On Relational Meaning: The Acquisition of Verb Meaning

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GENTNER, DEDRE. *On Relational Meaning: The Acquisition of Verb Meaning.* CHILD DEVELOPMENT, 1978, 49, 988–998. The acquisition of verb meaning is very different from the acquisition of simple noun meaning. ("Simple nouns" comprise concrete nouns and proper nouns.) Verbs are slower to be acquired than simple nouns. Verbs are used by children and adults with greater breadth of application than simple nouns. Finally, a componential account of meaning appears to fit the acquisition of verb meaning somewhat better than it does that of simple nouns. These differences reflect an important difference in the kind of meaning conveyed by verbs and simple nouns. Simple nouns refer to real-world entities, and verbs convey relationships among entities.

The aim of this paper is to give an account of the acquisition of verb meaning, basing the discussion on the premise that there is a fundamental difference between the relational meanings expressed by verbs and the referential meanings expressed by simple nouns. The plan of discussion is, first, to set the stage by describing the difference in rate of acquisition between nouns and verbs, second, to present a formal notation for representing verb meaning; and third, to discuss in some detail the acquisition of verb meaning, in light of the representational model and in consideration of the major current theories of acquisition of meaning.

Children learn verbs more slowly than nouns. In a typical diary study by William Stern (1851–1938), at 1-3 the child's vocabulary consisted entirely of nouns; at 1-8, 78% nouns and 22% verbs; and at 1-11, 63% nouns, 23% verbs, and 14% adjectives (Chukovsky 1968). Three children studied by Huttenlocher (1974) all learned nouns before verbs. In Nelson's (1973) corpus drawn from 18 children, action words constitute only 16% of the first 10 words learned, while nominals constitute 65% (41% general nouns and 24% individual names). Moreover, the proportion of general nouns increases to 62% over the course of the first 50 words (achieved between 15 and 24 months), while the proportion of action words declines slightly to 9%, indicating a much greater rate of increase for general nouns than for verbs. Greenfield and Smith (1976), who observed two children from their first one-word utterance until the stage of combining words, found that the earliest clearly linguistic semantic functions were referential uses of nouns—for example, "*dada*," looking at father, at 7 or 8 months. For both children the earliest relational word was *down*, at 13–14 months. The first true verbs, *eat* and *bay* (play), entered at 16 and 20 months, respectively. For these children, the period between the first noun and the first verb was as long as the period between birth and the first words. Finally, in a systematic study of the comprehension and production of 2-year-old children, Goldin-Meadow, Seligman, and Gelman (1976) found two stages of early vocabulary development. In both stages, about twice as many nouns as verbs were comprehended. In the first stage, about one-third of the comprehended nouns were produced, and *no* verbs were produced. In the second stage, characterized by longer sentences, almost all nouns comprehended were produced, and about one-third of the verbs comprehended were produced. Thus acquisition of verbs lagged behind that of nouns, and moreover the production/comprehension ratio for verbs

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in the second stage was similar to that for nouns in the first stage.

In these observational studies, there is the possibility that children hear more nouns than verbs. It is, of course, impossible totally to manipulate children's exposure to words. However, the same pattern appears in a controlled study by Wick Miller using artificial words (reported in Ervin-Tripp [Note 1]). Miller and a 2-year-old child played a game with plastic beads for a period of a year. The noun *po* was used for beads of a particular kind, and the verb *to sib* for actions of a particular kind. The child first used the noun at age 2-2, after 67 inputs; the verb was not used until 8 months later, after 164 inputs.

This difference in rate of acquisition between nouns and verbs persists over time. Even some fairly frequent verbs are not fully understood by children of 9 years and older.

Representation of Verb Meaning

Representations of verb meaning have been proposed by researchers in linguistics (e.g., Bendix 1966; Chafe 1970; Fillmore 1971; Postal 1971; Talmy, Note 2), artificial intelligence (e.g., Schank 1973), and psychology (e.g., Abrahamson 1975; Fillenbaum & Rapoport 1971; Gentner 1975; Miller & Johnson-Laird 1976; Rumelhart & Levin 1975). All of these systems are componential, in that verb meanings are represented in terms of meaning elements which are smaller or more primitive than words, and propositional, in that semantic relationships are explicitly represented. The format used in this paper is a propositional network notation developed by the LNR Research Group at the University of California at San Diego.[1] The elements of the representations are subpredicates which stand for relational concepts (e.g., CAUSE) and labeled pointers which identify the entities to be related (e.g., →). Most English verbs are represented by a set of several subpredicates with a number of interrelationships. For example, figure 1 shows that *give* conveys that an agent performs some unspecified action which causes the possession of an object to change from the agent to someone else. Subpredicates can be related to other subpredicates (e.g., in fig. 1, CAUSE is related to CHANGE by a pointer labeled

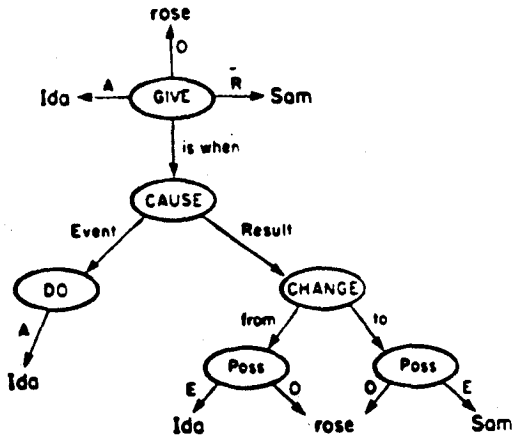

FIG. 1.—Representation of "Ida gives Sam a rose." *A* = agent, *E* = experiencer, *O* = object, *R* = recipient.

