brush or box that can refer to objects having any of a range of forms and functions, it may be because there is only one potential referent present or the target referent is salient enough to easily be identified (Clark, 1996). When more than one possible referent is present (or could be imagined, in text), speakers (or writers) disambiguate by adding modifiers (Brennan & Clark, 1996). Although brush by itself can refer to many different sorts of objects, the longer expressions paint brush, hair brush, scrub brush, or basting brush narrow the relevant properties substantially. In subsequent utterances, the object can be referred to simply as brush once a mutual understanding has been achieved. Children produce and accurately interpret such modifier-noun expressions by 2–3 years of age (Clark & Berman, 1987; Clark, Gelman, & Lane, 1985), demonstrating the ease of use of such expressions. Thus, through a variety of devices, an addressee’s interpretation is heavily scaffolded by the speaker who is actively engaged in helping her arrive at the understanding he intended.

2.2.3. Conclusion Regarding How to Explain Artifact Naming Patterns

At a general level, uses of artifact names may be described by the family resemblance idea of an object needing only some degree of overlap with other things called by the same name. Understanding why this family resemblance pattern comes about, though, requires digging deeper into an understanding of how naming patterns come about. Historical linguistic processes are key to this understanding, and they can produce chains of linked uses. Despite the looseness of such a system, it affords communication without problems because the inherently social nature of communication provides the necessary support. Addressees are not left on their own to
figure out the intended meaning of ambiguous nouns; many social, linguistic, and paralinguistic forms of assistance are provided by speakers (and, in more limited ways, by writers).

3. INTERPRETATION ISSUES

In this section, I will address several questions about the interpretation of the naming observations used as motivation for my arguments. These questions ask, from several different perspectives, whether artifact name use could look simpler and less in need of appeal to diachronic and social processes by adopting certain constraints on the words or objects being considered. I will argue that the answer is no in each case.

3.1. Does Function Fully Constrain Some Artifact Names?

Many of the nouns that have been used in the examples so far are non-transparent in their names. Chair or basket or carton contains no morphemes within that hint at a meaning or range of application. Some names for artifacts, though, contain meaningful units that might specify a particular function. For instance, given some understanding of tooth and brush, toothbrush seems to tell us that the word applies to things for brushing teeth, and given some understanding of tooth and pick, toothpick seems to tell us that the word applies to things for picking teeth. Some, perhaps many, nouns of this sort do seem fairly well constrained in their range of application by the function implied by their name. Doorstop may be used only for objects that stop doors, and headrest may be used only for things that heads are rested on.

But the first two examples illustrate that such nouns need not always obey a strong functional constraint. Things named toothbrush are certainly for the most part made and bought for purposes of brushing teeth. Toothbrushes make good cleaning tools, though, and one company now makes and markets a set of objects they call toothbrushes specifically for use in house cleaning, even offering them in professional cleaner’s grade, and advertised with the exclamation “Definitely not for your teeth!” (see http://www.thecleanteam.com/catalog_f.cfm). Even more compellingly, toothpick originally did label an object made and bought for picking teeth (Petroski, 2007), but today the dominant reason for the making and buying of objects called toothpick (at least in the U.S.) is a different one: to use to spear cheese cubes and other canapés and bring them to the mouth for eating. In many social circles, using them to actually pick the teeth would be considered poor manners. That these objects, so named, are created (not just used) for the eating purpose is verified by the wide range of decorative toothpicks available for party platters, and by their positioning with kitchen wares and
party supplies in merchandising. In fact, some toothpicks are now sold purely as decorations; one manufacturer offers American flag toothpicks to place on cakes and other desserts for Independence Day. As these examples illustrate, artifact names of this sort most likely start out with a range of application that is well described by a particular function. However, it seems that even in these cases, they can break loose from their origins and acquire a wider range that is not limited by a single function. Perhaps this should not be entirely surprising, since it has been observed in other contexts that transparent elements of meaning can be combined with others that violate them. We talk about plastic silverware, jumbo shrimp, working vacations, loose tights, white chocolate, and small fortunes (Lederer, 1989) without any problem.

