Chapter 9

# Why Can't You "Open" a Nut or "Break" a Cooked Noodle? Learning Covert Object Categories in Action Word Meanings

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## INTRODUCTION

Psychologists interested in the development of object concepts have focused primarily on categories of objects that are labeled by nouns, such as *dog, animal, cup,* and *chair.* Named categories of objects are indeed critically important for language learners. But object classes are woven into the structure of language in a number of less obvious ways as well, for example, into the meanings of verbs, prepositions, particles, and other relational words. These concepts are often "covert": Speakers are typically not consciously aware of them, and they elude simple description. Yet children must master them to become fluent speakers of their native language. How do they do this?

As an informal introduction to the problem, let's look first at a relatively straightforward case. The felicitous use of the English verb *kick* requires that the action referred to involve a specific body part, a "foot" (generously defined so as to take in hooves, paws, and the like). It cannot be applied to otherwise "kick-like" actions using another body part (arm, wing, tail, etc.), much less no body part at all (except for certain metaphorical extensions). So "foot" is a covert object category lurking in *kick.* In this case the covert category coincides with a concept for which there is a nominal label, *foot.* Other examples of such verbs include *eat* ("food"), *drink* ("liquids"), and *neigh* ("horse"). Although the importance of "foot" for the concept *kick* may seem obvious, it is not necessarily so for children.

For example, between the ages of 1;6 and 1;8 a little girl, E, overextended *kick* to a variety of actions that were in some ways kick-like but did not involve a foot, such as throwing something, bumping her stomach up against a mirror on the wall, the fluttering of a moth on the table, and hitting a ball with the front wheel of her tricycle, making it roll (Bowerman, 1978a). Interestingly, this error ceased just as the noun *foot* appeared in her vocabulary.

Unlike *kick*, most covert object categories underlying non-nominal forms do not correspond directly to named object categories. Good examples are the objects relevant for actions English speakers call *open*, *cut*, or *break*. The existence of action-related object requirements becomes most apparent when these requirements are violated, as in the following child utterances (Bowerman, 1978a, and unpublished records):

1. OPEN
   a. *Open.* (Trying to separate two stuck-together Frisbees. C 1;4)
   b. *Open.* (Request for M[other] to crack nuts for her. E 1;6)
   c. *Mommy! Open!* (Wants M to take last pieces out of a wooden jigsaw puzzle. C 1;8)
2. CUT
   a. *Daddy cut ice.* (Watching F[ather] break ice cubes into chips with a rolling pin. C 1;10)
   b. *Me cutting.* (Pulling pieces of peach apart with her fingers. C 2;1)
   c. *Hey! I was about to cut mine!* (Getting ready to crack a nut with a mallet; upset when M puts her nut down in its place. C 7;7)
3. BREAK
   a. *Break it.* (Peeling a cooked noodle apart. E 1;8)
   b. *Don't break my coat.* (As someone pulls on the back of her coat. C 2;11)

In every instance the child's intention is clear, and the action is in many ways similar to an action that can felicitously be described as *open*, *break*, or *cut*. But it is strange to speak of "opening" objects like nuts or Frisbees, "cutting" things with instruments like rolling pins, fingers, or mallets, and "breaking" objects like cooked noodles and coats. What does the child have to know in order to be able to apply these verbs only to events involving objects of the "right kind"?

For adults who speak the same language as the child, the categories may seem obvious: Surely any self-respecting infant will come to identify "openables," "cutting instruments," and "breakables" in the course of his or her nonlinguistic interactions with the world! But there is striking variation across languages in the makeup of the covert object categories associated



with verbs and other relational morphemes. For instance, the class of "openable objects" that is critical to the meaning of the English verb *open* is irrelevant in Korean, which partitions the domain covered by English *open* among at least six verbs (Bowerman & Choi, 2001).

The language-specificity of covert object categories raises an intriguing possibility: that children form object categories not only through their nonlinguistic experience with objects (and possibly their observations of how adults label them), but also through learning the semantics of action words. Roger Brown once suggested that "the requirement that a child learn to make correct referential use of a morpheme . . . is sufficient to cause the child to form the governing concept if the physical world has not already imposed it upon him" (1965, p. 317). In the cognitivist climate of the last 40 years, this idea has rarely been pursued. One goal of this chapter is to show why, after all, it must be taken seriously.

## CROSSLINGUISTIC PERSPECTIVES ON COVERT OBJECT CATEGORIES

It is possible, as we have just seen, to illustrate covert object classification by non-nominal forms using English examples, but English in fact demands relatively little of its learners along these lines: In this language, information about objects *is* in fact heavily concentrated in nouns. In many other languages the task of imparting object information is far more extensively shared by other parts of speech, including special classifier morphemes, verbs, prepositions, particles, and verb affixes. The relative emphasis on nominals built into the structure of English and related languages—which is mirrored, incidentally, in the relative emphasis placed on learning nouns by English-speaking mothers (Choi, 2000)—is perhaps an important reason why investigations of object categorization in the Western world have revolved so closely around nouns and noun semantics. If the developmentalists interested in the acquisition of object concepts had been native speakers of, say, Cherokee, Navajo, or a Mayan language, the research in this field might have looked very different!

### Classifiers

The best known linguistic devices with which languages express covert object category information are probably *numeral classifiers* (see Grinevald, 2000, and Aikhenvald, 2000, for good recent reviews). Characteristic of Southeast and East Asian languages, and also found in Mesoamerica and

Oceania, numeral classifiers are elements that are obligatory in noun phrases in the context of *quantifying* objects (e.g., counting them, or asking how many there are). These forms often have anaphoric (pronoun-like) uses as well. Numeral classifiers categorize the referents of noun exhaustively as members of one or another of a discrete set of classes, most typically on the basis of dimensionality and shape, often combined with secondary characteristics of consistency, size, or animacy. Paraphrases give the rough idea: "one *ROUND.CLASS* orange (ball, stone . . .)"; "two *LONG.RIGID.CLASS* pencils (boards, guns . . .)"; "three *FLAT.FLEXIBLE.CLASS* blankets (pants, pieces of paper . . .)"; "five *FOUR-LEGGED.CLASS* donkeys (cows, dogs . . .)."[1]

In real life, of course, the meanings of classifiers do not come prelabeled for children: It is one thing to read a gloss like *ROUND.CLASS* or *LONG.RIGID.CLASS* (these sound deceptively simple), and another to arrive at such meanings through observing actual contexts of use. And although similar physical features of objects often play a role in the semantics of numeral classifiers across languages (E. Clark, 1976), the categories vary and can be quite idiosyncratic. For instance, Burmese has a numeral classifier for "long slender living or recently living things which are vertical or perpendicular to the object to which they are attached" (trees, plant, blades of grass, hair, strands of woolen yarn, etc.) (Burling, 1965). And Tzeltal Mayan has a classifier for "oblong, vertically erect solid objects slightly diminishing toward the apex" (Berlin, 1968).

There are several other less familiar types of classifiers as well (Grinevald, 2000; Aikhenvald, 2000).[2] For example, many Oceanic languages have *genitive classifiers*: bound morphemes that must be used in constructions specifying possession, as suggested by paraphrases like "my-*EDIBLE.CLASS* food,"

[1]In some languages each noun can be combined with only one classifier, while in others different classifiers can be used to highlight different aspects of a noun's referent. For example, in Japanese, T-shirts can be enumerated with a classifier for either *FLAT FLEXIBLE* objects or *CLOTHING ITEMS*, whereas in Burmese, knives can be counted as *LONG RIGID* objects (along with umbrellas, spoons, etc.), as *CUTTING INSTRUMENTS* (along with axes, scissors, etc.), or as *HUNTING INSTRUMENTS* (along with guns, bows and arrows, etc.) (Grinevald, 2003).

[2]In some cultures, *conventional gestures* may serve a function analogous to that of classifiers. For example, when indicating the height of something, it is conventional in much of Mexico to vary the orientation and shape of the hand according to the class of the object being measured (Foster, 1948): index finger pointing upward for humans (e.g., a child); hand extended sideways with palm vertical to the ground for nonhuman animates (e.g., a donkey); and hand flat with palm down for inanimates (e.g., a fence or table). The selection of the gesture is done outside the focus of awareness, and can sometimes lead to implicit dilemmas. When asked the size of the wooden statues of the saints in the church of a neighboring town, a village woman talked confidently, while her hand wavered uncertainly back and forth between the "inanimate" and the "human" gesture (Mary L. Foster, personal communication, 1975). (See Zavala, 2000, p. 144, and Wilkins, 2003, for additional examples of classification by gesture.)



"my-*TRANSPORT.CLASS* boat," "my-*WEAPON.CLASS* bow." These classifiers tend to pick out object categories defined by function, as shown, rather than shape. Still another classifier genre, *noun classifiers*, is found in many Mayan and Amazonian languages; these forms serve various syntactic functions such as determiner of a noun and third-person pronoun. For example, for Jakaltek Mayan: "*MAN.CLASS* John saw *ANIMAL.CLASS* snake" (John saw the snake); "ripe *PLANT.CLASS* tomato is red" (the ripe tomato is red); "*MALE.NON-KIN* saw *ANIMAL.CLASS* (he saw it [an animal])." Classifiers of this kind often pick out the material of which something is constituted.[3]

Some languages have only one set of obligatory classifiers, whereas others have two or three, often requiring speakers to classify the same object in multiple ways within the confines of a single sentence. For example, to report that "there are two avocados" in Akatek Mayan, one says roughly, "there are two-*INANIMATE.CLASS VEGETABLE.CLASS* avocados," thus indicating not only that these things are avocados (the noun), but also that they are inanimate entities (the numeral classifier), as well as vegetable entities (the noun classifier) (Zavala, 2000). But multiple classification of the same referent is not restricted to exotic languages. Notice, for example, that in the everyday English sentence *I put the apple in the bowl*, the object to which the apple is transferred is assigned not only (by the noun *bowl*) to the category of "bowls," but also (by the preposition *in*) to a more abstract class of containers and volumes that encompasses, for example, baskets, mugs, mouths, puddles, gopher holes, and clouds.