Result), or they can be related to noun arguments (e.g., DO is related to *Ida* by a pointer labeled *A* [*agent*]).

These subpredicates are not put forward as basic primitive units of thought. On the contrary, it seems likely that some of the components can be further analyzed. Nor is the representation of a given verb exhaustive. Not all logically possible inferences that follow from use of a given verb are represented as subpredicates, but only those which are psychologically extremely probable. The subpredicates of a verb are intended to express the almost inevitable inferences that are made during comprehension of a sentence containing the verb.

Relational Meaning and Referential Meaning

It is sometimes said that nouns refer to objects and verbs refer to actions. This formulation slights an important distinction between relational and referential meaning. In the linguistic description of a situation, nouns specify the thinglike elements, while verbs and other relational terms specify relations between those elements (see Talmy [Note 2] for a more complete discussion of this issue). This difference in communicative function leads to differences in both the content and the structure of verb and noun meaning. The meanings of proper nouns and concrete nouns (which I will call "simple nouns") are more concrete in content than are verb meanings. Simple nouns can be

[1] This representational format was developed in a seminar headed by David E. Rumelhart and attended by Adele A. Abrahamson, Danielle Du Bois, Dedre Gentner, James A. Levin, and Stephen E. Palmer.

seen as pointers to objects. As Rosch (1973, 1975) has demonstrated, their meanings are highly constrained by the nature of the physical world. Verbs, in contrast, express relational meanings which depend on abstract concepts and are relatively unconstrained by the physical world.[2] For example, in the representation shown in figure 1, no one particular action is associated with the verb *give*. Instead, *give* conveys a set of relationships among the noun arguments. These relationships—such as CAUSE or POSS—are abstractions that depend heavily on cultural notions of relatedness. They are not immediately perceivable from the sensory information. A child learning verb meanings is in part learning which abstract relationships may appear in word meanings. This is one reason that children are relatively slow to acquire verb meaning.

The relational-referential distinction is relevant to the structure of meaning representations as well as to the content. A simple noun, with its referential function of pointing to an object, behaves as a unified node for most communicative purposes. In contrast, the verb has the function of providing a relational framework for the sentence. It must decompose into subpredicates that link with the appropriate nouns. Consider the representation of "Ida gives Sam a rose" in figure 1. The separate components of *give* are linked with different nouns: POSSESSION (initial) relates *Ida* and *rose*, POSSESSION (final) links *Sam* and *rose*, DO relates *Ida* and the causal chain, and so on. This is not the case with *rose*. Its attributes—the physical parts, the scent, etc.—do not enter into separate relations with other parts of the sentence; rather, they act as a unified concept. This need not imply that simple nouns have no componential structure. Featural representations of nouns, including simple nouns, have been proposed (e.g., Katz & Fodor 1963; Smith, Shoben, & Rips 1974). However, a complete representation of simple noun meaning would have to reflect the fact that the components of simple nouns are both highly interrelated with one another and highly redundant as compared with the components of verbs. Simple noun meanings are in this sense more dense than verb meanings. Because the components of verb meanings are more separable from one another than those of noun meaning, verbs (and other relational terms) provide some of the clearest examples of componential acquisition of meaning.

Acquisition of Relational Meaning

We turn now to research on the details of the acquisition of verb meaning, using the representational notions discussed above. The material is organized according to whether it bears primarily on the structure, the content, or the use of word meanings.

Structure

Componential acquisition.—If the structure of verb meaning is separable into component subpredicates, then we might expect to see evidence of children's gradual accretion of these semantic components, along the lines suggested by E. Clark (1973). I investigated the acquisition of the verbs *give*, *take*, *pay*, *trade*, *spend*, *buy*, and *sell* (Gentner 1975). The verbs were divided into three groups based on semantic complexity. Because the verbs share a great many semantic components, this complexity ordering is quite precise: the representations of verbs in simpler complexity groups are contained as proper subsets in the representations of the verbs in more complex groups. For example, all the components of *give* (fig. 1) are contained within the representation of *sell* (fig. 2). Applying the notion of componential acquisition (E. Clark 1973) yields two predictions: (1) the verbs should be acquired in order of complexity; and (2) in the period before children have completely acquired the meaning of a given complex verb, their representation of the verb should contain just those components with which they are familiar. Thus the children's representations of the complex verbs will be similar to their representations of simpler verbs.

[2] Both noun meaning and verb meaning can be considered referential, with nouns referring to thinglike elements and verbs referring to relational elements. Thus the contrast could have been described as "thing referring" versus "relation referring." However, this description, in addition to being rather cumbersome, gives things and relations equal status as real-world entities. My choice of the terms "referential" versus "relational" is intended to emphasize that the relational meanings included in a semantic system reflect human conceptual choices to a greater extent than do the terms that refer to real objects. A similar (though not identical) distinction has been made by the philosophers Kripke (1972) and Putnam (1975) (see also Fodor 1977, pp. 209–14). They discuss a class of "natural kind terms," which are defined essentially by pointing to real-world objects.

