

The Acquisition of Word Meaning: An Investigation into some Current Conflicts

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The last few years have seen a rising interest in the question of how children acquire the meanings of words. In recent literature on the subject, several areas of conflicting opinion have begun to come into focus. In this study, three such conflicts are investigated through the analysis of spontaneous speech data from two children.

Briefly, the issues to be discussed are as follows: 1) What kinds of cues do children use as a basis for extending words to novel referents early in development? 2) Do all the referents for which a child uses a particular word share one or more features or are words typically used 'complexively', such that no one feature is common to all referents? 3) How do children organize and store word meanings? Controversy has centred on whether word meaning is described most accurately as a set of semantic features or in terms of prototypical referents or 'best exemplars'.

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The data referred to in the following analyses come from my two daughters, Christy and Eva. Christy is the older child by 2-1/2 years. I kept detailed records on both children by taking extensive daily notes and by tape recording periodically from the start of the one-word stage. Fairly complete records are available on the way in which almost every word was used from its first appearance in the child's speech to about 24 months. Data on word use continue beyond that point but are more selective.

BASES FOR EXTENDING WORDS TO NOVEL REFERENTS

Word for Objects. In her 'Semantic Feature' theory of the acquisition of word meaning, Clark (1973, 1974b) has argued that children's extensions of words to novel objects are initially based primarily on perceptual similarity. That is, objects that are referred to by the same word are perceptually similar in some way, particularly with regard to shape, and, to a lesser extent, size, texture, movement, and sound.

Nelson (1974) has recently argued strongly against this view. Citing Piagetian theory in support, she contends that children initially lack the ability to analyze objects into perceptual components like 'round' or 'four-legged' and to use these components in isolation as a basis for classification. Nelson argues instead that children at first experience objects as unanalyzed wholes and classify them in terms of the actions associated with them and the relationships into which they enter. They regard objects as similar if they are functionally similar, e.g., if they are acted upon or act spontaneously in a similar way.

Unlike Clark, Nelson views the perceptual characteristics of objects as playing a secondary rather than a primary role in the way children form concepts. Perception is secondary because it is used not as the basis for classification but simply to identify an object as a probable instance of a concept even when the object is experienced apart from the relationships and actions that are concept-defining.

The theories of Clark and Nelson make divergent predictions about how children initially use words for objects. Clark's theory predicts that a given word will be used for objects that are perceptually similar, regardless of function, while Nelson's predicts that the word will be used to refer to objects that either function in the same way, regardless of perceptual properties, or that the child predicts would function in the same way on the basis of similar perceptual properties. Both the perceptual and the functional accounts

of categorization agree on the salience of spontaneous motion as a basis for classifying animate creatures, vehicles, etc. Thus, the conflict is primarily over the relative importance of static perceptual features like shape.

Nelson (1973a) has presented some experimental material in support of her claim that shared function rather than similar perceptual properties is the primary basis for children's early object concepts, but the data are limited (only one concept, 'ball', was investigated). Previously-reported naturalistic data on children's spontaneous use of words for novel objects offer little support for Nelson's theory. For example, some of the overextensions reported in the diary studies that Clark (1973) drew from in formulating her perception-based theory are clearly incompatible with a theory that stresses the prepotence of shared function (cf. Clark, 1975). ('Overextension' refers to the child's application of a word to a referent that an adult regards as lying outside the semantic category labelled by that word, e.g., 'doggie' for a horse.)

The spontaneous speech data from the two subjects of the present study provide further strong evidence against the theory that functional similarity predominates over perceptual similarity in the child's classification of the objects to which his early words refer. In all the data from both children, there is only a handful of examples of overextensions of words to new objects purely on the basis of similar function in the absence of shared perceptual features, and these occurred relatively late, after many object words were already known. In contrast, there are scores of examples of overextensions based on perceptual similarity, especially shape, in the absence of functional similarity, and many of these occurred during the early period of word acquisition.

These data would not be incompatible with Nelson's theory if the instances of overextension based on perceptual cues could be interpreted in accordance with Nelson's proposal that perceptual cues are used primarily to predict the function of an object so that the object can be identified as a member of a known function-based category. However, this interpretation is not possible in many instances. Rather, the children often disregarded functional differences, i.e. gross disparities in the way objects act or can be acted upon, that were well known to them in the interests of classifying purely on the basis of perceptual similarities. Some examples illustrating this phenomenon are presented in Table 1. Eva, for example, used the word 'moon' for a ball of spinach she was about to eat, for hangnails she was pulling off, for a magnetic capital letter D she was about to put on

TABLE 1. Overextensions based on perceptual similarities, counter to known functional differences.

Age given in years, months, days.

All examples in all tables are spontaneous; there was no prior modelling of the word in the immediate context.

All utterances were single words unless otherwise marked.

