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A STUDY OF EARLY WORD MEANING USING ARTIFICIAL OBJECTS: WHAT LOOKS LIKE A JIGGY BUT ACTS LIKE A ZIMBO?

ABSTRACT: Theories of semantic acquisition have differed as to the relative importance of form and function in early word meaning. One reason that the issue has been difficult to resolve is that in everyday life the forms of objects are highly correlated with their normal uses. The present study attempts to circumvent this difficulty by using artificial objects.

Two objects were constructed to' differ from one another both in form and in function, and to be quite interesting to children. Children played with these objects and learned their names in a naturalistic setting. One of the objects had an extremely salient function: it delivered jellybeans. Yet, when children were asked to name a hybrid object which had the function (delivering jellybeans) of the jellybean object, but the form of the other original object, the youngest children (aged 21/2 to 5 years) named the new object according to form. These and other aspects of the data suggest that the proper resolution of the form-function debate may be more complex than some early accounts had supposed: that functional relevance and salience determine *which words* young children learn, but that the *meanings* stored with the word are based chiefly on form and other perceptual information.

This paper is concerned with the question of what information' enters into children's early word meanings. When a child first learns that a word refers to an object, what does the child store as the word's meaning? When the child later applies the word to the same or other objects, on what basis is she doing so? In particular, one focus of concern in recent research is whether perceptual information or functional information is of primary importance in children's early word meanings.

Clark (1973), in her semantic feature theory, proposed that children base their first

This research was supported in part by the National Institute of Education under Contract No. HEW-NIE-C-400-76-0116, and in part by the Psychology Department of the University of Washington. A preliminary account of this research appeared in the Stanford *Papers and Reports on Child Language Development,* No. *15,* August 1978.

I would like to thank Louise Carter and Erik Svehaug for their helpful suggestions concerning this research, and Cindy Hunt and Kathy Starr for their help in preparing the manuscript.

SOURCE: From Dedre Gentner, "A Study of Early Word Meaning Using Artificial Objects: What Looks Like a Jiggy but Acts Like a Zimbo?" Papers *and* Reports *on Child Language* Development, 1978, *15,* 1-6. Reprinted by permission of the author.

word meanings on perceptual information associated with the referent. Her review of parental diaries of children's first word usages suggested that a large number of early noun overextensions were based on similarity of form and other perceptual similarities between the original referent and-the new object to which the word was applied. This position is supported by the findings of Anglin (1977) and Bowerman (1974, 1975) and others, whose examinations of overgeneralizations have shown a predominance of perceptually-based overextensions.

Nelson (1973) has put forth an opposing view: that children's initial word meanings are predominantly based on dynamic and functional information, rather than on perceptual information. She points out that children are strongly interested in actions and functional relationships (Piaget, 1954). Questions like "What does it do?" or "What is it for?" seem more important to young children than "What does it look like?". Therefore children are more likely to include in their initial word meanings information about the actions and relationships an object engages in, particularly those that affect the child, than information that merely derives from the perceptual form of the object. As support for this view, Nelson's examinations of early vocabularies showed that children learn first the names of objects that they can operate on and that change and move (Nelson, 1973; Nelson, Rescorla, Gruendel, & Benedict, 1978).

Both theories hold that an object's normal motion is likely to be included in its early meaning, since motion is both perceptually salient and functionally important. Where the two positions differ is on the relative importance of the static form of the object versus the use or function of the object. The Clark theory states that form should predominate over use in early word meaning; the Nelson theory, that use should predominate over form. Both sides have intuitive appeal. The argument for the perceptual view is that at the stage when the child is learning his first words, perceptual regularities may well constitute his main set of dependable cognitive structures; they are therefore likely to be recruited in his attempts to assign meaning to words. The appeal of the functional view is that it seems compelling that children should focus more on the functionally significant aspects of objects than on their mere appearances.