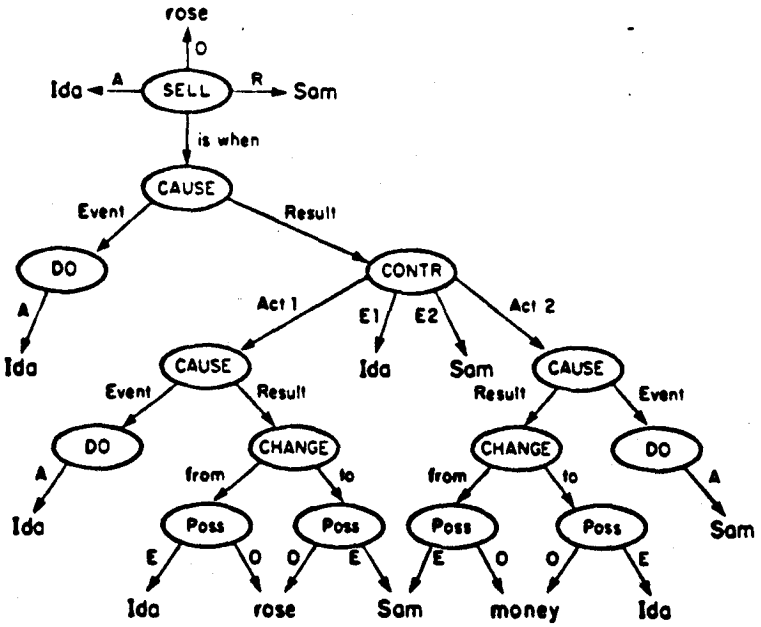

FIG. 2.—Representation of "Ida sells Sam a rose." *A* = agent, *E* = experiencer, *O* = object, *R* = recipient, *Act* = action.

Children aged 3½–8½ were asked to act out sentences, such as "Make Ernie buy a car from Bert," using dolls with toys and money. The results support the notion of componential acquisition. The verbs are acquired in the order predicted: first *give* and *take*; then *pay* and *trade*; and finally *buy*, *sell*, and *spend money*. Further, the pattern of errors for the complex verbs suggests componential acquisition. The most frequent error for *buy* is for children to act it out as though it meant *take*; similarly, *sell* is acted out as *give*. These errors indicate incomplete representations of *buy* and *sell*. The children have acquired enough of the meanings to perform object transfers in the correct direction (namely, DO, CAUSE, CHANGE, and POSS), but show no awareness of the components OBLIG or CONTR or of the constraint of a money argument.

Similar evidence for an acquisition order from simple meanings to complex meanings has been found for the verbs of motion *come*, *go*, *bring*, and *take* (Clark & Garnica 1974), for the verbs of communication *ask*, *promise*, and *tell* (Chomsky 1969), and for other kinds of relational terms, notably dimensional adjectives.

Possible words: rules for combining semantic components.—Bowerman (1974) has observed in her daughter's speech the overgeneralization of a rule for combining semantic components into words. This rule concerned the component CAUSE. After having used noncausal verbs such as *fall* and *stay* correctly for some time, Christy at the age of 2 years began to use them causally; for example, "I'm just going to fall this on her." The verb *fall* for adults means something like "CHANGE from LOCATION (high) to LOCATION (low), nonvolitionally." Christy used *fall* transitively, as though it meant "DO something to CAUSE a CHANGE in another object from LOCATION (high) to LOCATION (low)." Although she had never heard the word used with that meaning, she had learned a common English pattern of word relationships: namely, that the word for a change of state can often be used to refer to causing the state or change of state to occur: for example, "The box is open." / "I open the box." To have overgeneralized this rule, the child must not only have had a distinct component for causality in her representation, but also must have been aware at some level of the regularity of the rule for the addition of a CAUSE component.

Bowerman's observations show that simple additive accretion of semantic components is not the only process in acquisition of meaning,

for Christy had eventually to subtract the overgeneralized causal component from *fall* in order to arrive at the adult meaning. However, both Bowerman's studies and the componential accretion studies provide evidence that semantic components are the units of acquisition, at least among relational terms.

Although the componential acquisition model was at first thought to apply to the acquisition of concrete noun meaning, recent evidence suggests that it may not (Rosch, Mervis, Gray, Johnson, & Boyes-Braem 1976; Thomson & Chapman 1975). However, there is evidence for componential acquisition of relational nouns, notably nouns of kinship (Haviland & Clark 1974). This underscores the point that what is really at issue here is not a syntactic distinction between verbs and nouns but a semantic distinction between relational terms and terms that refer to physical objects.

Finally, it may be important to distinguish between domains, such as that of possession, in which the children initially lack some of the necessary conceptual knowledge, and other domains (such as, possibly, the domain of motion verbs) in which children initially have the necessary conceptual knowledge but do not know which aspects are relevant to word meanings. We must ask whether the pattern of additive accretion of semantic components that characterizes the acquisition of the possession verbs is also applicable in domains in which the child begins with more complete conceptual knowledge.