M = Mummy; D = Daddy

1. Eva, 'moon' (selected exx.) 1;3.26 (first use): looking at the moon, 1;4.2; looking at peel-side of half-grapefruit obliquely from below, 1;4.19; playing with half-moon shaped lemon slice, 1;4.23: touching circular chrome dial on dishwasher, 1;4.24: playing with shiny rounded green leaf she'd just picked; touching ball of spinach M offers her, 1;5.2: holding crescent-shaped bit of paper she'd torn off yellow pad, 1;6.16: looking up at inside of shade of lit floor lamp, 1;6.21: looking up at pictures of yellow and green vegetables (squash, peas) on wall in grocery store, 1;6.29: looking up at wall hanging with pink and purple circles, 1;7.7: pointing at orange crescent-shaped blinker light on a car, 1;8.4: looking up at curved steer horns mounted on wall, 1;8.11: putting green magnetic capital letter D on refrigerator, 1;8.11: picking up half a cheerio, then eats it, 1;8.13: looking at black, irregular kidney-shaped piece of paper on a wall, 1;11.20: 'my moon is off' after pulling off a hangnail (a routine usage).
2. Christy, 'snow' 1;4.10 (first use): as handles and eats snow outdoors, 1;4.16: looking at white tail of her spring-horse; touching white part of a red, white, blue toy boat; looking at a white flannel bed pad, 1;4.17: after drops bottle and it breaks, spreading white puddle of milk on floor.
3. Christy, 'money' 1;3.30 (first use): holding a handful of pennies, a button, and a bead taken from a bowl; she has often played with these; 1;4.11: scratching at wax circles on a coffee table, 1;6.7: putting finger through round, penny-sized hole in bottom of new plastic toy box, 1;7.14: feeling circular flattened copper clapper inside her toy bell.

the refrigerator, and so on. These objects all have shape in common with the various phases of the real moon, but the child's actions upon them were completely dissimilar. The other examples illustrate a similar disregard for known functional differences among the objects in question. Such examples of classification on the basis of perceptual cues counter to known functional differences weigh heavily against Nelson's proposal that perceptual cues play a secondary, purely predictive role in the child's classificatory operations.

A second factor that counts against the function-based theory of how children form object concepts and attach words to them can be mentioned only briefly. Nelson proposes, as a logical corollary of her theory, that 'when instances of the child's first concepts come to be named, it would be expected that they would be named only in the context of one of the definitionally specified actions and relationships' (1974:280). In other words, 'the name of an object will not be used independently of these concept-defining relations at this point; early object word use would be expected to be restricted to a definable set of relations for each concept' (1974:280). According to Nelson, this hypothesis 'describes accurately what is usually termed the holophrastic stage...' (1974:280).

The early object-naming behaviour of Christy and Eva does not accord with this prediction. Most of their first object words (e.g., 'ball', 'bottle', 'dog', 'dolly', 'cookie') were initially uttered not when the children (or others) were acting upon the objects in question (or, for animate objects, watching them act) but when the objects were static, seen from a distance ranging from a few feet to across a room (see, for example, nos. 1, 2 in Table 3, p. 272). This suggests that the role of function ('actions' and 'relationships') in the child's early formulation and naming of concepts is less crucial than Nelson proposes.

It is possible that the age at which particular words for objects are first uttered is a critical factor with regard to this issue. That is, the earlier an object name is acquired, the more likely it is that it will be uttered in connection with concept-defining actions, etc. However, Christy's and Eva's first object words were learned at 14 and 13 months, respectively, which is toward the lower end of the typical 'holophrastic' stage to which Nelson suggests her hypothesis applies. This indicates that even if Nelson's function-based theory accurately describes the acquisition of object words that are learned unusually early, the theory specifies constraints on the child's methods of

formulating concepts and/or identifying new instances of existing concepts that no longer necessarily operate during most or, depending on the child's age at the start of word production, all of the holophrastic period during which the early lexicon is established.

Words for Non-Object Concepts. Words that do not refer to objects often figure importantly in children's earliest lexicons (e.g., Bloom, 1973; Nelson, 1973b). How are these words acquired and extended to novel referents? Something other than perceptual similarity is clearly involved in the acquisition of words like 'more', 'allgone', 'up', etc., since the objects or activities involved in the contexts in which children say these words are extremely varied. For many such words, the governing concept or cross-situational invariance involves a certain kind of relationship between two objects or events or between two states of the same object or event across time. Despite Nelson's (1974) emphasis on the importance of relational, functional concepts, her theory does not explain how words for actions and relationships are acquired. This is because in her theory, actions and relationships are the givens by which objects are classified; there is no account of how these concepts themselves are formed, nor is it explicitly recognized that they, no less than object concepts, in fact are categories summing across non-identical situations. (See Bowerman, 1976b:124 for further discussion.)

Words that reflect the child's recognition of constancies across his own subjective experiences or reactions to diverse events are particularly resistant to interpretation in terms of similarities among perceptual attributes or functional relationships. Nelson (1973b) has observed that many children acquire words of this type (a subgroup of 'personal-social' words, in her study) relatively early. Some examples from the Christy and Eva data of words that were extended to new situations on the basis of similarities in subjective experience are given in Table 2. The recurrent element in the use of 'there!' seems to have been a sense of having completed a project, for 'aha!' it was an experience of surprise at some unexpected object or event, for 'too tight' it was a feeling of being physically restrained or harassed, for 'heavy' it was a sense of physical effort expended on an object.