## Classification by Verbs

Systematic categorizations of objects of the kind typically associated with classifiers are carried out in some languages by verbs (see Grinevald, 2000, and Aikhenvald, 2000). One kind of classification by verb involves a relatively transparent operation whereby an affix specifying a certain class of objects is inserted into the verb stem, with an effect suggested by paraphrases like "I *VEHICLE-have* a car" (I have a car) and "I *DOMESTIC.PET-have* a dog" (I have a dog). Another kind of verbal classification, particularly well developed in Athapaskan languages of North America such as Navajo and Chipewya, requires speakers to choose among multiple distinct verb stems,

[3]These classifiers apply not only to objects that are clearly, for example, "animals" or "plants," but also to objects that come from these sources (thus, *ANIMAL.CLASS* egg/milk/shoe; *ROCK.CLASS* bottle/can/pot) (Grinevald, 2000). Such systems evolve over time, and the introduction of nontraditional objects may force creative extensions and eventual changes in the category; for instance, modern Jakaltek speakers classify plastic sandals along with leather footwear under the *ANIMAL.CLASS* marker.

all expressing what from the English point of view is "the same" event or situation, but involving objects of different kinds. For example, to speak of the motion or location of an entity, a Navajo speaker must select from among 12 parallel "classificatory verb" stems according to whether X is a: *ROUND OBJECT, LONG OBJECT, LIVING BEING, FABRIC-LIKE OBJECT, BULKY OBJECT, RIGID CONTAINER WITH CONTENTS, SET OF OBJECTS, SET OF PARALLEL OBJECTS, MASS, WOOL-LIKE MASS, MUD-LIKE MASS, ROPE-LIKE OBJECT* (Hoijer, 1945).

These verb stems often define whole covert taxonomies of objects (Basso, 1968; Carter, 1976; Haas, 1967). For instance, to say "X is there" or "give me X," Chipewya speakers must not only distinguish animate referents from referents of all other kinds, but subdivide them by choice of verb stem according to whether they are *AWAKE, SLEEPING,* or *DEAD* (with the last-mentioned including not only dead people but, for example, a raw fish) (Carter, 1976). According to Carroll and Casagrande (1958), speakers of languages like these are not consciously aware of the systematic nature of the object classifications built into their verb system, and have no explicit labels for these object categories.

Although few languages build object classification into their verbs as pervasively as Athapaskan languages, every language has verbs that impose restrictions on the kinds of objects involved in the event.[4] The zeal with which languages differentiate among objects in their verbs is related in part to language family affiliation; for example, the Mayan languages dazzle speakers of English with their proliferation of verbs for seemingly "similar" events and situations involving different objects (Berlin, 1967; P. Brown, 1994, 2001; Pye, 1996). Degree of object differentiation is also influenced by broader typological differences among languages; for example, Plank (1985) showed that in domain after domain, German draws finer semantic distinctions with its verbs than English does, and he related this to the fact that German, but not English, distinguishes formally between types of grammatical objects (accusative vs. dative). An additional influence is the geographical area where a language is spoken: for example, verbs make fine object distinctions not only in Mayan languages but in many other unrelated languages of Mesoamerica as well. But even when languages agree in subdividing events according to the properties of the objects involved, they differ in how finely they partition the object categories, the object properties that are important, and which categories of objects are important for which kinds of events.

[4]The object with which the verb must "agree" is often the referent of the direct object of a transitive verb or the subject of an intransitive verb. Subjects of transitive verbs typically impose only very general constraints, for example, that the referent entity be animate (Keenan, 1986). These constraints have often been treated grammatically as "selection restrictions" on core arguments, but verbs can also constrain the referents of instruments, place noun-phrases, and other non-arguments: *kick* (foot) and *carry* (support by a body part) are examples.



## Categorization of Objects Relevant to Early-Learned Action Words

Among the conceptual domains that are broken down differently by different languages, several are of particular interest from a developmental point of view because they include high-frequency verbs and other relational words that are learned very early, usually in the second year of life, and some comparative data are available on how children use them. These include verbs for dressing (putting on clothing), carrying and holding things, and consumption.

***Dressing.*** For putting on clothing in English, one verb fits all: Regardless of the clothing item or body part, *put on* is the verb of choice (Fig. 9.1a).[5] Other languages require the speaker to choose from among a set of dressing verbs that distinguish between putting clothing onto various parts of the body. For example, Korean (Fig. 9.1b) distinguishes (among other dressing categories) between putting clothing on the head (*ssuta*, e.g., for hat, face mask, glasses, putting up umbrella), trunk or legs (*ipta*, e.g., for coat, shirt, pants, skirt), feet (*sinta*, e.g., for shoes, socks, roller skates), and wrist or waist (*chata*, e.g., for bracelet, belt, dagger) (Choi & Bowerman, 1991).

Japanese (Fig. 9.1c) also has a set of specialized "dressing" verbs, but the body regions and clothing sets that these verbs pick out are not identical to those of Korean (Kameyama, 1983); in common is a "head" verb (*kaburu*),[6] but below the neck the main partition falls not at the ankles but at the waist (*kiru* for the upper torso, *haku* for the lower torso on down through the feet) (compare Figs. 9.1b and 9.1c).

Still another approach is seen in the dressing verbs of two African languages (Schaefer, 1985). Tswana, a Bantu language of Botswana, distinguishes between putting clothing on the extremities (head, hands and arms, feet: *gòrwálà*) versus on the more central region of the body (*gòàpàrà*) (Fig. 9.1d), whereas Yoruba, a Niger–Congo language of Nigeria, has a special verb for putting clothing on the head (*dé*), but collapses all the other regions of the body into a single category (*wṑ*) (Fig. 9.1e).

[5]English in fact treats putting on clothing as a subtype of a much broader concept: *put on* picks out controlled actions (typically by hand) of bringing one entity into contact with the exterior surface of another entity ("put the magnet on the refrigerator," "put the cup on the table," etc.). But the "dressing" version of *put on* is syntactically somewhat specialized, in that the goal object is routinely omitted: *put your coat on/?on your body*; compare with *put your cup *on/on the table.* Some languages have a special verb for "putting on clothing" (e.g., Tzeltal and Tzotzil Mayan; P. Brown, 2001; de León, 2001), but do not subdivide the domain further.

[6]The meanings of the two "head" verbs are not, however, identical: Korean *ssuta* can be used for donning anything that is conventionally worn on the head or face, including, for instance, glasses, whereas Japanese *kaburu* is used for covering the head with something—conventionally hats and the like, but also, for example, a blanket or coat.

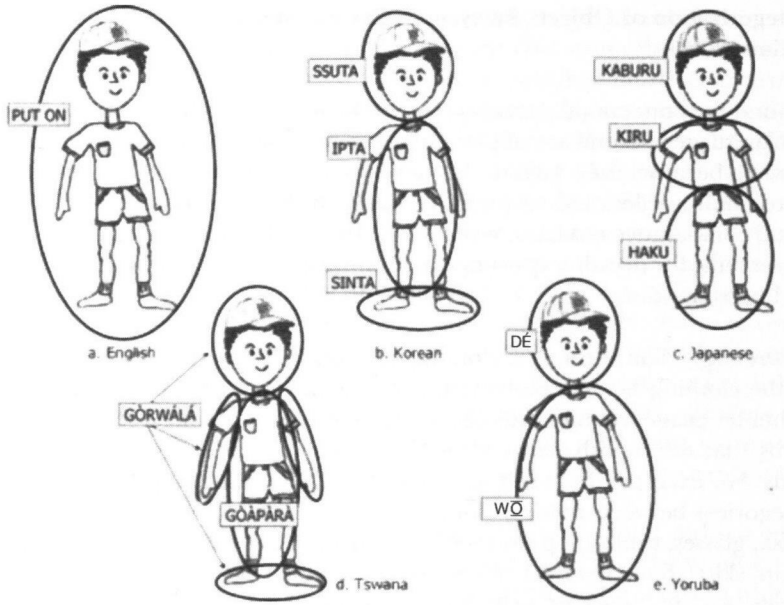


FIG. 9.1. Categorization of acts of putting on clothing in several languages.