Content

When children learn word meanings, what kinds of information are included in their representations of meaning? According to E. Clark (1973), early word meanings contain chiefly perceptual information, which is accessible even to the very young child. Nelson's (1974) position is that early word meanings contain chiefly functional information, since this is of primary interest to the young child. Both theories hold that an object's normal motion is likely to be included in its early meaning. They differ as to the role of the static form of an object and of the use to which an object is put. The Clark theory states that form and not use is prominent in early word meaning, the Nelson theory that use and not form is prominent.

An experimental comparison of form and use.—The difficulty in comparing form, motion, and use in early word meanings is that they all tend to be closely correlated in the real world (cf. Anglin 1977). In this section I describe an experiment in which novel objects were constructed to separate the variables of form and use.

The child learned the names *jiggy* and *zimbo* for two objects differing from one another in both form and use. In form, the jiggy was a blue and yellow wooden box with a large pink plastic face mounted on one side, a small hole at the bottom, and a lever on the right side of the box. Its use was that sliding the lever caused the nose and eyes to move up and down, changing the facial expression. The zimbo was a clear plastic sphere containing jelly beans, mounted on a red base. Like the jiggy, it had a small hole at the bottom and a lever on the right side. Its use was that sliding the lever caused jelly beans to pop out of the hole. After learning about the jiggy and the zimbo, the child was asked to name a hybrid object which was identical to the jiggy in form and to the zimbo in use. If children's meanings for *jiggy* and *zimbo* are based on use, then the name *zimbo* should be applied to the new object; if form is the basis for the word meanings, then the hybrid should be called a *jiggy*.

Subjects ranging in age from 2 years to adulthood learned the names of the two objects in a naturalistic way (details of the study are given in Gentner [in press]). The child first played with and learned the name of the jiggy. Then, in another room, the child was shown the zimbo and encouraged to operate it and to eat the jelly beans. Its name was learned very quickly. Finally, after checking to be sure that the child could remember the jiggy, the child was shown the hybrid object and asked "Can you make this work?" Children were usually astonished when jelly beans poured from what looked like a jiggy. The experimenter then asked, "Now what do you suppose this is called?" Most children readily identified the object as either a *jiggy* or *zimbo*. Older children and adults sometimes used a combination term such as *jiggy-zimbo*, in which case the experimenter asked, "If it had to be either a *jiggy* or a *zimbo*, which would it be?"

The pattern of results is rather surprising. Very young children and adults responded according to form, while intermediate-aged children responded according to use. The proportions of "jiggy" responses (responses based on form) were as follows: .82 for 3–5-year-olds ($N = 11$); .42 for 5–7-year-olds ($N = 12$);

.44 for 7–9-year-olds ($N = 9$); .25 for 9–11-year-olds ($N = 5$); .5 for 13–15-year-olds ($N = 8$); and .75 for adults ($N = 12$). This U-shaped pattern raises some interesting possibilities (see Gentner, in press). However, one clear conclusion is that the young children—2½–5 years of age—are applying the words on the basis of static perceptual attributes and not on the basis of use.

These results suggest that young children are likely initially to include in their word meanings static information about how objects look, rather than information about what they are used for. These results are in accord with Bowerman's (Note 3) analysis of her children's errors in noun usage during the one-word stage and with Anglin's (1977) review of similar observations in the literature. There were many errors based on perceptual similarity, particularly similarity of shape, in the absence of functional similarity; but there were hardly any errors based on functional similarity in the absence of perceptual similarity.

Mixing: motion and function.—In the jiggy-zimbo study, children showed a propensity to include perceptual information rather than functional information in their noun meanings. The question can also be posed about verbs: Are children more likely to include perceptual information or functional information in early verb meanings? A natural comparison exists here in the acquisition of verbs which convey information on both motion and use.

Many English verbs convey both an action and a change of state resulting from the action. This change of state is the normal purpose or result of the action and for our purposes can be considered the functional aspect of the verb's meaning. The action, on the other hand, falls in the category of dynamic perceptual information. For example, consider some verbs of mixing. *Mix*, *stir*, and *beat* (by hand) evoke similar scenarios with similar instruments, but differ in the degree to which they specify particular actions versus particular functions. The verb *mix* is strongly functional; *mix* specifies a change of state (an increase in homogeneity) and is unspecific as to the actions that result in this change. In contrast, *stir* specifies a certain kind of hand-and-spoon motion (rotary medium-slow) and leaves the function unspecified. Figure 3 shows tentative representations of the meanings of *mix* and *stir*, developed by James Greeno and me. *Beat* (by hand) specifies a rapid, more or less elliptical motion and has a weak functional specification of change of texture. *Shake*, though not primarily a mixing verb, is similar to *stir* and *beat* in specifying a certain kind of motion and placing few if any constraints on the function of that motion.