To conclude, the implications of the various arguments presented above on the nature of children's early bases for classifying are that an adequate theory of the acquisition of word meaning has to be flexible enough to account for the child's ability, even from a very early age, to classify experiences on the basis of many different kinds of similarities. Theories built

TABLE 2. Words extended to novel situations on the basis of subjective experiences.

1. Eva, 'there!' At 12-1/2 months in connection with the experience of completion of a project: as M finishes dressing her; as she gets last peg into hole of pounding board; after she carefully climbs off a high bed, etc. Drops out until 17th month, then 1;4.24: after getting a difficult box open (D has just shown her how), 1;4.25: after sticking each of several vinyl fish on side of bathtub, 1;4.26: after getting a rubber band onto handle of kiddicar, etc.
2. Christy, 'aha!'. From 1;6.10 in many different situations involving her experience of discovery and surprise, e.g., 1;6.10: as opens book and sees new picture; after gets up during the night and finds bowl of peanuts on table; it was not there earlier, 1;6.13: when M comes home with paper bag, 1;6.14: when sees D taking out a cake, 1;6.15: after sticks hand in cannister and finds rice in bottom; as finds piece of candy on M's dressing table, 1;6.16: discovering and looking into box, 1;6.17: coming upon M who is furtively eating a cookie; finding unexpected pile of tiles in a corner of house.
3. Eva, 'too tight'. From 23rd month, protest in situations involving physical restriction or interference, e.g., as M holds her chin to give her medicine; pulls down her sleeves; bends her legs up to change diapers as she lies on back; washes her ears, pulls on her hands to wash them over a sink.
4. Christy, Eva, 'heavy'. In situations involving experience of physical exertion (often unsuccessful) with an object, whether or not it is actually 'heavy', e.g., Christy, from 1;9.12: carrying books, etc., 1;9.16: trying to lift a packet of oatmeal out of a box above her shoulder level; it is stuck; pushing on and squeezing a small plastic cup (which does not bend), 1;9.21: trying to lift soap bubble bottle as D holds it down. Eva, 1;11.30: 'too heavy', trying unsuccessfully to unhook gas pump line on toy gas station.

around only one basic class of similarities, whether perceptual or functional, are too restricted to account for the rich diversity of ways in which children can recognize constancies from one situation to the next.

THE STRUCTURE OF CHILDREN'S EARLY WORD-CONCEPTS

Recent theorizing about the acquisition of word meaning has been predicated in part on the assumption that children identify words with one or more stable elements of meaning. In other words, it is assumed that all the referents to which a child extends a particular word share attribute(s), whether these attributes are perceptual or functional, and that the meaning of the word can be described in terms of these attributes or features. For example, all referents for a child's word 'dog' might share the perceptual feature 'four-legged' (Clark, 1973), all referents for the word 'ball' might share the functional features 'can be rolled/bounced' (Nelson, 1974).

This recent emphasis on words for which all referents are characterized by one or more common features contrasts with earlier accounts of the acquisition of word meaning. Theorists like Werner (1948), Vygotsky (1962), and Brown (1965) emphasized that children do not consistently associate a word with a single contextual feature, or set of features; rather, they use words 'complexively', shifting from one feature to another in successive uses of the word. Bloom (1973) has suggested that both kinds of word usage may occur in early development, but not typically at the same time. She argues that the association of words (at least words for objects) with consistent feature(s) requires a firm grasp of the concept of object permanence. Complexive usage reflects lack of that concept, according to Bloom, and occurs early in the one-word stage, while consistent usage does not occur until the concept is fully established during the second half of the second year.

The data from Christy and Eva do not support Vygotsky's sweeping claim that 'complex formations make up the entire first chapter of the developmental history of children's words' (1962:70), nor are they consonant with Bloom's more qualified stage hypothesis. Both children used some words for both object and non-object referents in a consistent, noncomplexive way virtually from the start of the one-word stage. In addition, they used other words complexively, but this kind of usage was not confined to the earliest period. Rather, it tended to flower a few months after the production of single-word utterances had begun and continued on well into the third year and, for certain words, even beyond. Moreover, the children's complexive use of words was somewhat more common for words referring to actions than for those referring to objects, which does not accord well with Bloom's view that complexive usage results from lack of firm mental representations of objects. In short, the complexive and the noncomplexive uses of words were not temporally ordered stages; rather, the two types of word use were contemporaneous.