Another candidate for being more fully constrained by function might be agentive nouns. In English, the suffixes “-er” and “-or” are used with some frequency to form nouns that denote the doer or performer of an action (e.g., Finegan, 1994). For instance, baker is composed of bake + -er and refers to a person who bakes, and runner is composed of run + -er and refers to one who runs. Although agentive nouns are usually discussed with reference to animate agents as in the preceding examples, they also can be formed to name inanimate objects that are used to accomplish some sort of act. So, for instance, dryer, container, and hanger are artifact nouns of this sort, that name, at least prototypically, objects used for drying, containing, and hanging, respectively. Given the nature of the names, one might wonder whether the usage of this sort of artifact noun is more fully constrained by function than the nouns we have been discussing to this point. That is, does the range of application of dryer, container, and hanger get fully determined by a single, specifiable function (to dry, to contain, and to hang)? As with the preceding case, there seem to be few counterexamples in which an agentive noun name is routinely used to name an object not intended to fulfill the function suggested by its name. But even so, again, this strong tendency is not absolute. Consider brightly colored objects called pipe cleaners, made and sold for use in children’s crafts (e.g., http://www.discountschoolsupply.com/Product/ProductList.aspx?category=89&es=5530200000G&CMP=KNC-Google&s_kwcid=TC|10010|pipe%20cleaner%20crafts||S||3019930373&gclid=CKjnhfDLb8ZwCFCdF5god8lfO6Q). Their craft use has no resemblance to pipe cleaning (or any sort of cleaning), indicating that the name can break loose from the function it originally implied. Furthermore, note that even when uses are consistent with the name, the function suggested by the name only partially constrains the range of objects to which the name is applied. Duster and dustcloth are applied to different types of objects although both are for dusting (a duster usually having a handle with feathers or lambswool, etc., attached). Cleaner and cleanser are also applied to different types of objects although both are for cleaning (cleaners usually being nonabrasive as in silver cleaner or glass cleaner, and
cleansers being gritty), and likewise mixer and blender are although both are for thoroughly combining food ingredients (mixers usually having an open bowl with beater blades and blenders having a more vertical container with a chopping blade). Even doorstop and door stopper, so minimally different, imply different forms although they both function to hold doors open (a doorstop usually being a heavy form placed against the door, and a door stopper being plastic or rubber and wedged under the door). Thus these agentive names still integrally require reference to elements of form in order to describe the range of referents to which they apply: Having a particular function revealed by the name may usually (though not always) be a necessary condition for application of an agentive noun but even then, it is not sufficient.

One could argue that these agentive names are distinguished by the finer details of the function and so are still truly function-defined (even if the details are not transparent in their name). As with nonagentive nouns, though, the specifics of function can vary among things called by the same agentive name, making it impossible to describe function at a detailed level and encompass all objects that do get labeled by the name. For instance, computer and calculator are distinguished by both form and the specifics of the kinds of calculations they can carry out, but earlier computers could only perform at the level of today’s calculators (or even abacuses, before that), and tomorrow’s computers will have new capabilities. In general, objects that change rapidly with advancing technology will encompass fairly wide ranges of functions as well as forms (e.g., scooter, from a child’s two-wheeled, muscle-propelled toy to electric versions that transport disabled adults; cash register from mechanical to digital versions that generate coupons and track product sales as well as make change). Again, it seems that function may come closer to constraining the range of application of these names but it still is only a partial constraint. Highly specific functions may appear more sufficient for distinguishing between pairs such as computer and calculator, but then they are unlikely to be truly necessary for all uses of the words.

3.2. Is the Apparent Complexity of Artifact Name Use Only Because of Polysemy?

Even setting aside homonymy, most words have a network of related senses (e.g., Nerlich, Todd, Herman, & Clarke, 2003). In some cases, these senses can be quite disparate although still having transparent connections, such as in the meanings of nose that include a facial organ, an olfactory attribute of wine, and an ability to detect (as in She has a good nose for this) (Nerlich & Clarke, 2003). These senses of nose are so different from each other that it seems meaningless, or least foolhardy, to even ask if there is any simple account of the meanings that can be articulated in terms of a shared constraint on what the term nose applies to. The range of things that nose
applies to, and how one would describe that range, might become more tractable and meaningful if we limit the referents under consideration to concrete objects. Then it is a matter of explaining why nose applies to people, dogs, birds, airplanes, rockets, etc.—still not a simple task but presumably a more manageable one that might have a better chance of yielding some straightforward constraint. One might wonder if the case of artifact terms would look a great deal simpler if we divided off some examples as entailing distinct senses and tried to account for only one sense at a time. For instance, does box in reference to plastic boxes with snap lids or fork in reference to fish-serving forks reflect different senses than when the words refer to more typical examples? The difficulty with this strategy is finding a motivated way to restrict the set of referents that should count as falling under one sense. I have already limited the cases under consideration to concrete referents and uses that do not seem to involve metaphor, metonymy, or any other such extension device. If some of the examples discussed to this point constitute separate senses of the words because they seem to invoke different attributes, then all of them do. Alternatively, if we were to try to specify what will count as the separate major concrete-object senses of a word such as box by, say, taking a single form or function as the diagnostic criterion, then the argument becomes circular. Naturally, if the range of examples to be explained is restricted according to some a priori criteria for the properties they can have, then they will all share these properties. In the end, it is hard to provide any objective criterion for separating any collection of concrete-object uses from any other (see Nunberg, 2004, for a related argument).

3.3. Is the Apparent Complexity of Artifact Name Use Only Because of Compounding or Conceptual Combination?

As noted earlier, some of the artifact names I have discussed contain more than one morpheme. Some, such as toothbrush, are commonly written as a single word. Others are often (hair brush) or always (scrub brush) written as two words. All of these cases are potentially noun compounds, which are considered morphologically complex single words rather than nouns phrases consisting of a head noun and modifying noun or adjective. The classification is generally made based on the stress pattern. Compound nouns are said to resemble unanalyzable (monomorphemic) nouns (such as table or garbage) in having the primary stress on the first element of the compound, whereas noun phrases have primary stress on the last lexical element (e.g., Bybee, 1985; Pinker, 1994). For instance, this difference is illustrated by the stress patterns of Bluebird3 and blackboard (compounds)

3 Names of species are capitalized following the convention in ornithology.
compared to blue bird and black board (noun phrases) (e.g., Finegan, 1994).