Children aged 5–9 and adults (eight subjects per group) were asked to label various events. The experimenter performed actions of stirring, beating, or shaking, using mixable or nonmixable substances in glass containers. The mixable substance was a combination of salt and water, the homogeneity of which was increased by any of these actions. Cream was

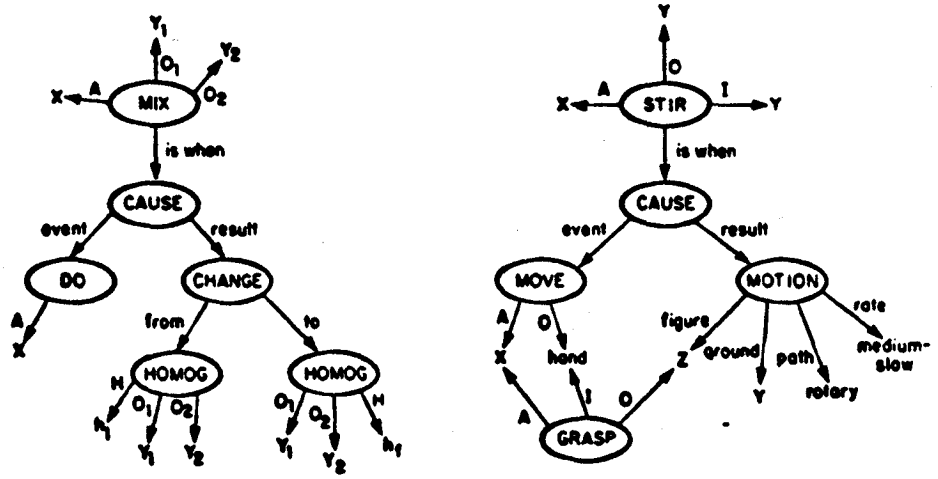

FIG. 3.—*A*, Representation of "*X* mixes Y_1 and Y_2"; *B*, representation of "*X* stirs *Y* with a *Z*." *A* = agent, *H* = homogeneity, *I* = instrument, *O* = object.

used as the nonmixable substance; its homogeneity was unchanged by any of the actions. There were six combinations of the two substances with the three actions, as well as other events not relevant here. After a first pass in which the child labeled each of the events as the experimenter performed them, the experimenter repeated each event, asking specific questions: for example, "Am I beating it?" "Am I mixing it?" For each event the child was asked to verify *beating*, *stirring*, *mixing*, and *shaking*, as well as filler verbs (e.g., *singing*). Assuming that our representations of the verb meanings are correct, an ideal speaker should agree to the use of *stir*, *beat*, or *shake* when and only when the corresponding action was performed (i.e., for one-third of the events) and should agree to the use of *mix* when and only when the substance acted on was mixable (i.e., for half of the events). Each event was tested twice, in random order. The results of the verification task are shown in table 1.

The results indicate that, for the mixing verbs, understanding of action meaning precedes understanding of function meaning. All age groups distinguished appropriate from inappropriate actions in their uses of *stir*, *beat*, and *shake*. That is, they were more likely to agree to a word's use when the action was correct than when it was not. However, the youngest children—aged 5–7—did not distinguish appropriate from inappropriate changes of state in their uses of *mix*. Older children and adults did make this distinction, applying *mix* more often to actions performed on salt and water than to actions performed on cream. Thus it appears that knowledge of the action components of *stir*, *beat*, and *shake* precedes knowledge of the proper change of state (the function meaning) of *mix*.

TABLE 1

PROPORTION OF TRIALS LABELED BY THE VERBS "BEAT," "STIR," AND "SHAKE" AND BY THE VERB "MIX"

Age in Years	Appropriate Action	Inappropriate Action	Appropriate Function	Inappropriate Function
5–7.....	.97	.06	.48	.46
7–9.....	.93	.05	.67	.48
Adult...	.81	.19	.69	.35

NOTE.—Responses for *beat*, *stir*, and *shake* are pooled over both substances (32 possible appropriate uses and 64 possible inappropriate uses), responses for *mix* are pooled over all three actions (48 possible uses).

Summary.—Children appear to learn the action components of the mixing verbs before they learn the change of state components. This need not imply that the functional aspects of mixing are uninteresting to children. On the contrary, young children take great interest in successfully mixing paints, foods, mudpies, and so on. One indication of children's interest in the notion of mixing is that they begin to learn the meaning of *mix* very early. In other experiments I have found that *mix* is understood as an action verb (similar to *stir*) by about 3½ years.

Similarly, in the jiggy-zimbo experiment the children seemed much more interested in playing with the zimbo, with its jelly beans, than with the jiggy; and it was informally observed that they learned the name *zimbo* considerably more quickly than they learned the name *jiggy*. Yet, in spite of their clear interest in function, when they were required to choose between form and function as the basis for applying a word, they chose form.

I suggest that the conflict between the form and function positions can be clarified by separating the issue of *which* words children learn first from the issue of *what* the words mean to them. A strong case can be made that functional relevance determines which words children learn. Nelson (1973) showed in her examination of early vocabularies that children learn first the names of objects that they can operate on and that change and move. This accords with the pattern observed in the jiggy-zimbo experiment. However, it appears that the content of the meanings and the basis for generalizing to new instances is likely to be perceptual information and not functional information. This becomes less surprising if one considers that perceptual information, particularly static perceptual information, may constitute the first conceptual system that the child knows well. Many investigators have emphasized that children base their word meaning on prior conceptual structures (e.g., H. Clark 1973; Huttenlocher 1974; Nelson 1974). It seems likely that perceptual knowledge is the conceptual system that children understand earliest and therefore rely on in their early word meanings.