Noncomplexive Words. Some examples of words used consistently for referents sharing one or more features from early in the one-word stage are given in Table 3. Examples 1 and 2 are words for objects (cf. also examples 2 and 3 in Table 1), while examples 3 and 4 are words for actions. The latter two examples are particularly interesting because they demonstrate how two children can differ dramatically in the concepts they attach to the same word, despite what is probably fairly similar input (see Bowerman, 1976b:135, for discussion). Notice that Christy's word [ɑ:] ('on' and 'off'; it was not clear if these were two words or one, as she did not pronounce final consonants at this time) was overextended to refer to virtually any act involving the separation or coming together of two objects or parts of an object. Adults would refer to many of these acts by the words 'open', 'take apart/out', 'unfold', or 'close', 'join', 'put together/in', 'fold'. Eva's word 'off', unlike Christy's, was initially used in a restricted range of contexts from the adult point of view. It referred only to the removal of clothes and other objects from the body and did not generalize beyond this domain for several months. During this time Eva simply did not have a way of referring to other kinds of separation, although she engaged in activities involving separation and joining just as much as Christy had.

Complexes. Several different types of complexive thinking have been described in the literature on concept formation (e.g., Vygotsky, 1962; Olver and Hornsby, 1966). Discussions of children's early complexive use of words most frequently refer to the type Vygotsky (1962) called 'chain complexes'. In forming a chain complex, whether in a block sorting task or by the use of a word, a child proceeds from one item to the next on the basis of attributes shared by two or more consecutive items but not by all the items. In other words, there is no stable attribute nor set of recurrent attributes associated with the concept. For example, item B shares something with item A (e.g., shape), item C shares something with B (e.g., colour) but perhaps not with A, and so on. Despite the frequency with which children have been described as typically forming chain complexes in their early use of words, few examples of the phenomenon have actually been presented in the literature.

Chain complex formation was negligible in Christy's and Eva's linguistic development. In all the data from both children there is only one rather limited example. Almost all their complexive uses of words were 'associative', a pattern that Vygotsky (1962) describes

TABLE 3. Words used noncomplexively for referents with shared attributes.

1. Eva, 'ball'. From 1;1.5 for rounded objects of a size suitable for handling and throwing, e.g., 1;1.5 (first use); as spies a large round ball in adjoining room; then goes to pick it up, 1;1.7: as picks up rounded cork pincushion; then throws it, 1;1.9: as looks at a round red balloon; later, also as handles it, 1;2.4: whenever sees or plays with balls or balloons, 1;2.7: as holds an Easter egg; then throws it, 1;2.8. after picking up a small round stone, then throws it, 1;2.10: as sees plastic egg-shaped toy, 1;2.18: as holds a round cannister lid, then throws it; etc.
2. Eva, 'ice'. From 1;1.9 for frozen substances, e.g., 1;1.9 (first use): watching M open a package of frozen peas; she likes to eat them, 1;2.29: reaching towards ice in a glass, 1;3.2: rushing towards M as M takes frozen spinach from package, 1;3.2: after M gives her her first taste of frozen orange juice concentrate; etc.
3. Christy, [α:] 'on-off' (not clear if two words or one). From 1;3.12: in connection with situations involving separation or rejoining of parts, e.g., between 1;3.12 and 1;4.17 in connection with getting socks on or off, getting on or off spring-horse, pulling pop-beads apart and putting them together, separating stacked dixie cups, unfolding a newspaper, pushing hair out of M's face, opening boxes (with separate or hinged lids as well as sliding drawers), putting lids on jars, cap on chapstick, phone on hook, doll into high-chair, pieces back into puzzle, while M takes her diaper off, trying to join foil-wrapped torn-apart towelettes, etc.
4. Eva, 'off'. From 1;2.18, in connection with separation of things from the body only (as request or comment), e.g., between 1;2.18 and 1;4.22, for sleepshades, shoes, car safety harness, glasses, pinned-on pacifier, diaper, bib. Starting at about 1;3.23: 'open' begins to be used in other 'separation' situations, e.g., between 1;3.23 and 1;5, for opening doors, boxes, cans, toothpaste tubes; pulling pop-beads apart; taking books out of case, tip off door stop, wrapper off soap; cracking peanuts; peeling paper off book cover, etc. 'Off' still used for taking things off the body.

in connection with children's block sorting behaviour. In an associative complex, successive instances of the concept do not necessarily share anything with each other but all share at least one feature with a central or 'nuclear' instance, e.g., the sample block given to the child. Thus, the elements of the associative complex are '...interconnected through one element - the nucleus of the concept'. In contrast, in the formation of a chain complex 'the original sample has no central significance'. In other words, 'there is no consistency in the type of the bonds or in the manner in which a link of the chain is joined with the one that precedes and the one that follows it' (1962:64).

In Christy's and Eva's complexive use of words, the central referent for a word (which will be called here the 'prototype' to link it with a literature to be discussed in the following section) was, with a few exceptions, the first referent for which the word was used. In addition, it was the referent in connection with which the word had been exclusively or most frequently modelled. (Sometimes there were several 'prototypical' referents for a word; these all shared the entire set of attributes that appear to have been associated with the word, as judged by the child's subsequent overextensions, and they all figured importantly in both the adult's modelling and the child's earliest uses of the word.) Other referents appear to have been regarded as similar to the prototype by virtue of having any one or some combination of the attributes that, in the child's eyes, characterized it.