If things called toothbrush, hair brush, or scrub brush are not examples of the
name brush by itself, but are separate words, then perhaps the range of
referents of brush itself is not as variable as I have suggested. A related
argument might be made from the perspective of psychologists who study
conceptual combination (e.g., Hampton, 1997; Murphy, 1990;
Wisniewski, 1997). If several concepts (labeled by nouns and adjectives)
are put together to form new concepts, perhaps the terms that result should
be considered to pick out some set of things that are distinct from those
labeled by the head noun. For instance, chocolate bee, when used to refer to a
piece of chocolate shaped like a bee, names something that lacks all the
behavioral properties and almost all internal and external form properties of
the majority of things called bee. Intuition suggests this sort of thing might
not be considered an example of the noun bee by itself.

Two points argue against adopting these positions to exclude some
concrete-object examples from consideration. First, although some com-
pounds may be coined to label things that don’t comfortably fit among
other things labeled by their head noun, others do label things that are
moderately to highly typical of the head noun alone. For instance, shoe box,
hair brush, paint brush, Coke bottle, tea cup, and baby shoe would all be counted
as conventional combinations having the signature stress on the first word of
the phrase. However, they name things that are perfectly reasonable as
eamples of the bare nouns and can comfortably be referred to by box,
brush, bottle, cup, or shoe alone. If this is true, one might wonder why the
compound occurs with some frequency in reference to these objects rather
than just labeling them with the bare noun. It may be that the routine use of
the modifier (resulting in the status of the phrases as familiar compounds)
functions simply to identify distinctive properties of the objects against a
field of potential referents that is highly variable.

Second, despite the widespread appeal to stress patterns to distinguish
between compounds and noun phrases, this diagnostic test is substantially
less valid that is usually assumed (e.g., Plag, Kunter, & Lappe, 2007; Plag,
Kunter, Lappe, & Braun, 2008). For instance, the stress is on the right-hand
element in chocolate donut, apple pie, paper doll, silk tie, and aluminum foil. For
names of street-like passageways, the stress pattern varies depending on the
right-hand element; thus Green Street is similar to Bluebird, but Green
Avenue, Green Boulevard, and Green Parkway all have stress on the second
constituent. (I note that even for color terms in bird names, variability from
the often-cited Bluebird pattern exists: Black Phoebe, Yellow Rail, Green
Heron, and among the blues, Blue Mockingbird, Blue Grosbeak, and Great
Blue Heron.) There is even variation among native-speaker informants in
stress assignment, and variation can be induced by the sentence context
(Pennanen, 1980). A number of variables including argument structure,
semantic relation between the first and second constituent, frequency of the
combination, and analogy to other combinations sharing the same head noun all have predictive value for the stress on a given combination, with none providing an absolute rule (Plag et al.). Thus, the message from stress patterns about what should count as a compound versus as a “mere” modifier-noun phrase is unclear. If the stress pattern test does not hold up, from a practical perspective, it is hard to know how to decide what is a compound and what is not. From a psychological perspective, maybe there is simply a gradient of conventionality, with the more familiar, frequently used combinations feeling like compounds and less common ones feeling like modifier-plus-noun phrases. In that case, there is no principled distinction to appeal to in deciding whether multimorphemic names do or do not label objects that count as examples of a given bare noun. In fact, if the more lexicalized modifier-noun combinations are the more frequently used ones, they are also likely to include some naming the most common referents of the noun (e.g., as in the shoe box and hairbrush, etc.), which argues against lexicalization as an indicator of names that should be treated as distinct from instances of the head noun alone.

3.4. Conclusion Regarding Interpretation Issues

Complexity of naming patterns is pervasive for nouns used to label artifacts, although it varies across noun types. Nouns that are transparently composed of several morphemes, including agentive nouns, may tend to stray less in their usage from that implied by the meaning of their constituents. Even in those cases, though, the constraints are not absolute, reinforcing the possibility that virtually any artifact noun has the potential to develop a range of uses that overlap with one another on different dimensions. This conclusion is not readily explained away by trying to limit the range of exemplars that should count in the analysis of a given name, because principled bases for limitations are lacking.

4. Implications of Artifact Naming Patterns for Other Aspects of Human Cognition

The points made so far have implications for understanding aspects of cognition beyond how people use English nouns. In this section, I will consider how the naming issues relate to views of artifact categorization, how English naming patterns relate to those of other languages, and how the cross-linguistic variability that exists impacts word learning by children and by those learning two or more languages (either from birth or as second-language learners later in life). I end this section by returning to
how naming and nonlinguistic thought are related, this time considering the
questions raised by the documented cross-linguistic variation.