Word Usage

Given that a child has a meaning representation for a word, how is that stored meaning manifested in speech? E. Clark's (1973) initial hypothesis might be termed the "trans-

parency hypothesis": children apply a word when the situation fits perfectly with their stored meaning of the word. Thus, if a child called cows, sheep, and other animals *doggies* it could be inferred that the child's meaning of *doggie* was consistent with all those animals, so that *doggie* might have only the features "animate, four-legged." Overextension of a word thus implied underspecification of its meaning. Following Huttenlocher's (1974) suggestion that children may understand more about word meanings than their productions reveal, Thomson and Chapman (1975) tested 2-year-old children and found that words overextended in production are not always overextended in comprehension. A child who spontaneously applied *doggie* to cows might, when asked, be able to correctly choose the doggie from a pair consisting of a dog and a cow. This kind of evidence has led to the abandonment of the transparency assumption. As Clark (1975) says in her restatement of the semantic feature hypothesis, we cannot assume that children always apply the entire meaning of a word in a situation; rather, it appears that children sometimes use a word when only part of its meaning applies. An example given by Bowerman (1976) is Eva's use of the verb *kick* when one or more of three features of a prototypical kicking situation was present: a waving limb, a sudden sharp contact, or an object propelled.

An interesting asymmetry between comprehension and production occurs in the use of the verb *stir*. I investigated the verbs *stir*, *mix*, and *beat* in a production task (in which children labeled actions performed by the experimenter) followed by a comprehension task (in which children were given a variety of implements and asked to act out various actions). In comprehension of *stir*, all subjects, from 4 years old through adulthood, were exceedingly precise: they almost invariably acted out *stir* as a slow-to-moderate rotary motion, using correct implements. Thus, the action meaning of *stir* appears to be well specified, even for young children, and in particular it is better specified (and less variably acted out) than the action meanings of *mix* and *beat*. However, a different pattern emerged in the production task. *Stir* is the word most frequently applied by the youngest children to all hand-mixing actions, regardless of the rate of motion or the shape of the spoon's trajectory. Paradoxically, the verb most narrowly comprehended is the one most broadly produced. This is a rather striking example of nontransparency in children's word usages.

Why do children who comprehend a word very precisely nevertheless apply that word outside their own apparent boundaries, in spite of possessing (at least in comprehension) more accurate words? I suspect that, in production, children often prefer to extend words they know well, rather than to use words of whose meaning they are less certain. This may apply particularly to verbs and other relational terms, whose meanings in general are broadly used (see Bowerman, this issue).

Breadth of usage.—Most common verbs are used very broadly in adult speech. We use the verb *give* to convey change of possession, but we also speak of giving someone a headache, a college education, a good talking-to, and so on. We can *make* time, space, love, and war, among other things. If the number of word senses listed in a dictionary is taken as a rough measure, the breadth of usage of the verbs learned earliest by children is greater than that of the nouns. Dictionary entries for the first five verbs acquired (on the average) by children in Nelson's (1973) study show a mean of nine word senses; for the first five nouns, the mean number is 6.2. Because of the breadth of adult verb usage, children's extensions of verbs often pass unnoticed. For example, a child who learns the verb *open* in the context of opening a door can extend *open* to removing a box top, pushing a window up, and stretching the mouth and still be correct within the adult use of the term. Indeed, adult patterns of verb use may be based on the same principle as children's. The word senses of a given verb are not random collections of meanings, but are in general related to one another, often as metaphorical extensions. It is only when children stumble onto an extension that happens not to occur in adult parlance, such as "open (turn on) the television" (Bowerman, Note 4), that we notice their adventuresome behavior with verbs.

The greater extendability of verbs is probably a factor in the long time course of verb acquisition, not only because of the greater variability in adult usage, but also because, from the child's point of view, a small number of verbs suffices to convey a large number of messages. Children are able to communicate quite effectively by combining a few predicates such as *go* and *more* with large numbers of specific referential terms. The pivot/open dis-

tinction was an early formulation of the phenomenon that a small class of predicates is used broadly in early speech, while a large class of argument words, mostly simple nouns, is used more specifically (Braine 1963; also see Bloom 1970). Thus, in addition to the greater difficulty of learning abstract verb meanings, another reason that verbs are slower to be acquired than nouns may be that it is a good communication strategy to have few verbs and many nouns or, more generally, few relations and many things.

Conclusions

Implications for Theories of Acquisition of Meaning

E. Clark's (1973) semantic feature hypothesis, with its central postulate that word meanings are acquired componentially, makes two specific predictions: (1) word meanings should be learned in order of semantic complexity, and (2) early errors should be indicative of incomplete semantic representation. Clark further hypothesized that the content of early word meaning is predominantly perceptual. Finally, a subsidiary assumption was that word use is transparent: that is, that words are used in strict accordance with their meanings. If the notion of semantic features is extended to include the kinds of subpredicates that figure in verb meaning, the findings on acquisition of verbs agree remarkably well with the central tenets of the theory. Both of the predicted lines of evidence have been found: semantically simple verbs are learned before semantically complex verbs, and complex verbs are misapprehended in the early stages as meaning only part of what they mean to adults. Further, there is now a great deal of evidence for the contention that children's initial word meanings are based primarily on perceptual information and that this contributes to the slowness with which verb meanings are learned. The only aspect of the original theory that seems to need serious revision is the transparency assumption. It appears that children make far more active use of their word meanings than was at first thought. Particularly where verbs are concerned, children (and adults) extend words to situations that only partially match their stored representations (see Clark 1975). Finally, a further amendation is that the processes of word acquisition must include occasional subtraction of erroneous subpredicates (as in Bowerman 1974).