Some examples of complexive word usage that can be characterized in terms of variations around a prototype are given in Table 4. Consider example 1, Eva's use of 'kick'. Some of the referents for this word seem to share nothing with each other, e.g., a moth fluttering vs. bumping a ball with the wheel of a kiddicar. But all share something with the hypothesized prototypical 'kick' situation, in which a ball is struck by a foot and propelled forward. For instance, the moth is characterized by 'a waving limb', while the kiddicar referent is characterized by 'sudden sharp contact' plus 'an object (ball) propelled'. (In this example, prototypical 'kick' was not first referent for the word, as in most of the other examples. However, it seems to be implicit in the second referent (a cat with a ball near its paw) and it was almost certainly the most frequently modelled referent for 'kick'.)

Example 2 in Table 4 illustrates that for Christy, 'night night' was associated with three primary features that were present one-at-a-time in many of the situations in which she used the word: beds or cribs, blankets, and the 'nonnormative' horizontal position

TABLE 4. Complexively used words with prototypical referents.

1. Eva, 'kick'.

Prototype: kicking a ball with the foot so that it propelled forward.

Features: a) a waving limb, b) sudden sharp contact (especially between body part and another object), c) an object propelled.

Selected examples: 1;5.14: as kicks a floor fan with her foot (Features a, b), 1;5.21: looking at picture of kitten with ball near its paw (all features, in anticipated event?), 1;5.25: watching moth fluttering on a table (a), 1;5.22: watching row of cartoon turtles on TV doing can-can (a), 1;6.3 and 1;6.13: just before throwing something (a, c), 1;6.20: 'kick bottle', after pushing bottle with her feet, making it roll (all features), 1;8.6: as makes ball roll by bumping it with front wheel of kiddicar (b, c), 1;8.7: pushing teddy bear's stomach against Christy's chest (b), 1;8.19: pushing her stomach against a mirror (b), 1;8.20: pushing her chest against a sink (b).

2. Christy, 'night night'.

Prototype: person (or doll) lying down in bed or crib.

Features: a) crib, bed, b) blanket, c) non-normative horizontal position of object (animate or inanimate).

Selected examples: 1;3.28 (first use): pushing a doll over in her crib; from this time on, frequent for putting dolls to bed, covering, and kissing them (features a, b, c); 1;4.5: laying her bottle on its side (c), 1;5.18: watching Christmas tree being pulled away on its side (c), 1;5.26: after puts piano stool legs in box, one lying horizontally (c), 1;5.27: after putting piece of cucumber flat in her dish and pushing it into a corner (c), 1;6.3: as M flattens out cartons, laying them in pile on floor (c), from 1;6.3: while looking at pictures of empty beds or cribs or wanting a toy bed given to her (a, sometimes b), 1;6.31: laying kiddicar on its side (c), 1;7.11: 'awant night night', request for M to hand her blanket; she then drapes it over shoulders as rides on toy horse (b).

TABLE 4 continued

3. Eva, 'close'.

Prototype: closing drawers, doors, boxes, jars, etc.

Features: a) bringing together two objects or parts of the same object until they are in close contact, b) causing something to become concealed or inaccessible.

Selected examples: starting from 1;3.23 for closing gates, doors, drawers (features a, b). From 1;5: for closing boxes and other containers (features a, b), 1;6.16: 'open, close', taking peg people out of their holes in bus built for them and putting them back in (a), from 21st month: while pushing handles of scissors, tongs, tweezers together and for getting people to put arms or legs together, e.g., 'close knees' (a), 1;8.18: 'close it', as tries to push pieces of cut peach slice together (a); trying to fold up a towlette (a, (b?)), 1;8.25: 'open, close', as unfolds and folds a dollar bill (a, (b?)), 1;9.16: 'open, close', after M has spread a doll's arms out then folded them back over chest (a), 1;11.8: 'Mummy, close me', 2;1.9: 'I will close you, o.k.?' both in connection with pushing chair into table (a), 1;11.14: 'that one close', trying to fit piece into jigsaw puzzle (a, (b?)), 1;11.30: 'I close it', as turns knob on TV set until picture completely darkens (b), etc.

4. Christy, Eva, 'open'.

Prototype: opening drawers, doors, boxes, jars, etc.

Features: a) separation of parts which were in contact, b) causing something to be revealed or become accessible.

Selected examples:

Christy: From middle of 17th month, 'open' starts to take over the function of 'off' (see example 3, Table 3) for 'separation' situations, both with and without 'revealing'. 1;4.12 (first use): for cupboard door opening (a, b), 1;4.19: pointing to spout in salt container that M had just opened (a, b), 1;4.28: trying to separate two frisbees (a), 1;5.1-7: for opening boxes, doors, tube of ointment, jars (a, b), 1;5.26: trying to push legs of hand-operated can opener wider apart than they can go; spreading legs of nail scissors apart (both a), 1;6.1: several times in connection with pictures

TABLE 4 continued

in magazine; wants M to somehow get at the pictured objects for her (b), 1;6.29: request for M to unscrew plastic stake from a block (a), 1;6.31: request for M to take out metal brad that holds 3 flat pieces of plastic together (a), 1;7.10: request for M to take stem off apple (a), 1;7.17: 'awant mummy ...open', request for M to pry pen out of piece of styrofoam (a), 1;7.20: request for M to take pegs out of pounding bench (a), 1;7.20: 'awant open hand', request for M to take leg off plastic doll (a), 1;7.23: request for M to turn on electric typewriter (b), 1;7.25: trying to pull pop beads apart (a), 1;8: request for M to turn on water faucet (b), 1;8.5: request for M to take pieces out of jigsaw puzzle, (a, (b?)), 1;8.6: trying to get grandma's shoe off her foot (a), 1;8.17: 'open light', after M has turned light off; request to have it turned on again (b), 1;9.6: 'awant that open', trying to pull handle off of riding toy (a), etc.