It is difficult to test between these two positions, since form and function are mutually constraining and highly correlated among real objects (Anglin, 1977). Objects designed to float on water generally look a lot like boats; objects that move fast are streamlined, and so on. This correlation makes it hard to resolve the - controversy unambiguously using evidence from spontaneous speech, such as patterns of word extension. A further reason that it has been difficult to test between the two views is that Nelson's position has an additional complexity. Nelson states that, while the earliest word meanings are based on functional information, children rapidly learn that perceptual information is correlated with this functional core. Once they learn about this correlation, they may rely on perceptual information rather than functional information in their use of object names. The naming behavior of children whose core meanings were functional, but who used perceptual information when applying words, would of course be indistinguishable in most situations from the behavior of children whose meanings were perceptual. Thus the Nelson theory can yield predictions similar to those of the Clark theory once the child has learned the correlations between form and function for a given object. This makes it all the more difficult to draw evidence from natural usage that can decide between the two positions.

An adequate test between these two theories requires a situation in which static

perceptual information and functional information could not have been previously associated by the child. Therefore, to conduct this study, artificial objects were constructed to allow form and function to be independently manipulated. The basic plan was (1) to teach the child, in a naturalistic manner, names for two objects that differed both in form and function; and (2) to then present the child with a hybrid object possessing the form of one object and the function of the other, and ask what this object should be called. If the child thought the original word names referred to the forms of the objects, then the hybrid should have the same name as the object of the same form; and analogously for function. In such a case, Nelson's theory predicts that a child's meaning will center on the functional aspects of the object. Therefore the new object should be named according to shared function. Clark's theory predicts that the child's meaning will be based on perceptual aspects of the object, so that the new object will be named by form.

MATERIALS

Both the forms of the objects and their functions were chosen to be natural and interesting to children. There were two original objects that differed both in form and function, and a hybrid object used as a test object. Figure 1 shows the objects. The *jiggy* was a blue and yellow square box, on the side of which was mounted a bright orange face. There was a lever on the side of the box, connected to the face in such a way that when the child moved the lever back and forth the eyes and nose moved up and down, changing the expression on the face.

The *zimbo* was a modified gumball machine. It had a red base and a clear plastic sphere containing jellybeans. It had a lever similar to that of the *jiggy,* and operated with the same kind of motion. When the lever was moved back and forth, two or three jellybeans dropped from the machine. Thus, the jiggy and zimbo differed from one another in both form and function.

SUBJECTS

There were 57 subjects, ranging in age from 21½ years to adulthood. The distribution by age and sex is shown in Figure 2.

PROCEDURE

The experiment was conducted in a naturalistic manner. Children encountered the jiggy in a waiting room where other children and adults were playing and talking. Three experimenters, all engaged in different primary studies, joined in treating the *jiggy* as a natural toy. We would say to the children as they entered the waiting room, "Oh, have you seen the jiggy yet? Here it is. Would you like to make it work?". Then we would ask other children to show the *jiggy* to the newcomer. When we passed through the room, we made a practice of saying to onee or. another of the children something like, "Can you remember what this is called?" or "How do you make this work?". In this way, we tried to be sure that all the children were very familiar with both the name and the function of the jiggy, and that they regarded it as a natural toy, and not an experimental device.

The children encountered the *zimbo* in a second room, while participating in an unrelated experiment. Most children spontaneously asked "What's that?", as there were no other objects on its shelf. When this happened (or unprompted, if the child did not inquire) the experimenter said casually "That's a zimbo. Can you see how to work it?". The children, particularly the younger

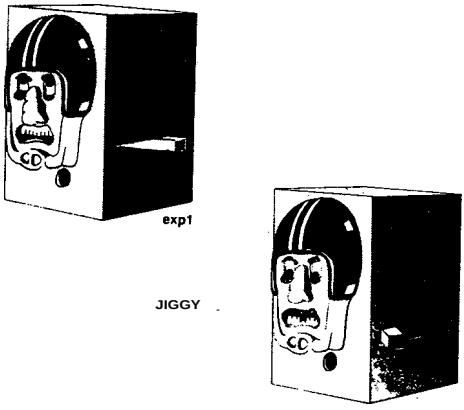

Figure 1. Materials used: *jiggy, zimbo* and hybrid object used in test.

ones, were quite pleased with the zimbo, learned its name very rapidly, and asked to play with it again and again, each time consuming another few jellybeans. By the end of the session, each child had learned the name *zimbo* thoroughly and knew how to operate the machine.