4.1. Implications for Views of Artifact Categorization

As alluded to earlier, a large number of studies over the past several decades
have addressed questions about how adults and children categorize artifacts.
One major line of inquiry has been about how adults make artifact category
decisions—whether they are based on the form, original (intended) func-
tion, or current function of an object, the creator’s intended category
membership, or some combination of these factors. A second major line
has asked whether there is a developmental progression from one basis to
another. The latter studies have focused on whether children move from
form- to function-based categorization or whether they are oriented to
function from early on. In both the adult and developmental literatures,
original, intended function and creator’s intended category membership
have generally been taken as use of “deep” properties over more superficial
ones and sometimes cast in terms of psychological essentialism, the notion
that people seek some underlying trait that determines an entity’s kind
(Bloom, 1996; Medin & Ortony, 1989). The debates over the various
possibilities have been extensive, but they have not resulted in convergence
on final answers. Original, intended function and creator’s intended cate-
gory membership are often found to have strong pull in the answers
that both children and adults give to questions about what an object is
(e.g., Bloom; Diesendruck, Markson, & Bloom, 2003; Kemler Nelson
et al., 2002; Rips, 1989), but some studies have found contributions of (or
domination by) current function or form (e.g., Estes, 2003; Hampton et al.,
in press; Landau, Smith, & Jones, 1988; Malt & Johnson, 1992; Siegel &
Callanan, 2007). Methodological differences in the types of stimuli used and
how the judgments are posed to participants may contribute to the varying
results (e.g., Diesendruck et al.; Kemler Nelson et al., 2000; Malt & Sloman,
2007a). But there is also a theoretical muddying of the issues that contributes
to the lack of resolution. Defeyter, Hearing, and German (2009) remark that
research often has not distinguished clearly between the question of how
people categorize something and the question of to what extent they focus
on original or current function of an artifact when trying to understand a
novel object. Following from my earlier argument, I would suggest that the
confusion goes deeper than this. The research overlooks the difference
between naming and how people might understand or group objects con-
ceptually (Malt & Sloman, 2007a). Measures of artifact categorization are
most often measures of the name chosen for an object, usually in a forced-
choice task. The observations I have described make clear that the question
of how the name for a given artifact is determined does not have a simple
pick-one-factor answer, and so it is not surprising that results have been

mixed. In fact, it will not be possible to get an accurate picture of patterns of
artifact naming in the real world through tasks that tap only synchronic
variables, because such tasks eliminate many of the forces that actually
influence naming that I described earlier (such as cultural history, the impact
of word borrowings from other languages and subsequent reorganization of
semantic space, and marketing goals).

Once the distinction between naming and nonlinguistic understanding of
objects is appreciated, it is easier to make sense how the factors studied may
play in these processes. Many researchers who use naming as their dependent
measure are actually most concerned with how people think about and
conceptually group objects (e.g., Bloom, 2007). Despite the relevance of
form in establishing naming patterns, affording a use is the main reason that
artifacts exist. It is natural that function is primarily what people seek to
understand when encountering a novel artifact, that function may be a
dominant basis for grouping artifacts conceptually, and that whether original,
intended function or current use is more salient can vary depending on the
context in which the object is encountered. It is also natural to want to know
what use the original creator intended for object, because knowing that often
reveals what the best use of the object is. Conversely, despite the importance
of creator’s original intention in understanding artifacts, it is natural that it
would be only a partial determinant of naming. In communicative situations
people often receive direct information about what the object has been
named in the past. People will tend to respect this naming precedent for the
reasons described earlier: Language use is a social process, and using the name
offered is usually the best way to achieve mutual understanding and acknowl-
edge the speaker’s intentions. This name offered may be that intended by the
creator, in which case creator’s intention is carried forward, but it may also be
something else. Depending on the distance from the original creator and his
or her intentions, and the importance of any contrasting current goals, the
relative suitability of the original and possible alternative names may vary, and
names other than those associated with original intention may be adopted
(Malt & Sloman, 2007b; Siegel & Callanan, 2007; see also Chaigneau,
Barsalou, & Sloman, 2004).

The fluidity and flexibility of naming does not, by itself, argue against the
possibility that either original, intended function or creator’s intended cate-
gory membership fully determines the boundaries of some sort of nonlinguis-
tic categories. A problem with this line of reasoning, though, is that if the
groupings picked out by names are considered distinct from nonlinguistic
groups and therefore not revealing of them, it is hard to know exactly what
would constitute the nonlinguistic categories (Sloman & Malt, 2003). When
looking at an object that is plastic and has a snap lid, how would someone
judge that its use, or what its creator intended, should group it with cardboard
things with flaps and not with other plastic containers or with some new
group of things?
An alternative approach to this issue is to suggest that although name use in conversational contexts reflects the impact of metaphor, metonymy, pragmatic constraints such as lack of a better name, and so on, there are neutral contexts in which names delineate more constrained groupings and are a useful measure of the nonlinguistic categories (Bloom, 2007). That is, maybe the plastic snap container is not really a box, nor is, say, a drummer’s brush really a brush, even though they may be referred to in conversation as box or brush. In on-going work we have been evaluating how people make judgments of what something really is by asking them to judge whether certain artifacts are really examples of a particular name. In one study (Malt & Paquet, 2008), one group of participants gave typicality ratings to objects with respect to a target name (e.g., a short, round seat with three legs was judged typical of things called stool, and a taller, plastic seat with a back was judged less typical of things called stool). A second group of participants were then either told that the name (e.g., stool, in these cases) was given to the object by the creator or else was just assigned to it by someone who had found the object at a yard sale. The participants judged the extent to which each object was really an example of the target name. These really judgments strongly correlated with the objects’ rated typicality, and the judgments showed no effect of whether the creator intended it to have that name or not. In another study, we had people read stories in which a pictured object started out with one intended use and associated name (e.g., decanter) but the story characters then adopted a different use and associated name (e.g., vase) for it. Participants rated the extent to which the object was really an example of the first name and of the second. Original intention had an impact on the ratings, but the effect was modulated by how typical the pictured object was of each of the two names and whether or not the story characters had ever actually used the object as it was intended or had bought it planning to use it for the second purpose. In a study in progress, we have been using recent and more traditional objects associated with artifact names (e.g., a corded phone and a cell phone) and have asked college-aged and older adults to judge whether each object is really an example of the target name (e.g., phone). We are finding that older adults rate the recent objects as less really examples of the name than the younger participants do. All of these outcomes point to the conclusion that judgments of what an artifact really is don’t pick out some bounded underlying category defined by original intended use—or creator’s intended category membership. Instead, they reflect gradations in how well the object properties match properties associated with the word in the participants’ mind—multiple properties that can shift with context and across generations as the range of objects experienced in connection with the name shifts.