Eva: (cf Table 3, example 4 for initial uses). Later, 1;5.20: request for M to take apart a broken toothbrush (a), for M to pull apart two popbeads (a), 1;5.28: request for M to take pieces out of jigsaw puzzle (a, (b?)), 1;6: pulling bathrobe off M's knee to inspect knee (a, b), 1;6.9: request for M to turn TV on (b), 1;6.18: 'open tape', request for M to pull strip off masking tape (a), 1;7.10: 'open tangle', bringing M pile of tangled yarns to separate (a), 1;7.14: taking stubby candle out of shallow glass cup (a), 1;8: 'open mommy', trying to unbend a small flexible 'mommy' doll (a), 1;8.11: unfolding a towlette (a, b); 1;9.16: 'open slide', request for M to set slide in yard upright (a, (b?)), 1;8.19: request for M to put legs apart (a) 1;10.20: 'I'm open it', after rips apart two tiny toy shoes that were stuck together (a), 2;0.3: 'my knee open', as unbends her knee (a); 2;2.1: 'I will open it for you', before taking napkin out of its ring for M, does not unfold it, then says 'I open it' as report on completed action (a), 2;7.29: 'I'm gonna leave this chair open like this, I'm not gonnal shut it', as leaves table with chair pulled out (a), etc.

5. Eva, [gi] (from 'giddiup')

Prototype: bouncing on a spring horse

Features: a) horse (later, other large animals and riding toys which one sits astraddle). b) bouncing motion, c) sitting on toy (especially astraddle)

TABLE 4 continued

Selected examples: From 1;2.9: while bouncing on spring-horse or as request to be lifted onto it (a, b, c), 1;2.13: as picks up tiny plastic horse, then tries to straddle it (a, c), 1;2.14: getting on toy tractor (c), 1;2.15: looking at horses on T.V. (a), 1;2.17: getting on trike (c), 1;2.17: seeing picture of horse (a), 1;2.20: bouncing on heels while crouching in tub (b), 1;2.23: climbing into tiny plastic blow-up chair (c), 1;2.24: looking at hobby horse (a), 1;2.30: bouncing astraddle on M's legs (b, c). Later, continues to be used for pointing out horses, generalizes to other large animals like cows, and while pointing out or riding on trikes, tractors, kiddicars.

6. Eva, 'moon'

Prototype: the real moon

Features: a) shape: circular, crescent, half-moon. These shapes were distinct, i.e., a stretch of curved surface not enough to elicit 'moon'. b) yellow colour, c) shiny surface, d) viewing position: seen at an angle from below, e) flatness, f) broad expanse as background.

Selected examples: (see Table 1, example 1 for details and dates): real moon (all features); half-grapefruit seen at an angle from below (a, b, d); lemon slice (a, b, e); dial on dishwasher (a, c, d, e, f); shiny leaf (a, c, e); ball of spinach (a), spheres were usually called 'ball'. (There was perhaps a limited chaining effect here to the leaf, e.g. earlier in the day, through shared greenness); crescent-shaped paper (a, b, e); inside of lamp shade (a, b, d); pictures of vegetables on wall (a, b, d, e, f); circles on wall hanging (a, d, e, f); crescent-shaped orange blinker light (a, (b?), c, e); steer horns on wall (a, d, f); letter D on refrigerator (a, d, e, f); half-cheerio (a, (b?)); kidney-shaped paper on wall (a, d, e, f); hangnails (a, e).

an object that is usually oriented vertically. These three features are all present in prototypical 'night night' situations in which a normally vertical person is lying down in bed covered with a blanket.

For both children, 'open' was associated with a feature involving the physical separation of two objects or parts of the same object and a feature to do with something being revealed, while 'close' was associated with the opposite features of bringing together and concealment (see examples 3 and 4 in Table 4). Both members of each pair of features co-occur in prototypical 'open' and 'close' situations involving doors, boxes, drawers, jars, etc. They are found separately in such referents as turning on or off a TV, water faucet, or light (revealing and concealing without separation and joining) and taking things off or apart and putting them on or together, such as taking the stem off an apple and buckling a wrist strap (separation and joining without revealing and concealing). Examples 5 and 6 of Table 4 present similar examples of complexive word usage revolving around prototypical referents.^{1,2}

Instances of complexive word usage similar to those discussed here have been remarked on by a few other investigators. For example, Labov and Labov (1974) observed that their daughter apparently identified the word 'cat', one of her first two words, with a set of features all of which characterize ordinary cats. She overextended the word to other animals that possess one or some of these features, but seemed more confident in using the word when many of the features were present. Clark (1975) notes that there are similar exemplars in the diary data from which she has drawn. She has modified her original (1973) theory of children's overextensions to account for this kind of usage by postulating that some overextensions are 'partial' rather than 'full', i.e., they are based on only a subset of the features that the child associates with the word (Clark, 1975).