Nelson's (1974) functionally based theory of meaning acquisition postulates an initial stage in the development of a word's meaning in which (1) dynamic and functional information predominates over perceptual information; (2) the representation of the concept is holistic, not analytical; and (3) many functional relationships are stored, with superfluous ones being dropped later. These assumptions are not well supported by the research presented here. Considering the points in order: (1) both with artificial objects and in the acquisition of the verb *mix*, perceptual information (whether static or dynamic) preceded functional information in children's meanings; (2) in predicting acquisition patterns, the success of the componential treatment of verb meaning supports the notion that verb meanings are acquired and represented componentially, not holistically; and, more specifically, (3) in acquisition of verb meaning the typical pattern is one of gradual accretion of semantic components, rather than of initial storage of large numbers of components with later dropping out of irrelevant components. Nelson's theory may apply better to children younger than those studied here. It may be that the children studied here had already learned rules for associating perceptual information with word meanings that were initially functional. However, the interpretation that best fits the present studies is that children's early word meanings are not functional but perceptual.

Verbs and Nouns: A Reprise

The acquisition of verb meaning differs from the acquisition of simple noun meaning in several ways. First, verb acquisition is a slower process. Verbs enter the vocabulary later than nouns and the rate of vocabulary increase in the first few years is lower for verbs than for nouns. Further, the meanings of many common verbs are not fully acquired until the age of 8 years or older. A second difference is that acquisition of verb meaning follows a more obvious pattern of accretion of components of meaning than does acquisition of simple noun meaning, particularly since early noun overgeneralizations can no longer be taken as sufficient evidence for componential acquisition. Finally, verbs are more broadly used by children and by adults than are simple nouns.

These differences between verbs and simple nouns are traceable to differences between relational and referential meaning. Simple nouns can be seen as pointing to objects in the world. Perceptual information figures largely

in their meanings, which are thus highly constrained by the nature of the world. In contrast, the meanings of verbs reflect the abstractions that enter into our notions of relatedness. Oversimplifying somewhat, one could say that the child has only to look at the world to discover simple noun concepts. The task of discovering which relationships are considered by the culture to be linguistically relevant is a more difficult one. As Bowerman says, ". . . it is possible to imagine an almost infinite variety of ways in which particular children might come to regard some relationships between objects or events in their experiences as similar to other relationships . . ." (1976, p. 62). Thus, the relative abstractness and arbitrariness of relational terms makes them slower to be acquired. Further, since the componential meaning structures of relational terms such as verbs are both less redundant and less densely interrelated than those of simple nouns, their components are acquired separately to a greater extent than are noun components. (This avenue awaits a more detailed representation of simple noun meaning than we now have.)

The study of the acquisition of verbs and other relational terms offers a slow-motion glimpse into the child's implicit learning of the conceptual systems of the culture. In children's use of verbs we see from the very beginning a capacity for analogy and for creative extension. Gertrude Stein (1957, p. 212) summed it up well: "Beside being able to be mistaken and to make mistakes verbs can change to look like themselves or to look like something else, they are, so to speak on the move and adverbs move with them and each of them find themselves not at all annoying but very often very much mistaken. That is the reason any one can like what verbs can do."

Reference Notes

1. Ervin-Tripp, S. M. Some bases for early features of production. Paper presented at the Colloques Internationaux du Centre National de la Recherche Scientifique, no. 206, Paris, December 1971.
2. Talmy, L. Semantic structures in English and Atsugewi. Unpublished doctoral dissertation, University of California, Berkeley, 1972.
3. Bowerman, M. The acquisition of word meaning: an investigation of some current conflicts. Paper presented at the Third International Child Language Symposium, London, September 1975.
4. Bowerman, M. Personal communication, January 1977.

References

Abrahamson, A. A. Experimental analysis of the semantics of movement. In D. A. Norman & D. E. Rumelhart (Eds.), *Explorations in cognition*. San Francisco: Freeman, 1975.

Anglin, J. M. *Word, object, and conceptual development*. New York: Norton, 1977.

Bendix, E. H. *Componential analysis of general vocabulary: the semantic structure of a set of verbs in English, Hindi, and Japanese*. The Hague: Mouton, 1966.

Bloom, L. M. *Language development: form and function in emerging grammars*. Cambridge, Mass.: M.I.T. Press, 1970.

Bowerman, M. Learning the structure of causative verbs: a study in the relationship of cognitive, semantic and syntactic development. *Papers and Reports on Child Language Development* (Stanford University) 1974, 8, 142–178.

Bowerman, M. Semantic factors in the acquisition of rules for word use and sentence construction. In D. Morehead & A. Morehead (Eds.), *Normal and deficient child language*. Baltimore: University Park Press, 1976.