***Carrying.*** When someone moves along supporting an object above the ground, this is described as "carrying" by speakers of English. *Carry* is indifferent to both *what* is carried and *where* on the actor's body it is supported (Fig. 9.2a). We have already seen that when talking about the movement or location of objects, speakers of Athapaskan languages like Navajo must choose among verb stems on the basis of the nature of the object; the application of these roots to "carrying" events is shown in Fig. 9.2b. Events such as those shown in Fig. 9.2 are also distinguished in Tzeltal Mayan (P. Brown, 2001), Tzotzil Mayan (de León, 2001), and Korean (Choi & Bowerman, 1991), but differently in Navajo: not according to the carried object, but to the body part that supports this object; see Fig. 9.2c for the Tzeltal system.[7]

[7]There are other differences among these verbs in addition to those captured in Fig. 9.2. English *carry* requires the agent to be moving; *hold* is its usual static counterpart (Talmy, 1985): *Mary *carried/held the baby while she sat on the couch; Mary carried/*held the baby into the kitchen.* The Navajo forms are applied to both the motion and location of the specified kind of object across a wide range of event types distinguished in English (carrying, giving, throwing, putting, etc.). The Tzeltal and Korean forms are more similar to English *hold* than to *carry* in that they do not inherently specify motion. Toddlers often use them as requests to be picked up and supported by the specified body part.

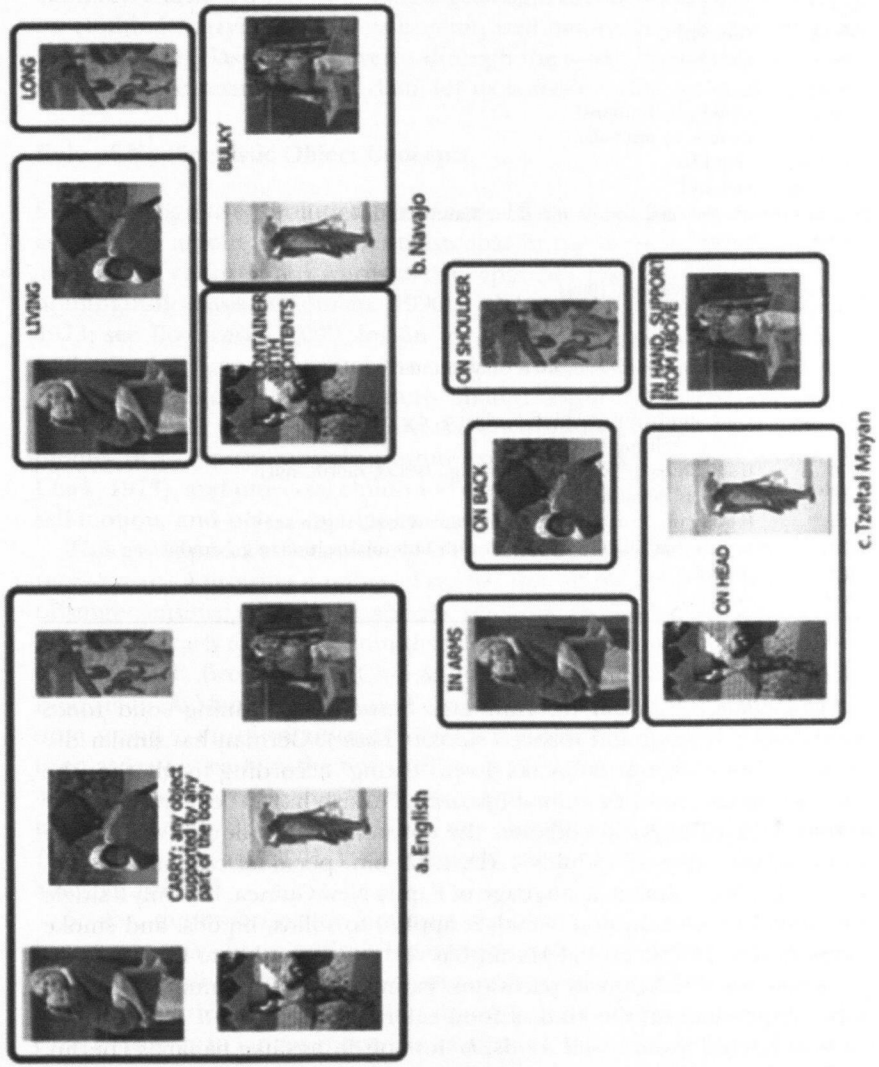


FIG. 9.2. Categorization of "carrying" in several languages.

TABLE 9.1
Verbs of Consumption in Different Languages

| | |
|---|---|
| *English* | |
| *eat* | (solids) |
| *drink* | (liquids) |
| *smoke* | (smoke) |
| *German* | |
| *essen* | (solids, by humans) |
| *fressen* | (solids, by animals) |
| *trinken* | (liquids) |
| *rauchen* | (smoke) |
| *Turkish* (Slobin, personal communication, March 12, 2002) | |
| *yemek* | (solids) |
| *içmek* | (liquids, smoke) |
| *Kalam (New Guinea)* (Pawley, 1993) | |
| *ñb-* | (solids, liquids, smoke) |
| *Tzeltal Mayan* (Berlin, 1967; P. Brown, 2001) | |
| *tun* | (superordinate 'eat', used only in interrogative contexts, e.g., "What are you eating?") |
| *lo'* | (soft, mushy, or gelatinous objects, e.g., banana, potato) |
| *ti'* | (meat, chili, mushrooms) |
| *k'ux* | (individuated hardish objects, e.g., beans, radish, nut) |
| *we'* | (tortillas, breadstuffs) |
| *tz'u'* | (chewy object with pulp expectorated, e.g., sugarcane) |
| *butz'* | (foods that dissolve in mouth with little mastication, e.g., candy) |
| *uch'* | (liquids) |
| *nuk'* | (smoke) |

***Consumption.*** English discriminates between consuming solid foods (*eat*), liquids (*drink*), and tobacco smoke (*smoke*). German has similar distinctions, but obligatorily breaks down "eating" according to whether the actor is human (*essen*) or animal (*fressen*). Turkish has an "eat" verb similar to that of English, but it collapses the consumption of liquids and smoke into a single category ("fluids") (D. I. Slobin, personal communication, March 12, 2002). Kalam, a language of Papua New Guinea, has only a single verb root for consumption, which it applies to solids, liquids, and smoke alike (Pawley, 1993). Tzeltal Mayan has verbs comparable to English *drink* and *smoke*, but it obligatorily partitions "eating" into a large number of categories depending on the kind of food eaten, for example, *ti'* for meat, *we'* for tortillas and grain-based foods, *lo'* for soft things like bananas (Berlin, 1967; P. Brown, 2001).[8] These differences are outlined in Table 9.1.

[8]Tzeltal does have a superordinate verb for eating, *tun*, for situations in which the identity of the foodstuff is unknown, as in "What are you eating?," but one of the more specific verbs must be used when the identity is known.



## ACQUIRING COVERT OBJECT CATEGORIES: SOME THEORETICAL QUESTIONS

Children learning a variety of languages begin to talk about acts of putting on clothing, carrying, and consumption well before the age of 2. How do they implicitly classify these events through the words they select to encode them? Before turning to the data, let us consider what we might expect.

### Role of Nonlinguistic Object Concepts

Since the cognitive revolution of the early 1970s, there has been a pervasive assumption among developmentalists that in the early stages of language acquisition, children link words to concepts they have already formed on a nonlinguistic basis (Gleitman, 1990; Nelson, 1974; Piaget, 1954; Slobin, 1973; see Bowerman, 2000, for an overview). These concepts are, by hypothesis, the same all around the world, because they are shaped not by exposure to language but by infants' shared cognitive and perceptual predispositions (E. Clark, 1976), universal environmental and biological conditions (e.g., gravity, upright posture, possession of a human body) (H. Clark, 1973), and universal childhood experiences such as eating, sleeping, self-motion, and object manipulations.

This assumption of "cognitive priority" has been seriously challenged in recent years: A growing number of studies now shows that children are surprisingly sensitive to language-specific semantic categories in the input language by as early as 18 to 24 months (Bowerman, 1996; Bowerman & Choi, 2001, 2003; P. Brown, 2001; Choi & Bowerman, 1991; Choi, McDonough, Bowerman, & Mandler, 1999; de León, 2001). This work suggests that children attend to the distribution of forms across contexts in the linguistic input from at least as early as the one-word stage, and can use this information to *construct* semantic categories when necessary (i.e., when the concepts needed to guide the word's application are not already nonlinguistically present) (Bowerman & Choi, 2001, 2003; Casasola, in press; Casasola, Wilbourn, & Yang, in press).[9]

So far, the evidence for language specificity and for language-driven learning comes almost entirely from the domain of spatial relations; other kinds of meanings have yet to be systematically explored. When it comes to object categorization, the existing literature gives little reason to expect early sensitivity to language-specific categories. Infants have been shown to categorize objects at various levels of abstraction long before words are

[9]Whether these semantic categories, once formed, influence nonlinguistic cognition as well as language behavior (i.e., whether they have Whorfian effects) is controversial; see Bowerman and Choi (2003) and other chapters in Gentner and Goldin-Meadow (2003) for discussion.

comprehended or produced (Quinn & Eimas, 1996). Theorists differ on what is important in children's object categorization, with some emphasizing perceptual similarities, especially of shape, and others stressing higher-level conceptual knowledge about objects (see Landau, Smith, & Jones, 1998, for a review), but these processes are widely assumed to run off on a nonlinguistic basis, at least during the first couple of years of life.