To summarize, the data presented above indicate a) that children are capable of using words non-complexively from the start of word acquisition and b) that many children's 'complexive' word usages, rather than conforming to the traditional notion of an unstructured 'chain' of constantly shifting meanings, in fact reflect an internal structure describable in terms of a set of variations around a central instance (or instances) that may be termed a 'prototype'.

These findings suggest that there is less discontinuity between child and adult methods of classification than has often been supposed. First, the data from Christy and Eva provide evidence for an early ability to classify according to superordinate features (i.e., features characterizing all concept instances), a type of concept formation often thought to be beyond the capability even of children considerably older than they were at this time (e.g., Vygotsky, 1962). Second, the particular type of conceptual structure exhibited-

in their complexive use of words, a set of variations around one or more prototypical exemplars, does not reflect a 'primitive' mode of thought that later fades out. Rather, as recent research has demonstrated, a large number of adult semantic categories are characterized by this kind of structure (e.g., Rosch and Mervis, 1975). The correspondence between Christy's and Eva's complexive word usages and the internal structure attributed to adult semantic categories by Rosch and others will be examined more closely in the following section.

THE ORGANIZATION AND STORAGE OF WORD MEANING

A number of investigators studying concept formation, the structure and/or acquisition of word meaning, or semantic memory have recently focused attention on the role played by 'prototypes' or 'best exemplars' in the internal structure of natural categories (e.g., Rosch, 1973a, b; Rosch and Mervis, 1975; Fillmore, n.d.; Anglin, in press; Smith, Shoben, and Rips, 1974). Rosch (1973b), for example found that adult subjects were able to rate exemplars of particular semantic categories such as 'fruit' according to how well they exemplified the category, and agreed with one another in their ratings.

Some theorists have suggested that the representation of semantic categories (word meanings) in terms of prototypical exemplars should be regarded as an alternative to the more common practice of representing word meanings as sets of semantic features. For example, Fillmore (n.d.) argues that it may often be psychologically inaccurate to describe word meanings in terms of sets of features specifying conditions that must be satisfied before the word can be appropriately used. He proposes instead that 'the understanding of meaning requires, at least for a great many cases, an appeal to an exemplar or prototype -- this prototype being...possibly something which, instead of being analyzed, needs to be presented or demonstrated or manipulated'. Anglin (in press), writing with specific reference to very young children, also suggests that word meanings are often stored in the form of prototypes or visual schemas that are not analyzed into components. In making this proposal he draws upon Posner (1973), who has argued that being able to analyze a concept into a set of attributes or features is a relatively advanced skill, whereas the formation of prototypes is a more primitive process that does not require featural analysis.

The data presented in the last section indicate that accounting for referential prototypes does not have to be done at the expense of a featural analysis. Instead, both models can and should be combined,

as Rosch and Mervis (1975) have also argued. The data indicate in addition that, contrary to Anglin's argument, even very young children are capable of performing a featural analysis upon a prototypical referent and extending a word to novel referents on the basis of this analysis.

According to the model proposed by Rosch and Mervis (1975), explaining the existence of prototypical referents requires reference to the way in which features or attributes of possible referents are distributed within the category. Their model draws on Wittgenstein's (1953) notion of 'family resemblances'. According to Wittgenstein, possession of common elements is not the sole principle by which the referents for words may be linked together under a single concept; rather, for many words each possible referent has at least one and often several elements in common with one or more other referents, but no, or few, elements are shared by all referents. Rosch and Mervis hypothesized that the degree to which items are viewed as 'prototypical' members of the category labelled by a particular word is a function of the number of attributes they have in common with other referents for the word. As a corollary of this, they hypothesized also that the most prototypical referents for a given category would tend to share many attributes with each other. These hypotheses are supported by findings from a wealth of experimental studies that Rosch and Mervis conducted with adults.

The data from Christy and Eva fit the 'family resemblances' model proposed by Rosch and Mervis very well. It will be recalled that for virtually all of Christy's and Eva's complexively used words, there was one referent (or, occasionally, a small group of referents) that had one or more features in common with every other referent. In other words, in one (or a few) referent(s), the various attributes associated with the word, as judged by the way in which the child extended the word to novel items, co-occurred or clustered to the maximum degree possible.

How do categories structured around prototypical or 'best' exemplars arise? Rosch (1973b, 1974) has argued that the prototypes for certain categories, particularly physiologically determined ones, are salient prior to the categories and determine the nature of the categories. However, she doubts that all categories evolve in this manner. Some alternative sequences would be a) prototypes are formed through principles of information processing subsequent to experience with a number of particular instances of their categories (Rosch, in press) and b) frequency of exposure to given instances 'may make some items salient in a not-yet-organized-domain and may influence how that domain comes to be divided' (1973:143).