In light of these observations, one key implication for views of artifact categorization is that it is critical to distinguish whether the issue of interest in a given study is actually how people use names for artifacts or something
about how they understand them nonlinguistically, and to select methods
that will reflect the target topic. Another implication is that if there are
nonlinguistic “categories” that artifacts are put into, a noncircular way of
identifying those categories needs to be identified so that views of how this
categorization is accomplished can be evaluated (Sloman & Malt, 2003).
Alternatively, perhaps there are no such categories, apart from those given
by the use of a name in linguistic context (Malt & Sloman, 2007c; Sloman &
Malt). From the developmental perspective, these observations may actually
turn part of the research focus on its head. If it is of interest to ask how
children extend artifact names to objects (as opposed to how they under-
stand the objects nonlinguistically), then the most pressing issue is not to
decide whether they start with a shape-only strategy and shift to function
later or use function from the start. It is to determine whether children are
truly limited by either dimension in their early word use, and if so, how they
break free of a single dimension to mastering the full range of uses that are
linked by either one or both dimensions together. This perspective is
compatible with that in other developmental arenas. Young children can
be overly rigid as they begin to acquire a sense of adult conventions (e.g., in
applying mutual exclusivity to their word use, Markman & Wachtel, 1988;
or strict rules to moral behavior, Kohlberg, 1976; see also Casler, Terziyan,
& Greene, 2009). Becoming more flexible, not more constrained, is the
important developmental path they must follow. I will discuss developmen-
tal word learning issues further below.

4.2. Implications for Word Meanings Across Languages

Naming patterns for concrete objects have often been assumed to be more
cross-linguistically similar than naming patterns for abstract and socially
construed entities such as emotions or kin relations (e.g., De Groot,
1993). This assumption could be true for artifact naming if several condi-
tions were met: if the artifacts fell into fairly unambiguous groups with gaps
between them, if names were assigned to artifacts on the basis of the
groupings perceived when considering the current set together as a
whole, and if the objects and the resultant groups they fell into remained
constant over time and across cultures. I have already argued, though, that
the last two conditions don’t hold. Based on the examples that have been
discussed to this point, it should also be apparent that artifacts don’t always
fall into neat clusters separated cleanly from one another. Even if some
clustering exists, there are many objects that have partial overlap with
members of two or more clusters and no strong affiliation with anyone. If
patterns of artifact naming evolve over time and are subject to the varied
influences that I have described, then it should be expected that they will
vary across languages.
In several studies, my collaborators and I have found that this expectation is right. We first looked into this possibility by having largely monolingual speakers of American English, Argentinean Spanish, and Mandarin Chinese name a set of 60 photographs of common household objects (Malt et al., 1999). We found that the naming patterns of the three groups had similarities but also some notable differences. English speakers labeled most of the 60 objects with one of just three names—jar, bottle, and container—which they used in roughly equal proportions. Spanish speakers used 15 different names for the objects, with 28 objects being called frasco (or its diminutive, frascito), and each of the remaining names applying to no more than six objects. Chinese speakers used just five names for the objects, but one of these names (ping) accounted for 40 of the objects. These groupings of different sizes were not merely nested groupings reflecting finer and coarser differentiation; they were not all formed around the same centers and they partially cross-cut each other (Malt et al., 2003). We have now replicated these sorts of differences in naming patterns for Belgian speakers of Dutch and French using a different set of household containers plus a set of objects for preparing and serving food, and for speakers of English and Russian using a set of objects for holding and drinking liquids (Pavlenko & Malt, in press). Thus, the assumption that words for concrete objects in general will correspond closely across languages turns out not to be true.

The variation we have found for artifacts suggests that words for virtually any domain may be susceptible to some cross-linguistic variability. The extent of variability will depend on the extent of variation in the factors listed above. For natural kinds, for instance, if there has been more consistency over time in what exemplars are present in a culture and across cultures, and stronger clustering of exemplars with fewer exemplars that fall between clusters, there may be greater consistency in naming patterns (see Malt, 1995).