Several recent studies have asked whether labeling might serve as a general stimulant to object categorization. Using a familiarity/novelty-preference procedure, these studies show that providing labels (compared to no labels) when introducing objects indeed prompts categorization in infants as young as 9 to 13 months (e.g., Balaban & Waxman, 1997; Waxman & Markow, 1995). But the categories tested tend to be ones that infants of this age already know, so the labels may have simply facilitated infants' display of their existing object category knowledge rather than prompting them to form new categories (Nazzi & Gopnik, 2001, although see Booth & Waxman, 2002, for evidence on novel categories). Further experiments on the role of language in categorization show that the way children generalize a novel word is influenced by its word class; in particular, count-noun syntax heightens attention to an object's *shape* (Landau, Smith, & Jones, 1988, 1998). For learners of Japanese, a language that does not make the mass–count distinction, the attention to shape is attenuated (Imai & Gentner, 1997).

What for our purposes is a critical limitation to the studies in these two paradigms is that none of them shows—or attempts to show—that toddlers will categorize a set of novel objects differently as a direct function of the way a training set of objects has been classified by the words used for them.[10]

[10]I am aware of only two studies examining whether very young children can form arbitrarily different object categories depending on the distribution of noun labels across exemplars. Nazzi and Gopnik (2001) presented 20-month-olds with object triads consisting of three perceptually and conceptually dissimilar objects. In play sessions some children heard one label for objects A and B and another for C, while others heard one label for A and C and another for B. When subsequently shown A and asked "Which one goes with this?," children's choice between B and C was consistent with the classification suggested by the verbal input. The children were tested only on the items that had been explicitly labeled in the training, so it is unclear whether these categories were productive (i.e., could be extended to new objects). Landau and Shipley (1996) taught children either a single label for two novel and perceptually dissimilar objects (the "standards"), or two different labels. Four additional novel objects, shape-morphed so as to fall perceptually along a line between the standards, were then presented. Two- and 3-year-olds in the "same label" condition accepted the label at ceiling for all the novel objects as well as the standards, "probably guided by the assumption that members lying on the hypothetical similarity line between standards are also members of the category" (Landau & Shipley, 1996, p. 446). Children in the "different label" condition generalized the labels only to the novel objects most similar in form to the standards. This study suggests that differences in the distribution of nouns across objects can indeed affect generalization to novel instances, at least in children over 2.



Overall, then, there is little reason to expect very young children to be sensitive even to those language-specific categories of objects that are labeled by the nouns of their target language, much less those that are defined only indirectly, by their association with action words.

## Object Category Size and Ease of Learning

A second developmental question is whether children's ease of learning object-sensitive words for events is affected by the fineness with which the objects are partitioned. Is it easier to learn a single verb for "putting on clothing" or multiple verbs for putting more restricted classes of clothing on different regions of the body? A single verb for "eating" or multiple verbs for eating foods of different kinds? Ultimately this is a question about the level of abstraction at which infants spontaneously conceptualize events: Words that categorize at their preferred level should be easier to learn, or at least to extend to an appropriate range of actions, than those that pick out either bigger categories (thus neglecting distinctions that are salient to infants), or smaller categories (forcing attention to distinctions that are not salient).

According to one classical tradition, cognitive development progresses from global to differentiated (Gibson & Gibson, 1955; Werner, 1957). Thus, it should be easier to learn a single verb for a domain than a number of finer verbs. Recent studies supporting a "global to differentiated" progression in object-category formation include McDonough (2002) and Mandler and McDonough (1993, 2000). According to another classical tradition, it is *abstraction* that is difficult for children (Luria, 1930/1992; Saltz & Sigel, 1967): Early learning is at first concrete and context-bound, and generalization goes slowly stepwise from first-encountered exemplars to increasingly dissimilar exemplars. Modern adherents of this position suggest that it should be easier to learn a category revolving around a specific class of perceptually similar objects than a category applying across sets of dissimilar objects (Gentner & Boroditsky, 2001; Gentner & Rattermann, 1991; Quinn, 2003; Quinn & Eimas, 1996). Still other possibilities, of course, are that children initially do best at some intermediate level of abstraction (cf. the alleged, although controversial, primacy of the "basic level" in children's acquisition of noun taxonomies; Anglin, 1977; Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976), or that the preferred level varies across different domains of events. Common to all these positions is the idea that the level of abstraction preferred by young language learners is determined by cognition, not by the semantic structure of the input language. But is this indeed the case?

## ACQUIRING COVERT OBJECT CATEGORIES FOR EVENTS OF DRESSING, CARRYING, AND CONSUMPTION

In the crosslinguistic literature on early lexical development, there is by now sufficient material to allow at least an informal exploration of these questions. In this section we look at verbs of dressing, carrying, and consuming. A more complex set of cases—verbs of opening, cutting, and breaking—is saved for later.

***Dressing.*** In a comparison of how learners of English and Korean about 14 months to 3 years of age spontaneously encode motion events, Choi and Bowerman (1991) reported that both sets of children get the hang of dressing verbs early. By around 17 to 20 months, Korean-speaking children distinguish appropriately between putting clothing on the head (*ssuta*), the trunk or legs (*ipta*), and the feet (*sinta*), while English-speaking children use a single form, *on* or *put on*, for all these actions.

To explore this pattern in a more controlled way, Bowerman and Choi (2001; Bowerman, 1996) asked learners of Korean and English (age 2 yrs.–3½ yrs.) to describe eight specific actions of putting on clothing (along with many other object manipulations). In the youngest age group, 2 years to 2½ years, the Korean learners correctly used *ipta* for donning a dress, undershirt, and underpants 100% of the time; they used *sinta* for putting on shoes, slippers, and socks 97% of the time; and they said *ssuta* for putting on a big loose hat and a tight wool cap 50% of the time. The corresponding frequencies with which same-age learners of English produced *(put) on* for these specific groups of events is 90%, 97%, and 100%. Most nontarget responses in Korean were acceptable uses of *kkita* 'fit tightly into/onto', a more general verb not specialized to clothing (Choi & Bowerman, 1991), for putting on shoes and socks and pulling on the wool cap.

In a study of the acquisition of clothing verbs in Japanese, Kameyama (1983) found that children age 2 to 5 used *kaburu* appropriately for putting on a hat 93% of the time, *kiru* for putting on a coat 64% of the time, and *haku* for putting on shorts and shoes 71% of the time. Most nontarget responses in Japanese involved the "light" verb *yaru* 'do'. Recall that Korean and Japanese differ in their classification of the lower body (Figs. 9.1b, 9.1c), so this means that the two sets of learners differed in whether they treated putting on underpants/shorts like putting on shirts and dresses (Korean) or like putting on shoes and socks (Japanese).[11]

[11]To determine whether the children linked clothing verbs more to clothing items or to body parts, Kameyama also tested them on nonconventional actions like putting shorts over the arms or a coat over the head. Responses were inconsistent, suggesting that verb meanings revolved around prototypes in which clothing item and body part are combined in the conventional way.



There was no evidence that learners of Korean or Japanese initially associated any of their specific dressing verbs with a global meaning of "putting on clothing." Nontarget responses by Korean and Japanese children rarely involved overextensions of the dressing verbs to inappropriate body regions (e.g., Korean *ipta* [torso] to putting on a hat or shoes). Such errors—which would suggest reliance on a large, English-style concept like "put clothing item onto any body part"—constituted only 2.9% of the total relevant responses for the Korean children across the three age groups (2 yrs.–3½ yrs.); the comparable figure across the Japanese children from all three age groups (2½ yrs.–5 yrs.) is 8.9%.

These errors, although never frequent, actually increased over time rather than decreased, at least for the Korean children[12] (0% at 2 yrs.–2½ yrs., 2.5% at 2½ yrs.–3 yrs., and 6.3% at 3 yrs.–3½ yrs.); this is also counter to what we would expect if the children initially entertained a global concept of "putting on clothing," followed later by differentiation. In a previous study I documented a similar increase over time in substitution errors among a set of semantically related verbs, in that case verbs of caused motion such as *put, bring, take,* and *give* (Bowerman, 1978b). My interpretation for that pattern is also applicable here: The verbs are at first learned and used independently of one another, each for its own domain, but over time they draw together and become integrated into a common semantic domain, and so begin to compete with each other.

***Carrying.*** The comparative acquisition data is sparser for carrying and consumption than for putting on clothing, and it is limited to spontaneous speech. But it is compatible with the results for the dressing verbs. Choi and Bowerman (1991) reported that two learners of English began to use *carry* at 19 and 21 months. In inspecting the raw data for this study for purposes of this chapter, I found that the verb was extended during the first few weeks of use to a wide variety of carried objects (child, grocery bag, glass, bear, diaper, tricycle, etc.). It was, however, used in connection with support only by the arms (e.g., carrying a baby) or the hands (e.g., carrying a glass or a dirty diaper). Learners of Korean in this same age range distinguish appropriately between *anta* 'hold/carry in arms' and *epta* 'hold/carry on back' (Choi & Bowerman, 1991); by 24 months they add *tulta* 'carry in hands'. A child learning Tzotzil Mayan distinguished at 19 months between *pet* 'carry in arms' and *kuch* 'carry on back' (de León, 2001).

[12]Figures broken down by age are difficult to derive from the Japanese data, but the data are at least compatible with a similar increase: The higher percentage of overextensions overall than in Korean (8.9% vs. 2.9%) may be because the Japanese children were on average older (2½ yrs.–5 yrs. as compared to 2 yrs.–3½ yrs.).