Braine, M. D. S. The ontogeny of English phrase structure: the first phase. *Language*, 1963, 39, 1–13.

Chafe, W. L. *Meaning and the structure of language*. Chicago: University of Chicago Press, 1970.

Chomsky, C. *The acquisition of syntax in children from 5 to 10*. Cambridge, Mass.: M.I.T. Press, 1969.

Chukovsky, K. [*From two to five*] (M. Morton, Trans.). Berkeley: University of California Press, 1968.

Clark, E. V. What's in a word? On the child's acquisition of semantics in his first language. In T. E. Moore (Ed.), *Cognitive development and the acquisition of language*. New York: Academic Press, 1973.

Clark, E. V. Knowledge, context, and strategy in the acquisition of meaning. In D. P. Dato (Ed.), *Georgetown University round table on languages and linguistics*. Washington, D.C.: Georgetown University Press, 1975.

Clark, E. V., & Garnica, O. K. Is he coming or going? On the acquisition of deictic verbs. *Journal of Verbal Learning and Verbal Behavior*, 1974, 13, 559–572.

Clark, H. H. Space, time, semantics and the child. In T. E. Moore (Ed.), *Cognitive development and the acquisition of language*. New York: Academic Press, 1973.

Fillenbaum, S., & Rapoport, A. *Structures in the subjective lexicon*. New York: Academic Press, 1971.

Fillmore, C. J. Verbs of judging: an exercise in semantic description. In C. J. Fillmore & D. T. Langendoen (Eds.), *Studies in linguistic semantics*. New York: Holt, Rinehart & Winston, 1971.

Fodor, J. D. *Semantics: theories of meaning in generative grammar*. New York: Crowell, 1977.

Gentner, D. Evidence for the psychological reality of semantic components: the verbs of possession. In D. A. Norman & D. E. Rumelhart (Eds.), *Explorations in cognition*. San Francisco: Freeman, 1975.

Gentner, D. What looks like a jiggy but acts like a zimbo? A study of early word meaning using artificial objects. *Papers and Reports on Child Language Development* (Stanford University), in press.

Goldin-Meadow, S.; Seligman, M.; & Gelman, R. Language in the two-year-old. *Cognition*, 1976, 4, 189–202.

Greenfield, P. M., & Smith, J. H. *The structure of communication in early language development*. New York: Academic Press, 1976.

Haviland, S. E., & Clark, E. V. "This man's father is my father's son": a study of the acquisition of English kin terms. *Journal of Child Language*, 1974, 1, 23–47.

Huttenlocher, J. The origins of language comprehension. In R. L. Solso (Ed.), *Theories in cognitive psychology: the Loyola symposium*. Potomac, Md.: Erlbaum, 1974.

Katz, J. J., & Fodor, J. A. The structure of a semantic theory. *Language*, 1963, 39, 170–210.

Kripke, S. A. Naming and necessity. In D. Davidson & G. Harman (Eds.), *Semantics of natural language*. Dordrecht: Reidel, 1972.

Miller, G. A., & Johnson-Laird, P. N. *Language and perception*. Cambridge, Mass.: Harvard University Press, Belknap Press, 1976.

Nelson, K. Structure and strategy in learning to talk. *Monographs of the Society for Research in Child Development*, 1973, 38(1–2, Serial No. 149).

Nelson, K. Concept, word and sentence: interrelations in acquisition and development. *Psychological Review*, 1974, 81, 267–285.

Postal, P. M. On the surface verb "remind." In C. J. Fillmore & D. T. Langendoen (Eds.), *Studies in linguistic semantics*. New York: Holt, Rinehart & Winston, 1971.

Putnam, H. The meaning of meaning. In K. Gunderson (Ed.), *Minnesota studies in the philosophy of science*. Vol. 7. Minneapolis: University of Minnesota Press, 1975.

Rosch, E. On the internal structure of perceptual and semantic categories. In T. E. Moore (Ed.), *Cognitive development and the acquisition of language*. New York: Academic Press, 1973.

Rosch, E. Cognitive representations of semantic categories. *Journal of Experimental Psychology: General*, 1975, 104, 192–233.

Rosch, E.; Mervis, C. B.; Gray, W.; Johnson, D.; & Boyes-Braem, P. Basic objects in natural categories. *Cognitive Psychology*, 1976, 8, 382–439.

Rumelhart, D. R., & Levin, J. A. A language comprehension system. In D. A. Norman & D. E. Rumelhart (Eds.), *Explorations in cognition*. San Francisco: Freeman, 1975.

Schank, R. C. Identification of conceptualizations underlying natural language. In R. C. Schank & K. M. Colby (Eds.), *Computer models of thought and language*. San Francisco: Freeman, 1973.

Smith, E. E.; Shoben, E. J.; & Rips, L. J. Structure and process in semantic memory: a featural model for semantic decisions. *Psychological Review*, 1974, 81, 214–241.

Stein, G. *Lectures in America*. Boston: Beacon Hill, 1957.

Thomson, J. R., & Chapman, R. S. Who is "Daddy"? The status of two-year-olds' overextended words in use and comprehension. *Papers and Reports on Child Language Development* (Stanford University), 1975, 10, 59–68.