4.3. Implications for Developmental Trajectory

Most research on childhood word acquisition has focused on the learning that takes place from infancy through toddlerhood. There has been a sense that the interesting developmental stages of word learning are largely completed during this time (e.g., Bloom, 2000), except, perhaps, in certain domains that may pose special problems for the child (e.g., Clark, 1980). However, if artifact naming patterns vary from language to language and cannot be predicted just by looking for an obvious cluster into which each object falls, then learning to name artifacts as adults do will not be a trivial task. We (Ameel, Malt, & Storms, 2008) evaluated the developmental trajectory by comparing the naming patterns of Dutch-speaking Belgian children (aged 5, 8, 10, 12, and 14) to adults for large set of photos of household containers and objects for preparing and serving food (from Ameel, Storms, Malt, & Sloman, 2005, discussed later). We found that the children took up to
age 14 to converge their naming patterns onto those of the adults, even though the terms used by adults for most of the objects were present in their vocabulary by the age of 8. An extended reorganization of the lexical categories took place, with use of some names broadening (encompassing more objects) and others narrowing (encompassing fewer objects) over time. Regression analyses using features to predict naming choices at each age showed that this reorganization entailed learning both to attend to the same features the adults used and to assign adult-like weights to those features. These findings suggest that an extended word learning period to achieve full, adult-like use of words is not restricted to a small number of words or domains. It includes common, concrete terms such as names for familiar artifacts. Views of word learning will need to include an understanding of how word knowledge continues to develop throughout childhood. An important step toward a better understanding of the later stages of word learning for artifacts will be to know more about what it is that the child must master. How exactly do languages differ? Our previous work (Malt, Sloman, & Gennari, 2003) already demonstrated that different artifact naming patterns are not just a matter of the granularity of distinctions, but there is more to be understood about the differences. One way that the languages could produce the cross-cutting naming observed would be if they used different dimensions as the primary basis for grouping artifacts by name. For instance, one language might focus more heavily on shape, another on size, and a third on function. Under this scenario, the child’s task is one of parameter setting, as has been proposed for some aspects of grammar learning (e.g., in learning whether the language being acquired is one in which pronouns are routinely dropped; Chomsky & Lasnik, 1993). The child might have a range of possibilities ready, and by observing the adult naming patterns, she learns which values on the parameters create the artifact naming patterns of her language. But the discussion of English artifact naming above already suggests that this point of view is not likely to be right, since both function and form are implicated in English naming. The observations do not exclude the possibility that English weights certain dimensions more heavily than some other language does, but they do indicate that there will be no simple, single parameter setting that the child can select to produce mastery of English naming. What is needed, then, is to evaluate whether there are any systematic differences between languages that can be identified in dimensions weights or values used. If not, one can ask whether there are any systematic differences that are specific to certain parts of the domain. For instance, even if it is not true that English uses function more heavily Spanish or Chinese (or vice versa) across the board, could it be true for naming within some subset such as drinking vessels or tools? And if there turn out not to be any generalizations that can be drawn about dimension values or weights even within some portion of artifacts, then it will be important to characterize the differences at a finer
Informally, in a study of naming of drinking vessels in English and Russian that will be discussed below, we (Pavlenko & Malt, in press) have noted that, for instance, the English distinction between cup and glass is more heavily based on material than the Russian distinction between chashka and stakan, which is more based on size and shape. At the same time, English separates mug from cup based on size and shape and Russian further separates fascher from stakan based on material and function (use for alcoholic drinks).

So each language appears to make similar featural contrasts but applied to different sets of objects. Recently, we have been using feature-based regression models to more systematically explore the differences in naming patterns across English, Dutch, and French for household containers and objects for preparing and serving foods. As the Russian examples suggest, we have been finding that the three languages use the same dimensions and values on dimensions, but in different combinations for specific naming contrasts. For instance, one language may discriminate by name within bowl-shaped objects based on size whereas another does not, but the second language may discriminate between cardboard storage containers based on size. Even these statements do not fully take into account the family resemblance and chaining phenomena among objects that share the same name, where some can overlap on one dimension or set of dimensions and others will overlap on different ones. Interesting work remains to be done to fully characterize what it is that children must learn and how they are able to do so.

4.4. Implications for Bilingualism

Traditionally, research on bilingualism has not taken much interest in the mastery of words for concrete objects because of the assumption that the meanings of these words map closely across languages. If this assumption were right, then mastery would only be a matter of learning what word in one language corresponds to each word in the other one. However, our data comparing naming patterns across languages imply that the task is not nearly so easy. We tested this possibility by studying people who came to the United States (mostly as students) with first languages other than English (Malt & Sloman, 2003). All participants were immersed in English at the time of testing but varied from recent arrivals to 18 years of residency. Participants named pictures of artifacts in English, judged the typicality of each with respect to several English names, and gave us their intuitions about how they selected names. For comparison, native speakers did the same naming and typicality tasks. Even those second-language learners with the shortest length of immersion (less than 1 year) produced most of same basic vocabulary words that native speakers did, but they differed from native speakers in their application of the words to specific objects. Learners with less than 1 year of immersion showed the most divergence, and agreement with native speakers increased as a function of years of immersion. Similarly, those with
the fewest years of immersion did not have a good sense of what is most
typical of names such as bottle or plate, etc., but typicality judgments corre-
sponded better to native speakers’ over time. Strategy reports showed a shift
from greater reliance on explicit use of specific features or translation equiva-
\[\text{(10 or more years) still deviated significantly from the native speakers in both naming patterns and typicality judgments for some of the words. Mastering the subtleties of the artifact naming patterns of a second language is not at all quick and easy. To the contrary, it is a long, slow process, just as for the child native learner. Deviations from the language community’s norm may have subtle but real consequences for communication. For instance, a native Dutch speaker recently asked me, in an airport boarding line, if I had obtained a chair. His English was otherwise excellent, but it took several rounds of back-and-forth before I understood that he was asking if I had a confirmed seat on the overbooked flight.}