Differences in the frequency and manner of talking about carrying on different body parts is likely to be related to cultural practices as well as language categories. In Western industrial society, people carry babies and other entities on the back relatively rarely; in Mayan culture this is much more frequent. The two learners of English in Choi and Bowerman's (1991) study assimilated the concept of a child being carried on the back to the larger category of "riding." The word *ride* was used appropriately and frequently, from 16 months for one child and 19 months for the other, for events in which humans and other animates (including teddy bears, etc.) were supported and moved "for fun" by a wide range of objects (tricycle, spinning chair, rocking horse, wagon, toy train or car, bouncing parental shin, etc.). The assignment of acts of carrying children on the back to this larger category of "riding" events, as seen in the English data, is not found in the acquisition of Mayan or Korean.

***Consumption.*** According to P. Brown (2001), learners of Tzeltal Mayan begin to distinguish appropriately at around 18 to 24 months between *we'* 'eat corn- or grain-based food' (e.g., tortilla), *lo'* 'eat soft things' (e.g., banana), and *k'ux* 'eat crunchy things' (e.g., beans). A child learning Tzotzil, a sister Mayan language with a similar set of eating distinctions, used the "meat-eating" verb at 2 years when she first saw birthday cake, an unfamiliar food item, but switched spontaneously to the "corn-/grain-based-eating" verb as soon as she tasted it (Lourdes de León, personal communication, 2001).

Although it is clear that learners of English begin to produce the verbs *eat* (and *drink*) early, I am not aware of any published data on what kinds of consumables they use these verbs for. So I searched for these verbs in the longitudinal spontaneous speech records from the two English-speaking children studied by Choi and Bowerman (1991). *Eat* emerged at 17 to 18 months and was immediately extended to a wide range of solid foods; by 23 months the inventory included cake, French fries, sugar, crackers, cheese, yogurt, grass (said of a cow), hamburger, sandwich, cereal, apple, grapes, grapefruit, carrots, artichokes, popcorn, chocolate, lollipops, batter, cardamom seeds, and many more. *Drink* emerged at 17 and 20 months, and was likewise rapidly extended to beverages of many kinds (water, juice, milk, 7-Up, Coke, coffee, iced tea, liquid Jello, beer, wine, etc.), as well as to a variety of drinking techniques (from a glass, cup, bottle, bowl [said of a cat], straw, drinking fountain, spoon).[13]

[13]The covert categories associated with *eat* and *drink* are well enough understood by at least 26 months that learners of English can direct their gaze rapidly to an appropriate object in a visual array on the basis of the verb alone. For example, when asked "Which one do you *eat*?," they initiate an eye movement within 100 msec of the verb's offset to the cookie rather than the car (Chang & Fernald, 2003).



## TAKING STOCK

One of the theoretical questions raised earlier was whether children's early action-word use revolves around a set of event concepts that is universally shared. In the data just examined, there is no evidence that children learning different languages apply a uniform set of concepts to events of dressing, carrying, and consuming. Well before 2 years of age, they have discovered some of the major covert object categories that their language uses in grouping or distinguishing such events. Of course, they do not necessarily learn all the words of a domain early. They start, not surprisingly, with the words that are frequent in the speech around them. But once they begin to produce a word, they extend it rather quickly across a range of appropriate or near-appropriate events.

A second question was whether children find it easier to learn "big" (global, abstract) event categories or "small" (differentiated, concrete) categories involving objects of specific types. Category size per se seems to make little difference (although category makeup does, as we see shortly). On the one hand, children can readily learn event categories that make few or no distinctions among objects; recall English *put on, carry,* and *eat,* and to this evidence we can add toddlers' use of path particles like *up, down, in, out, on, off* for the movements of essentially any object (Choi & Bowerman, 1991; Smiley & Huttenlocher, 1995). On the other hand, it takes children no longer to learn some finer subdivisions of these categories: In the same time frame (about 18–24 months), learners of Korean, Japanese, Tzeltal, and Tzotzil successfully differentiate among several subtypes of dressing, carrying, and/or eating events. Later, we consider what kind of learning procedure could account for these patterns.

Despite their striking overall attunement to the semantic categories of the input language, children inevitably make some errors in word use. These are important for two reasons. First, errors help establish that children are using the words productively, and so rule out an uninteresting reason for early language-specificity: that young children simply learn "what to say" for particular events they have often heard adults talk about. It is difficult to establish productivity with confidence when the available data are limited (as for Tzeltal and Tzotzil carrying and eating verbs), but for the English versus Korean contrasts we have considered, there is good evidence for productive categorization in both spontaneous and elicited speech (see Bowerman & Choi, 2001, and especially Choi & Bowerman, 1991, pp. 110–113, for discussion and evidence).

Errors are also important because they provide clues to the learning mechanisms that enable children to acquire language-specific covert object categories so early. If children displayed uniform accuracy across categories of all kinds from the beginning, we would not know where to look. But dif-

ferential difficulty gives us a foot in the door to understanding the learning process. To the coarse-grained question whether "bigger" or "smaller" covert object categories are inherently easier, the answer was "children can learn both relatively accurately from the beginning." But some "big" categories do have special properties that give rise to telling errors.

## "OPENING," "CUTTING," AND "BREAKING" IN ADULT AND CHILD LANGUAGE

Three such categories are picked out by the English verbs *open*, *cut*, and *break*. Children often overextend these verbs to objects of the wrong kinds, as illustrated at the beginning of this chapter. At one time I assumed that overextensions like these reflected children's spontaneous way of viewing the world; for instance, that when a child says *open* not only for opening doors and boxes but also for manipulations with Frisbees and jigsaw puzzles, she does so because she has mapped the word *open* to a concept of her own nonlinguistic devising, perhaps "separation."

With the benefit of hindsight and more crosslinguistic data, I now interpret these errors differently: as resulting from an *interaction* between, on the one hand, children's nonlinguistic capacity to recognize relational similarities across events involving objects of different kinds and, on the other, their implicit efforts to make sense of how words are used in the speech around them. The evidence is that extension patterns *vary* for children learning different languages, and these variations are *systematically related* to the way the domain is categorized in the target language.

### The English Category of "Openable Objects"

Overextensions with *open* and its translation equivalents are common among young learners of English, French, German, Dutch, and other languages (Bowerman, 1978a, 1996; Clark, Carpenter, & Deutsch, 1995). If these errors were caused by toddlers' nonlinguistic way of conceptualizing the world, we could expect to see them in all children. But no word is used by learners of Korean for a similar range of events (Bowerman, 1996; Bowerman & Choi, 2003). Why not?

A first clue that the semantic structure of the target language is somehow involved is that Korean has no word that even begins to approximate the semantic range of English *open*. The conceptual glue that unifies, for example, "opening a door," "opening the mouth," "opening an envelope," and "opening a book" for speakers of English seems to be missing, and the domain is parceled out among a number of crosscutting categories that emphasize different aspects of the events (see Fig. 9.3). Many languages parti-



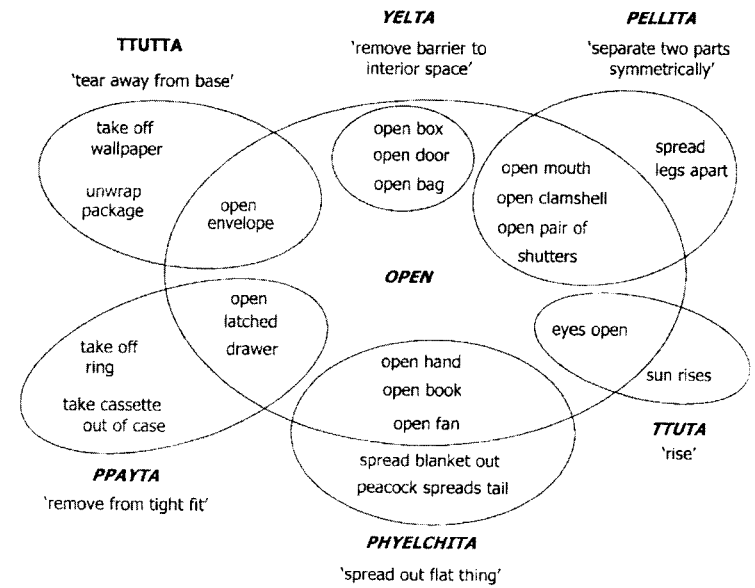


FIG. 9.3. Categorization of "opening" in English and Korean.

tion the "opening" events of English among a number of different verbs, but the criteria used for this differ strikingly from one language to another.[14] An English-like category of "opening" events does not seem to be inevitable to human cognition.

Let us imagine, then, with Roger Brown, that a child takes a new word as a "lure to cognition" (1958, p. 206)—as an invitation to discover the meaning that governs adult use of the word "if the physical world has not already imposed it upon him" (1965, p. 317). How might learners go to work on words like *open* and, for instance, *yelta* (top center of Fig. 9.3), an early-learned Korean verb that is usually considered the translation equivalent of *open*?