After the other experiment was over, the child and the experimenter went back through the waiting room, again encountering the jiggy. The experimenter casually asked "Do you remember what that is?" to be sure that the child could still remember what the *jiggy* was called and how it was operated. Finally the child was taken into a third room. The experimenter then unveiled the hybrid object, which looked almost precisely like the *jiggy*. Before the child could say anything, the experimenter asked, "Can you make this work?". The child stepped forward and moved the handle in the accustomed way. When, instead of changing facial expressions, the machine produced a handful of jellybeans, most children were astonished, often exclaiming to their parents. Then the experimenter asked "What do you think this is?".

RESULTS

Very young children usually responded very readily with one of the original names. Adults and some older children often responded with a combination name, such as *jiggy-zimbo*. In this case, we asked them, "If it had to be called either *a jiggy* or *a zimbo,* which would it be?". The results are shown in Figure 2.

An Age (4 levels) by Sex (2 levels) analysis of variance indicated significant main effects of Age and Sex {$F(3, 49) = 5.15$, $p < .01$ and $F(1, 49) = 14.74$, $p < .01$, respectively). The Age X Sex interaction was also significant {$F(3, 49) = 3.65$, $p < .05$).

The pattern of results shows, first, that the youngest children-aged 21/2 years to 5 years - responded on the basis of form and not function. For these children, when form and function are put into conflict, it is form rather than function that determines the application of the word to the new object. The second finding is that, while younger and older children responded chiefly on the basis of form, children of middle years responded chiefly on the basis of function. This curvi-

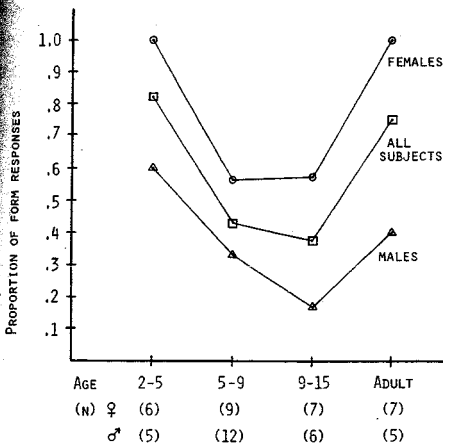

Figure 2. Proportion of responses based on form across age, by sex.

linear pattern raises some interesting possibilities, discussed later in this paper.

The fact that the younger children responded on the basis of form rather than function is rather clear counterevidence to the Nelson position, particularly in view of the strong interest that this youngest group displayed in the jellybean function. Almost all the children, particularly the younger ones, asked to play with the zimbo again and again. The young children's learning patterns left no doubt' that the functions of the objects, especially that of the zimbo, were important to them. A very consistent informal observation was that young children learned the name of the zimbo considerably faster than the name of the *jiggy*. For both objects, the children could imitate the name immediately after hearing it. The difference was in retention of the name. After one or two repetitions, almost all the children used the term "zimbo" in spontaneous production for the remainder of the session. Only rarely did a child request a further reminder of its name (e.g., "Can I play with the - uh - what do you call that thing?"). For the jiggy, *many* more repetitions of the name were required before the child could reliably produce the term non-imitatively.

Thus, the fact that the young children based their responses on form cannot be dismissed with the argument that they found the functional aspects of the situation uninteresting. Moreover, the name *zimbo* was normally produced many more times than the name *jiggy,* because children asked for it repeatedly. Thus any effects of prior frequency of word usage would have increased the likelihood that young children would call the new object *a zimbo.* Yet the children, particularly the youngest, still. called it a *jiggy* according to shared form.

It might be argued, in support of the Nelson theory, that these children had already learned the general correspondence between form and function, and can now apply it in word-learning situations. Perhaps, with still younger children, functional responses would have outweighed form responses. This would require postulating an N-shaped developmental pattern, adding another inflection to the U-shaped pattern found here. Since the youngest children tested gave the highest proportion of perceptual responses, this possibility seems cumbersome and would require considerable defending.

Further experimental evidence that form predominates over function in very early word meanings comes_ from a series of studies by Tomikawa and Dodd (in press). They constructed a set of nine objects that varied in form and function according to a 3 X 3 matrix: that is, there were three sets of three objects alike in form but different in function, and three different sets of three objects alike in function but different in form. They found that children aged two to four were

more likely to categorize these objects on the basis of form than function; and, even more to the point, that two- and three-year-old children readily learned referential names for categories consisting of three perceptually-alike objects, but not for categories of functionally-alike objects.