If second-language learners immersed in the second language do gradu-
ally converge on native speakers’ patterns of word use, this outcome raises the question of what becomes of the naming patterns in their native language. Reaction-time studies have demonstrated that a bilingual’s two lexicons are not isolated from each other and interact in some fashion. For instance, words of one language prime words in the other (e.g., Altarriba, 1992; Kroll & Curley, 1988). Given this interaction, second-language learners who become dominant in the second language may show an influence of the second on the first, shifting their native naming patterns in the direction of the second. Wolff and Ventura (in press) found evidence for this sort of effect in the learning of causal verbs. We (Pavlenko & Malt, in press) studied artifact naming patterns in Russian for native speakers of Russian who came to the U.S. at various ages and became immersed in English. We compared their patterns to those of native largely monolingual speakers of English and Russian. Even those who came to the U.S. as adults and rated their Russian proficiency considerably higher than their English proficiency showed some modest signs of English influence on their Russian naming. Those who came to the U.S. in childhood (ages 8–15) showed slightly greater influence. A substantially larger impact was shown by those who came to the U.S. early in their lives (ages 1–6), even though all had begun to learn Russian before exposure to English, continued to speak Russian at home, and considered themselves moderately proficient in Russian. These data indicate that even for those becoming immersed in the second language in adulthood, there can be an influence of the second language on the first. It is noteworthy, though, that the largest impact was seen for those who had spent less time immersed in Russian and more time immersed in English. This outcome raises new questions about to what extent first-language shifts in the direction of a second language are
related to the initial strength of the memory traces of the first language, the
completeness of learning, or the frequency of current use, and to what
extent they depend on similar variables for the second language.

The possibility of cross-talk between the two languages of second-
language learners also raises the question of what learners do who are exposed
to two languages from the start. One possibility is that these early learners,
acquiring two native languages during the period in which language acquisi-
tion is thought to proceed most effortlessly, are able to do something late
learners do not: learn and maintain two separate sets of naming patterns, each
fully matching monolinguals in each language. Alternatively, these children
might still not be able to accomplish this feat despite their early learning and
might in some way create a compromise between the languages. We (Ameel
et al., 2005) addressed this question in Belgium, where part of the population
is Dutch-speaking and part is French-speaking but it is fairly common for
Dutch- and French-speakers to intermarry. We looked at the naming pat-
terns of Belgian adults who had been raised with one parent whose native
language was Dutch and one whose native language was French, each of
whom consistently spoke their own native tongue to the child. We compared
bilinguals’ performance in each of their two languages (tested on different
days to avoid carryover effects) to that of largely monolingual Belgian speak-
ers of Dutch and French. Stimuli for the study were again sets of photos of
household containers and objects for preparing and serving food. Consistent
with earlier data, we found that the monolingual speakers had some note-
worthy differences in their naming patterns for these objects. Bilinguals,
however, showed better correspondence between the naming patterns in
their two languages than the monolinguals did for the same two languages.

In effect, bilinguals converged the patterns of the two languages toward each
other so that they were less distinct. Since they did not merge the patterns to
the extent of yielding a single, shared pattern for both, the data imply that the
differences are to some extent observed and encoded, but cross-connections
between the two lexicons may end up adjusting connections weights
between objects and words so that convergence occurs. Our on-going
research is examining the time-frame in which this takes place: Do children
start off with two distinct patterns that converge over time as repeated uses
cause adjustments of connection weights, or is the cross-language influence
something that is at work from the start, producing convergence from the
early stages of word learning?