Observing uses of *open* for actions on a wide variety of objects, learners of English are invited to generalize broadly, to look for an abstract relational

[14]For example, Japanese divides up most English "opening" events between two verbs: *akeru* is applied to opening doors, boxes, and many of the other objects in Fig. 9.3, but *hiraku* is needed for opening a hand, book, or fan. Some events—for example, opening the mouth, eyes, clamshell, or pair of shutters—can be described with either verb, depending on whether the speaker wishes to emphasize accessing an interior space or the separation of parts. In Lao, a language spoken in Laos, there is a special verb for opening the eyes, another for opening the hand, and still another for opening the mouth or spreading wings; manipulations with doors, boxes, books, fans, clamshells, and shutters all fall together. (For information about "opening" in Japanese, I am grateful to Megumi Kameyama, Sotaro Kita, and Ayumi Matsuo; for Lao, I thank Nick Enfield.)

meaning that is indifferent to the physical differences between a door, a pair of shutters, a mouth, a book, and an envelope. Learners of Korean, in contrast, are confronted with a different verb at every turn, and these verbs instruct them, in effect, to compare actions of opening a door, box, bag, and the like to discover what they share ('remove barrier to interior space': *yelta*), which is *not* shared by, say, opening a pair of shutters or a mouth; and, further, to determine what this latter set of actions share ('separate two parts symmetrically': *pellita*) that is not shared by opening a book, hand, or fan ('spread out a flat thing': *phyelchita*). These different "instructions" are associated with a broad pattern of overextensions for children learning English *open* (or a similar verb in French, German, etc.), but an essentially correct extension of Korean *yelta* 'open' from the beginning (Bowerman, 1996).[15]

Verbs associated with perceptually diverse classes of objects are not inevitably overextended; we saw that the English verbs *eat* and *put on* are used appropriately even though they require control of object categories such as "food," "clothing," and "body part." So why do children overshoot the target category for *open*?

There is reason to suppose that notions like "food," "clothing," and "body part" form relatively coherent categories for human beings regardless of how they are treated in specific languages. These categories are constituted by clusters of perceptual and functional features that correlate in the world of experience, just as features like wings, beaks, feathers, and flying correlate (Rosch et al., 1976). One bit of evidence that the categories are coherent is that they are usually dignified with a noun label that serves as a superordinate node in an object taxonomy ("food": bread, meat, fruit, etc.; "clothing": hat, coat, pants, etc.; "body parts": head, torso, legs, feet, etc.).[16] Another is that in the meanings of the "dressing" and "consumption" verbs in various languages, they behave as a set: for example, if the category "food" is collapsed with other categories under a higher node (as in Kalam's single verb for "consume": eat/drink/smoke), all its members go together; and if the category is subdivided (as in Tzeltal's multiple eating verbs), the daughter categories exhaustively partition the content of the mother node but do not go beyond it to pull in members that have nothing to do with eating.[17]

For English *open*—and also for *cut* and *break*, which we examine in a moment—the situation is different: The features that characterize the objects associated with these verbs do not cluster together in the real world, but instead are sprinkled about in a more "matrix-like" fashion (see Huttenlocher & Lui, 1979, on this useful notion). In cases like these, languages impose their own, somewhat arbitrary partitionings: They elect to go with certain features and feature combinations rather than others. Once conventionalized and shared within a speech community, these implicit choices seem natural and obvious to those who have learned them. But children have no way of knowing, independently of the linguistic input, how the partitioning will be done in their language (see Gentner, 1982, for discussion); the categories must be acquired on the basis of the linguistic input.

What properties of objects must English speakers be able to identify in order to extend *open* correctly? This is admittedly a complex question, but as an approximation, we can say that an entity that can be physically "opened" should have the following three properties (Bowerman, 1978a; Levison, 1993):[18] (a) it is a *unitary object* (although it may have separable parts, such as a pot with a lid); (b) it *separates along predetermined lines*, not unpredictably (hence actions of "opening" are usually reversible: objects that can be "opened" can also be "closed"); and (c) separation affords *access* to something (e.g., a "content," an interior space, or a previously concealed part of the object with which you can do something).

[15]Learners of Korean do often overextend *ppayta* 'remove from tight fit'. As suggested by the examples of this category in Fig. 9.3, *ppayta*, like English *open*, is a large category in adult speech that encompasses actions on a perceptually very diverse set of objects. Although the (over)extensions of *open* by English-speaking children and *ppayta* by Korean-speaking children overlap to some extent, the overall range of these two words is language-specific: Each word clearly has its core in the adult meaning of the target word—'separate to make something accessible' for *open*, and 'separate fitted or interlocked objects with a bit of force' (e.g., Lego blocks apart, top off pen) for *ppayta* (Bowerman & Choi, 2003).

[16]It would be useful to know more than we do about the developmental relationship between learning the covert object categories associated with verbs and learning the explicit nominal labels for these categories, where they exist. For adults, word pairs like *eat* and *food*, *put on* and *clothing*, are at least partially mutually defining (*food* is stuff that you can "eat"; *clothing* is the main category of things that you can "put on" or "wear," although these verbs also apply to makeup and jewelry). But the acquisition of verbs and their associated nominals do not necessarily run off in tandem. In particular, children as old as 5 to 6 years often underextend a superordinate nominal like *food* or *clothing*—for example, rejecting a lollipop or cookie as "food," or a shoe or glove as "clothing" (Anglin, 1977; Saltz, Soller, & Sigel, 1972)—even though children of this age and far younger routinely apply the verbs *eat* and *put on* to actions involving such objects.

[17]These remarks apply to the literal use of these terms. Of course, verbs for dressing and eating, like other verbs, often develop metaphorical extensions, and these may show considerable crosslinguistic variability (I am grateful to Cliff Pye for reminding me of this). For example, one "dresses" a turkey and a salad in English but not in Dutch; on the other hand, a nicely decorated party or a festively set table can be "well-dressed" (*mooi aangekleed*) in Dutch but not in English.

[18]In discussing the extensions of *open*, *break*, and *cut*, I limit myself to literal uses of the verbs for physical actions on objects, ignoring metaphorical extensions such as "open a meeting," "break your heart," and "cut through all the nonsense," which are learned much later by children. I also limit myself to transitive examples, and to "bare" instances of *open* alone as the main verb; its distribution as a particle in conjunction with a verb, as in *crack open* for a nut or *cut open* for an apple, is much more liberal; see also footnote 19 on the phrasal verb *open up*.

These features all come together in the objects for which *open* sounds fine, for example, a door, window, box, bag, mouth, umbrella, fan, or jackknife. But the features do not have a strong affiliation with each other: They are widely distributed in the world of experience, and they often turn up alone or in pairs. For example, stuck-together Lego pieces and Frisbees separate in a predictable way, but they are neither unitary objects nor allow access to something. A jigsaw puzzle separates predictably and it *is* a unitary (multipart) object, but again, there is nothing to access. Nuts, eggs, and apples are units with something to access, but they do not come apart along predetermined lines. (Walnuts do, but the action cannot be reversed.) Electrical appliances such as television sets are also units with something to access (their functions, when turned on), but one does not access them by separating anything. In these situations adults do not normally say *open*, but children often do (Table 9.2).[19] Learning how to use *open* as fluent speakers do requires being able to combine the relevant features consistently, and this takes time; application across too broad a range of objects is still common even among children as old as 6 or 7 (Schaefer, 1979).

## "Breaking" and "Cutting"

Like *open*, the verbs *break* and *cut* revolve around categories of objects that, in crosslinguistic perspective, can be seen as constructs of English. Many languages distinguish between, say, cutting something with a sharp instrument and breaking something with a blow, but this complex domain is carved up differently in different languages (Bowerman, Majid, Erkelens, Narasimhan, & Chen, 2004; Majid, van Staden, Boster, & Bowerman, 2004; Pye, 1994, 1996). Just as for "opening," there is a range of relevant features—for example, "degree of force, direction of force, instrument, type of object, spatial configuration of object, object's material" (Pye, 1996)—but these features are distributed independently across events, and do not cluster to delineate particular sets of actions that everyone agrees are somehow alike. Different languages make different implicit choices about which features must be attended to and how they should be combined.

***Breaking.*** Although English *break* prototypically applies to material disruptions in rigid objects, it is also used for one-dimensional and (some) three-dimensional flexible objects (e.g., a rope or thread, a baguette). But

[19]When an entity meets the first and third criteria (being a unit with something to access), but not the second ("predicable lines of separation"), the acceptability of *open* improves with the addition of the particle *up*: (surgeon) "Let's ??open/open up the patient"; (plumber) "We need to ??open/open up the floor in that room." The restrictions discussed here are specific for English; many languages, including Spanish and Finnish, have a "big category" verb similar to English *open* that is also applied, for example, to turning on electrical appliances or water faucets.



TABLE 9.2
Some Overextensions of *OPEN* by C and E
From 1;4 to 3;2

| |
|---|
| *Objects lacking predictable lines of separation* |
| cracking peanuts |
| peeling paper off a book cover |
| peeling skin off a hotdog |
| peeling a banana |
| peeling a hardboiled egg |
| pulling apart a meatball |
| pulling apart a grapefruit section |
| breaking a roll ("*Will you open this?*") |
| unbending a flexible mommy doll ("*Open mommy*") |
| *Objects with parts designed to separate, but nothing to "access"* |
| pulling leg off doll |
| taking pieces out of jigsaw puzzle |
| pulling legs of nail scissors apart |
| pulling removable tip off paintbrush |
| *Separations of assemblies that are not unitary objects* |
| pulling pop-beads apart |
| unscrewing stake from block |
| pulling up shirt ("*Open your tummy . . . now close it*") |
| raising couch cushion to look under it |
| taking wide, stubby candle out of shallow holder |
| pushing chair back from table ("*I'm gonna open my chair*") |
| untangling pieces of yarn |
| pushing M's knees apart ("*Open your knees*") |
| *Access but no separation involved* |
| turning on television set |
| turning on lights |
| turning on electric typewriter |

*Note.* From "The Acquisition of Word Meaning: An Investigation Into Some Current Conflicts," by M. Bowerman, 1978a, in N. Waterson and C. Snow (Eds.), *The Development of Communication*, pp. 263–287. New York: Wiley. Also from M. Bowerman, unpublished records.