Here again it appears that children take words as referring to the perceptual object. These results are in accord with the observations of spontaneous extensions (Anglin, *1977;* Bowerman, *1977;* and Clark, *1973).* However, the pattern of results found for the jiggy-zimbo case suggests a finer differentiation of the form-function hypothesis. Young children learned the name of the jellybean-providing zimbo more rapidly than the name of the less functionally interesting *jiggy.* Yet, when they had to apply a name to the hybrid object, they called it a *jiggy* on the basis of shared form, in spite of the fact that its function was that of the more interesting zimbo. This pattern suggests that we need to distinguish more carefully between *which objects* children learn names for and *what information* about these objects enters into their word meanings. It may well be that function is important in determining which object-names children learn earliest, but that the content of the word meaning, and the basis for applying the word to new instances, is primarily perceptual information.

This proposal, then, is that function determines *which* while form determines *what.* This could account for the seemingly conflicting findings in the literature. Nelson's *(1973)* findings that early vocabularies are heavily weighted towards small objects with interesting functions can be accounted for, since children should learn first the names of objects whose functions are important to them. On the other hand, Clark's *(1973)* findings concerning diary overextensions, Bowerman's *(1977)* observations of spontaneous word usage, and Anglin's *(1977)* studies of picture-naming, all of which indicate that early word meanings are heavily based on the perceptual form of objects, can also be explained in this framework. Regardless *of which* words a child learns earliest, the claim is that shape of an object, its characteristic movement patterns, and other perceptual information will predominate in the child's representation of the word meaning.

It is perhaps surprising that children fail to base their word meanings on the aspects of the objects that interest them most. One explanation that has been suggested is that children implicitly base their word meanings on information for which they possess relatively well-understood conceptual structures (H. Clark, *1973;* Huttenlocher, *1974;* Nelson, *1974).* The supposition is that completeness of conceptual framework is important even to children. Perceptual regularities, including static perceptual knowledge (that is, knowledge of form) probably constitute the conceptual system that children understand earliest (Bryant, *1974;* Piaget, *1954).* It is perhaps reasonable, therefore, that they rely on this system in their early word meanings (H. Clark, *1973).*

The notion that word meanings are based on well-understood conceptual systems raises some interesting possibilities concerning the U-shaped developmental pattern found here. It is possible that this trend represents children's growing understanding of different kinds of functions. Perhaps at an early age, children think of objects, even mechanical objects, in a simple visual way, since they lack any understanding of mechanical functions. Later, children begin to develop systematic understanding of the kinds of mechanical functions that objects can perform. At this stage they begin to include such information in their word meanings. There may even be a period during which the child relies more exclusively on functional knowledge than an adult would do. Such temporary over-use of a new domain of regularity

would be analogous to other instances of over-use of conceptual generalizations in language development; e.g., in acquisition of the past tense, as when *dug* gives way to *digged;* or in acquisition of causative morphology, as when a child who once said "Don't drop it." says instead "Don't fall it." (Bowerman, 1973).

This proposal that children go through a period of temporary over-use of mechanical knowledge in deriving semantics would explain the U-shaped pattern found here. It also might fit with the sex differences found. Girls showed less reliance on functional information throughout than boys. Assuming that the girls in this study had less experience with mechanical devices of this kind than did the boys, they would not have developed as well-elaborated a conceptual system as the boys did. They would therefore have continued to rely more on perceptual information in their word meanings. This account of the sex difference leads to an interesting prediction: that girls should show an earlier shift from perceptual to functional information than boys in cases when the functional knowledge lies in domains more likely to be learned by girls. More generally, for any domain, all else being equal, we would expect non-perceptual information to enter word meanings after the individual has had experience with the relevant system.

In conclusion, the results of the present naturalistic study converge with other experimental findings and observations to suggest that form and function may have different effects on early word learning. While functional relevance appears important in determining which words children learn, the patterns of extension of word use suggest that perceptual information about the referent object predominates in the child's representation of meaning.

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