4.5. Implications for the Whorfian Hypothesis

The Whorfian hypothesis that language shapes thought (Whorf, 1956)
suggests that where languages differ from one another in their naming
patterns, their speakers’ concepts of common objects should differ. The substantial differences we found in naming patterns for household
containers by speakers of English, Chinese, and Spanish suggest that these three groups should have quite noticeably different concepts in the domain. However, people learn a great deal about artifacts from direct interaction with them, not through language alone, and so the degree of linguistic differences may exceed that of conceptual differences (Malt, Gennari, & Imai, in press; Wolff & Malt, in press). Malt et al. (1999) evaluated similarity sorting by the three groups as well as naming and did find that groupings according to similarity were shared more strongly across the three groups than groupings according to name, suggesting that perception of the objects’ properties was at least partially independent of language. Even those most sympathetic to Whorfian hypothesis would generally not argue that words completely fix concepts, though, and so this finding, while not necessarily predicted a priori by the Whorfian position, is not entirely incompatible with it. One would want to ask whether the smaller differences in similarity sorting that did exist among the groups could reflect linguistic differences. Many studies testing Whorfian predictions (e.g., Kay & Kempton, 1984; Winawer et al., 2007) have made the straightforward prediction that speakers of a language that labels a certain distinction will see a greater difference between the two sets of referents than speakers of a language that does not make the distinction. This sort of prediction cannot be easily applied to the household container domain, though. For instance, in our study, Spanish speakers used *frasco* for many of the objects named *bottle* in English as well as all of those named *jar*, but on the other hand, they gave distinctive names to some objects that English speakers included within *bottle* (e.g., *mamadera* for a baby bottle; *talquera* for a talc bottle; *roceador* for a spray bottle.) Given both facts, it is not clear whether Spanish speakers should pay more attention to the form and/or function of objects in the *bottle/jar* range for English speakers or less. In fact, we (Malt et al.) found no evidence that what differences did exist in similarity sorting corresponded to where the languages differed in their naming patterns for a given pair of objects. The challenge for further testing a Whorfian perspective in the artifact domain is, then, to identify what specific effects of the linguistic differences one could expect given the complexity of the naming patterns and the nonsystematic nature of the differences among the languages.

5. **Summary and Conclusion**

5.1. **Summary**

Artifact naming patterns are complex. A given artifact noun, such as *fan* or *razor*, may be extended from one case (say, a metal key and a manual razor) to other objects that are unlike them in form but share the same function (say, an
electronic card-like key and an electric razor). Conversely, other artifact nouns, such as brush or knife, may be extended from one case (say, a hair brush and a dinner knife) to other objects that are unlike them in function but have similar forms (say, a scrub brush and a putty knife). Furthermore, some individual nouns have extensions based on shared form and others based on shared function, and some extensions may implicate form and function together. These patterns can be captured descriptively by the notion of a family resemblance among the exemplars of a noun, with each use needing only to overlap with some others on one or more dimensions. To account for the pattern theoretically, it is important to recognize that naming patterns result from diachronic, not just synchronic, processes. Naming patterns evolve over the course of a language’s history, with the pattern that emerges being influenced by cultural factors such as what objects are present in the culture at different times and linguistic factors such as what names become available through language contact and borrowing. Furthermore, it is important to recognize that naming patterns are influenced by social processes, not just individual ones. Naming is goal-driven, so that the selection of a name for an object may be influenced by the desire to either highlight similarities with certain other objects or distance the object from them. And naming is cooperative, with speakers and addresses working together in conversation to ensure that artifact nouns are interpreted as intended despite the wide variation in what the noun could refer to. Certain nouns may tend to stray less in their usage than others, but even in those cases, the constraints are not absolute, suggesting that virtually any artifact noun may be able to develop a range of uses that overlap on different dimensions. These points about the nature of artifact naming patterns and how to account for them cannot be readily dismissed by trying to limit the range of exemplars that should count in the analysis of a given name, because no principled bases for limitations are apparent.

The observations about artifact naming patterns and how they come about have implications for understanding other aspects of cognition. One is in reconciling conflicting data that have accumulated on the nature of artifact “categorization.” Because of the impact of historical and social influences on naming, an account of artifact naming must differ from an account of how people conceptualize the objects nonlinguistically. Once the distinction between naming as linguistic process and understanding artifacts as a conceptual process is recognized, the observations about naming are not incompatible with arguments that have been made about the nature of artifact conceptualization; they can be different but both correct. Another area of implication is for artifact naming across languages. Because languages have different cultural and linguistic histories, artifact naming patterns may differ from language to language, and this expectation has been confirmed. The cross-linguistic variability, in turn poses special challenges for child language learners, whose task is not just to identify obvious clusters of objects and put a name onto each but to learn a less-obvious grouping that the language of their
environment imposes on the objects. Child learners require many years to converge on adult naming patterns even for names of common household objects, and much more remains to be understood about what goes on during this extended learning period. Speakers of two languages have the added challenge of trying to acquire and maintain two distinct sets of naming patterns. Recent data suggest that the naming patterns of the languages can exert mutual influences on each other, with bilingual patterns differing from those of monolinguals in each language. This influence takes place whether the two languages are learned in parallel from infancy or the second is acquired later in life. Finally, the complexity of the naming patterns in any given language add a wrinkle to understanding how language may influence thought, because the nonsystematic nature of the differences makes it hard to generate straightforward predictions about where linguistic influence may lie.

5.2. Conclusion: Not Amazing, Yet Still Amazing

I opened this chapter pointing to a recent television ad in which a company CEO comments that it is amazing we call today’s smart phone by the name phone. I argued that this usage is not amazing at all in the context of a broader consideration of how artifact nouns are used. But in closing, it may be appropriate to turn that judgment on its head. Many artifact names, such as the ones used in examples throughout this chapter, are common, familiar nouns that refer to objects frequently observed and talked about in everyday life. As with many other highly familiar phenomena, in daily life we may take their use for granted, assuming there is little of interest to discover in the distribution of the names or the evolution or acquisition of the patterns. I have tried to show throughout the chapter that there is a rich and intriguing set of observations and issues tied to the use of artifact names. From this perspective, the CEO was right. It is amazing indeed that we still call it a phone.

ACKNOWLEDGMENTS

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REFERENCES


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