*break* sounds strange for inflicting material disruptions on flexible two-dimensional objects, for example, a sheet of paper, blanket, coat, or cooked noodle; *tear* (or *rip*) is needed instead.[20] The distinction between "breaking" and "tearing" in English also includes some information about the manner of the action. Separations in two-dimensional flexible entities like paper and cloth normally come about "bit by bit," and this manner is characteristic for *tear*; when the separation occurs all at once, *break* is often possible ("The heavy groceries broke the shopping bag"; "the high-pitched

[20]English *break* has another use not considered here, to do with objects becoming nonfunctional rather than coming apart ("I broke my watch"). Many languages have a special verb for this sense.

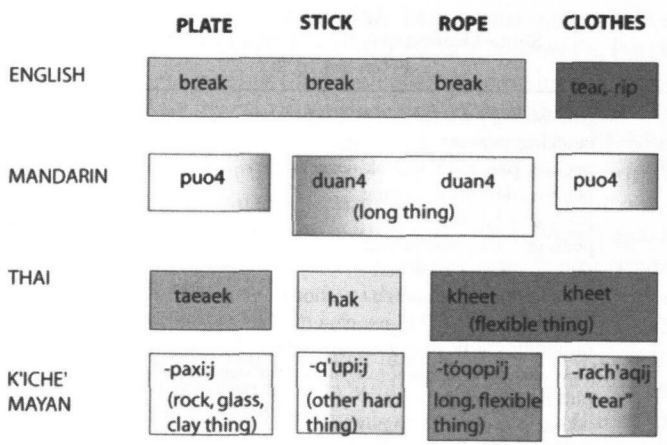


FIG. 9.4. Categorization of "breaking" in several languages (Pye et al., 1995).

sound broke the membrane"). Other languages dissect the "breaking" and "tearing" events of English differently, using various combinations of properties such as the object's shape, dimensionality, and material (see Fig. 9.4, based on Pye, 1994, 1996; Pye, Loeb, & Pao, 1995).

***Cutting.*** English distinguishes strictly between separations in objects brought about with a sharp implement (*cut*) and those effected in other ways, such as by fist or hammer blows, or snapping or pulling apart with the hands (*break*). Many languages have a somewhat similar contrast, but with the boundary between events of "cutting" and events of "breaking" falling in different places. For example, in Sranan, an English-based creole of Surinam, the nature of the separation is more critical than the use of a sharp-edged implement: A clean, "cut-like" break qualifies for the "cut" verb, *koti*, regardless of how it is brought about. So whereas English implicitly groups (a) "breaking a thread by jerking on it" with (b) "breaking a pot with a hammer" (both called *break*), and distinguishes these from (c) "cutting bread with a knife" (*cut*), Sranan groups (a) with (c) (both *koti* 'effect a neat, "cut-like" fracture'), and distinguishes them from (b) (*broko* 'break a hard, brittle object') (Essegbey, 2003). Spanish *cortar*, which is usually translated as 'cut', patterns similarly to Sranan *koti*; for example, it is used for breaking thread and plucking flowers (Enrique Palancar, personal communication, June 2001).

The sharp implement presupposed by English *cut* is prototypically a knife or a pair of scissors, tools especially designed for this purpose. But "cutting" can be done with a much wider range of objects, for example, a



cookie cutter, piece of broken glass or pottery, fingernail, wire or thread, blade of grass, or piece of paper. These objects are diverse both perceptually and in their usual functions, but they all have something in common: a *thin linear edge.* This edge is criterial for the literal use of *cut* in English, along with the "manner" specification that the separation in the object acted on must be caused by pressure from this edge, not, for example, by a blow from the handle of the cutting tool. Dutch and Mandarin also employ the notion of a thin linear edge, but they impose an obligatory distinction between actions of cutting with *two* opposing edges (scissors, gardening shears, nail clippers, etc.) versus with a *single* edge (knife, fingernail, grass blade, etc.) (*knippen* vs. *snijden* in Dutch, *jian3* vs. *qie1* in Mandarin [Bowerman et al., 2004; Chen, in progress; Erkelens, 2003]). So children acquiring these languages must learn a contrast that is irrelevant for learners of English.

***Acquiring Verbs of Breaking and Cutting.*** Like verbs for "opening," verbs for "breaking" and "cutting" are extended, and overextended, according to language-specific patterns. In an elicited production task comparing how children acquiring English, Mandarin, and K'iche' Mayan described various actions of "breaking" and "cutting," Pye et al. (1995) found far more overextensions among the learners of English than among the learners of Mandarin and K'iche'. For example, English learners age 3 to 5 said *break* not only—correctly—for "breaking a toothpick" (100%), but also in high numbers for dividing play dough (87%) and tearing paper (56%). Mandarin children often correctly used *duan4* 'break long thing' for the toothpick (64%), but extended it much less often to the play dough (25%) and not a single time to tearing paper.

The likelihood that children will overextend a particular "break" or "cut" verb is, as for *open*, related to the coherence of the associated covert object categories. "Small" categories revolving around perceptually rather similar objects seem to be readily acquired; for example, learners of both Dutch and Mandarin home in swiftly on their verbs for "double-bladed cutting," and rarely make errors (Bowerman et al., 2004; Chen, in progress; Erkelens, 2003). In contrast, certain kinds of "large," perceptually diverse categories—those involving language-specific and rather arbitrary choices about which features are important and how to combine them—give rise to many errors.

For example, English *break*, and related forms like *broke*, *broken*, are often used for events involving flexible two- and three-dimensional objects like cooked noodles and clothing. They are also overextended to actions of separating entities that are designed to be separated and rejoined, such as safety pins and overall straps (see Table 9.3). *Cut* is often overextended to actions involving instruments with no thin linear edge, such as crushing ice

TABLE 9.3
Some Overextensions of *BREAK/BROKEN* by C and E
From 1;5 to 1;10

| |
|---|
| *Flat, flexible objects* |
| after tearing a magazine page |
| after tearing a piece out of a pop-up book |
| re: a wadded-up torn piece of Kleenex, a piece of chewed baloney, a torn playing card, a torn towel, a torn book |
| *Objects designed to be separated/joined* |
| after overall straps come unbuckled and fall down |
| after slip-on eraser comes off a pen |
| pulling gently on a cloth chicken to unsnap it from a cloth book |
| re: an open safety pin, an open broach, an open barrette, two donut-shaped magnets that have come apart, a picture of a boy assembling pieces of a model car |

*Note.* From M. Bowerman, unpublished records.

with a rolling pin, pulling meatballs apart with the fingers, and cracking nuts with a mallet (see examples shown earlier).

Notice that the covert object categories associated with *break* and *cut*, like the one associated with *open*, encompass a vast range of perceptually and functionally diverse objects. (According to Pye, 1994, of the many languages he examined, "no other language has a ["breaking"] verb with as broad an extension as the English verb *break*," p. 15.) Although the objects involved are alike in some critical ways (e.g., the instruments associated with "cutting" all have a thin linear edge), these similarities play no particular role in a child's experience *except* insofar as they are relevant to adults' use of the verb. Identifying what the instances of the category have in common is not, then, a matter of finding out about the world, but of discovering the implicit criteria that adults weigh in choosing whether to say *cut*, *break*, or some other verb on a particular occasion.

Just as for *open*, it takes children a long time to completely work out the covert object categories associated with *break* and *cut*. Of the English-speaking 3- to 5-year-olds in Pye et al.'s (1995) elicited production task, 25% said *cut* for dividing play dough with a pencil, whereas none of the adults did. An average of 45% of these children said *break* across five actions of tearing paper with various instruments; adults never did. Similar results were obtained by Schaefer (1979) from even older children.

## MECHANISMS FOR CONSTRUCTING COVERT OBJECT CATEGORIES

We have seen that the ease or difficulty of learning a covert category of objects is not directly related to how finely the category is subdivided. Children can readily acquire action words associated with small, relatively



specific object categories (e.g., the multiple clothing and holding/carrying verbs of Korean; the eating verbs of Tzeltal; the "double-bladed" cutting verbs of Dutch and Mandarin). But they are equally quick to acquire words revolving around large categories of objects, for example, "any object at all" (e.g., things that can go *up* or be *carried* in English), or large but relatively coherent classes like "food" (for *eat*) or "clothing" and "body part" (for *put on*). The action words that are troublesome, giving rise to overextension errors over a period of years, are those associated with perceptually and functionally very diverse objects that do share some properties, but that are classified and cross-classified differently by the action words of different languages. This pattern of evidence allows us to make some inferences about how children go about the task of acquiring covert object categories.

### Generalizing to Fit the Attested Instances

First, it is clear that even very young children must pay close attention to associations between action words and objects in the speech around them. When they observe that a word is used for actions involving a sufficiently diverse set of objects, they generalize it quickly to "all objects" (cf. uses of spatial particles like *up*, *down*, *in*, *out*, and *away* between 18 and 24 months; Choi & Bowerman, 1991). But when the objects are closely similar in some way, children generalize conservatively, sticking to events involving the same sort of objects.

For instance, toddlers learning Dutch clearly register that uses of the verb *knippen* revolve tightly around events of cutting with a scissors(-like) implement, since they rarely extend it even to actions with knives, let alone rolling pins, fingers, and mallets. Learners of English often hear *cut* for events of cutting with scissors, but they quickly generalize this word to actions with knives and beyond (cf. the previously mentioned examples); this can be explained by reference to the broad range of instrument types associated with *cut* in the speech around them.

### Comparison

Generalizing on the basis of attested instances involves not only *noticing* the objects involved in the events labeled by given action words, but also *comparing* them to discover what they have in common. Because the action words of different languages revolve around different sets of objects, comparisons lead to different results. A proposed mechanism that seems well-suited to capturing this process is *structure mapping* (Gentner, 1983, 2003, chap. 10, this volume; Gentner & Rattermann, 1991; Markman & Gentner, 1993).

According to structure mapping theory, learners try to align structured conceptual representations with each other and to identify how they are

similar and different. At first alignments are based on perceptual similarities among the objects in the representations, but over time learners discover alignments based on more abstract relationships. Studies have suggested that comparison can call attention to relational similarities that otherwise go unnoticed.

Comparisons can be prompted in various ways. One important way, by hypothesis, is to hear different situations described by the same word (Bowerman & Choi, 2003; Gentner, 2003, chap. 10, this volume; see Casasola, in press; Casasola, Wilbourn, & Yang, in press, for experimental evidence). Exemplars of the concept encoded by a word such as *cut* or *break* are distributed haphazardly through a child's experience, and are often embedded in very different contexts (e.g., a hairdresser *cutting* the child's hair; mommy *cutting* a potato in the kitchen; the child *cutting* her foot on a piece of glass in the garden). Without language there is no reason to compare these events, but the shared word flags them as somehow "the same." Since words in different languages flag different, crosscutting sets of events, children are led to make different comparisons, and so to arrive at different sets of abstractions about relationships and the covert classes of objects that take part in them.[21]

## Retreating From Overextensions

Some covert object categories are clearly difficult for children to form with precision. Although learners of English quickly get into the right semantic ballpark with *open*, *break*, and *cut*, it can take them years to rein in their categories to their adult boundaries. Why do overextensions eventually stop? Several factors are likely to play a role.

***Competition and Contrast With Other Words.*** A number of researchers have emphasized the importance of *competition* between semantically related forms in shaping children's lexical entries (e.g., MacWhinney, 1987). In a computational model of the acquisition of spatial words, Regier (1997) showed that overextended words will gradually retreat to their conventional adult boundaries if the learning model is equipped with a weak sensitivity to Mutual Exclusivity (Markman, 1989): the principle that a referent

[21]Another source of evidence that could facilitate children's cross-situational comparisons and discovery of the constrained set of objects associated with a verb is *frame talk*: "the other forms of talk which typically arise within the same exchange" (Wilkins, 2002). In an analysis of uses of *open* in the speech of one child and his mother, Wilkins found a high rate of frame talk—at first primarily from the mother but later increasingly from the child himself—containing the words *in*, *out*, and *close*. These words highlight features of "opening" events such as gaining access (put in, take out for boxes, etc.; go in, go out of doors), and the reversibility of the action, a property associated with the presence of "predetermined lines of separation."



cannot have more than one name. Applying this finding to the current problem, we can predict that an overextended semantic entry for *open*—for example, one that permits use of the word for separating Lego blocks and peeling oranges—will gradually be pruned back when the learner hears other people use verbs like *take apart* and *peel* for these events.

Precisely how these experiences change a child's semantic representation is uncertain, but the process is often assumed to involve progressive adjustments to the *weights* assigned to particular features (MacWhinney, 1987; Schaefer, 1979). For example, Schaefer found that children gave undue importance to the mere presence of a bladed tool in deciding whether an event could be described as "cutting"; they often accepted this verb even when the tool was used to break a bottle or a pot. Over time, encounters with other verbs such as *break* in these contexts presumably dilute the brute association of *cut* with bladed tools by tuning up sensitivity to the manner in which the tool is applied.

***From Overall Similarity to Dimensional Similarity.*** Young children often rely on global resemblances among objects in categorizing, whereas older children and adults look for a match along specific dimensions (Smith, 1989; Sloutsky, Lo, & Fisher, 2001). For example, when asked to match a red ellipse to either a blue ellipse or an orange circle, preschoolers typically choose the orange circle (a partial match on both shape and color), whereas adults go for the blue ellipse (a full match on shape, no match on color). The isolation of dimensions, and the growing ability to hold one dimension constant while others vary, can be seen as a major conceptual achievement of the preschool years (Smith, 1989).

This framework offers a useful perspective on changes over time in children's use of verbs like *open*, *break*, and *cut*. Young children's overextensions of these verbs can be seen as "global matches" to the kinds of events for which they have heard adults use them: the child generalizes haphazardly on the basis of different dimensions or combinations of dimensions on different occasions. But to speak like an adult, children must isolate the *specific* dimensions that are important for a verb's meaning, and insist on a match in these, even though other aspects of the events may vary in myriad ways. This will often require them to override global similarity.

Consider a concrete example. In a nonlinguistic categorization task, Schaefer (1980) showed speakers of English (children age 2–8 years and adults) video clips showing someone opening, breaking, or cutting something, and for each clip he asked them to choose, from between two further clips, the one that showed the man "doing the same." Given the clip (a) "cutting an apple into pieces with a knife" and a choice between (b) "breaking a potato into pieces with the (vertically held) tines of a fork" and (c) "cutting out a cookie with a cookie cutter," subjects of all ages overwhelmingly chose

(b)—a good global match, since both (a) and (b), but not (c), involve a roundish food object, an eating utensil, and the creation of bite-sized pieces for immediate eating. In a second task, adults were asked to judge the applicability of various verbs as descriptions of these same scenes (children were not tested on this). This time the "match" was unanimously between (a) and (c): Both events were deemed instances of "cutting" (involving separation by pressure from a linear edge), whereas (b) was "breaking."

To consistently apply a verb like *cut* correctly, then, children must be able to resist attractive global matches that maximize similarity on multiple properties and hold out for more austere matches along a single dimension or combination of dimensions. This may be possible only for children who have reached a certain level of cognitive maturity.

## CONCLUSION

In the first few years of life children must learn to categorize objects in many different ways. The object categories we are most aware of are those associated with noun labels, such as *dog*, *apple*, *car*, and *furniture*. Presumably this is no accident: The reason these categories have labels is that they are useful constructs for us to think with, and to be able to communicate about.

Alongside this world of explicit object kinds is a shadow world of hidden object categories: ways of classifying objects that are woven subtly into the semantics of the verbs, classifiers, prepositions, and other relational words of the language we speak. Many of these categories play little or no role in our conscious mental life, and it is controversial whether they have any consequences for cognition outside of language (see footnote 9). But still we uncontrovertibly know them—the evidence is that we can use the language forms with which they are associated in the way that is normal within our speech community.

Children get to work on these covert categories remarkably early: As we have seen, they extend—and overextend—a number of words according to language-specific patterns well before the age of 2. The ability to ferret out patterns in the observed associations between words and objects so quickly attests to the power of the young child's learning mechanisms. Some categories are easy, whereas others can cause protracted difficulties. But in the end, every child winds up with firm intuitions, shared by other fluent speakers in the speech community, about the appropriate conjunction of action word and object:

(C, 7;11, and M are discussing a box of odds and ends, including broken toys and two scraps of felt)

C: What's in there now?



M: Some other broken things.

C: (smugly) *I* wouldn't call felt "*broken*," I would call it "*ripped*."

The subject of this chapter has been to determine how children arrive at this state.

## ACKNOWLEDGMENTS

I am grateful to Dedre Gentner and Cliff Pye for their valuable comments on an earlier draft of this chapter.

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# BUILDING OBJECT CATEGORIES IN DEVELOPMENTAL TIME

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32nd Carnegie Mellon Symposium
on Cognition

LEA
2005 LAWRENCE ERLBAUM ASSOCIATES, PUBLISHERS
Mahwah, New Jersey London

Lawrence Erlbaum Associates, Inc., Publishers
10 Industrial Avenue
Mahwah, New Jersey 07430
www.erlbaum.com

Cover art by Rachel Wu

Cover design by Kathryn Houghtaling Lacey

**Library of Congress Cataloging-in-Publication Data**

Carnegie Symposium on Cognition (32nd : 2002 : Carnegie-Mellon University)
Building object categories in developmental time / edited by Lisa Gershkoff-Stowe and David H. Rakison.
p. cm.
"32nd Carnegie Mellon symposium series on cognition."
Includes bibliographical references and index.
ISBN 0-8058-4490-2
ISBN 0-8058-4491-0 (pbk.)
1. Categorization (Psychology) in children—Congresses. I. Gershkoff-Stowe, Lisa. II. Rakison, David H., 1969– III. Title.

BF723.C27C37 2005
155.4'13—dc22 2004052068
CIP

Books published by Lawrence Erlbaum Associates are printed on acid-free paper, and their bindings are chosen for strength and durability.

Printed in the United States of America
10 9 8 7 6 5 4 3 2 1