The complexive categories represented in the data from Christy and Eva appear to reflect the first-and/or last-mentioned sequence. That is, the prototypical referent was present from the beginning and constituted the core around which the subsequent category grew, rather than being an induction made later on the basis of diverse exemplars of the category. It is difficult to assess the relative importance of language-independent cognitive activity vs. linguistic input (e.g., frequency of exposure) in drawing a child's attention to particular objects or events such that they become the growing point or prototype for a category. For some of the examples in Table 4, it seems most plausible that a particular referent for a word became more salient than other referents primarily because of the relatively greater frequency with which the word was paired with that referent in the input to the child (e.g., kicking a ball for Eva's 'kick'). For other examples, a referent may have been so salient for non-linguistic reasons that the input did no more than supply the child with a word for an item that already had special status on nonlinguistic grounds and was 'ready', in a sense, to serve as a prototype (e.g., the moon, for Eva's 'moon').

Regardless of whether prototypical referents are salient for the child independently of, or because of, linguistic input, the sequence in which complexive categories structured around a prototype appear to develop is as follows: The child hears a word modelled most frequently (often exclusively) in connection with one referent or a small group of highly similar referents: e.g., 'night night' as the child or a doll is put to bed, 'gididiup' as the child bounces on her horse, 'close' as someone closes doors, boxes, jars, 'moon' as the child looks at the real moon or at pictures of the moon. The child's first use of the word also occurs in connection with one of these referents. After a variable period of time (ranging from a few days to more than a month), the child begins to extend the word to referents that are similar to the original referent(s) in specifiable and consistent ways.

What has happened? A plausible inference is that the child has imposed a featural analysis on the original referent such that she is now capable of recognizing two or more of its attributes independently, i.e., in situations in which they do not co-occur blended into a single package but rather are recombined with entirely different contextual features. For example, the 'bringing together' of parts and the concealment of something, which are intimately connected in prototypical 'close' situations, can now be recognized independently of each other, each one being associated with the word 'close'.

The attributes that the child comes to recognize as components of a given prototypical referent may be quite varied in nature. Some that are represented in the Christy and Eva data as presented in Table 4 include perceptual properties or configurations (e.g., flatness, yellowness for 'moon'; horse, or horse-like animal for [gi]); associated actions (e.g., bouncing for [gi]); spatial relationships (e.g., horizontal positioning of normally vertical object for 'night night'; separation for 'open'); purpose or end state (e.g. concealment for 'close'); the child's viewing position (e.g., obliquely from below for 'moon'), and so on.

The account presented above of the development of categories revolving around prototypical exemplars is at odds with proposals made by Anglin (in press) and Fillmore (n.d.) in that it credits the very young child with the capacity to perform a featural analysis on a referent.³ As noted earlier, Anglin (in press) suggests that prototypes may be stored unanalyzed as visual images. But if the prototype is unanalyzed, how can we account for the child's ability to recognize attributes of an original referent when they are separated from each other and recombined in entirely new configurations? In particular, an appeal to a global notion of 'visual similarity' is inadequate to explain the child's extension of words to referents that are visually quite dissimilar to the prototype, such as 'open' for turning on a faucet, light, or electric typewriter as well as for opening boxes and doors.

Another aspect of early word use that appears to require reference to the individual features of a prototype is the fact that some aspects of a prototypical exemplar may be more central or concept-defining for the child than others. The evidence for this is that the attributes of a prototype may turn up in new referents for the word with differing probabilities. Some always be present and hence appear to be criterial, while others are simply characteristic but not essential. For example, consider Eva's use of 'moon' as it is presented in Table 4. Shape was obviously the most important determinant of whether or not a given item would be called 'moon': every referent for the word was either round, half-moon, or crescent shaped. But in addition to shape, almost every referent for 'moon' shared with the prototypical real moon one or a combination of several other less critical features: flatness, yellowness, shininess, having a broad expanse as a background, and being seen at an angle from below.

Variation in the centrality or importance of various attributes of a prototype cannot be accounted for when word meanings are represented as unanalyzed

wholes. In contrast, it can easily be handled by models that represent word meanings in terms of semantic features. For example, Smith et al. (1974) propose a model of word meaning that is similar to that suggested by Rosch and Mervis (1975) with the additional specification that semantic features should be differentially weighted according to their degree of 'definingness' for a category. Such a provision appears essential if we are to account for phenomena like Eva's use of 'moon'.

CONCLUSIONS

Three main arguments about the nature and development of children's early word meanings have been advanced in this paper. A common element linking all three has been an appeal for breadth and for the integration of theories that by themselves account for only a portion of the data. An adequate theory of the acquisition of word meaning must be sufficiently broad and flexible to handle many disparate phenomena with equal ease within a common framework. In particular, it must come to terms with the following findings:

- 1) Children need not adhere to a single classification principle in the early stages of word acquisition (e.g., using only perceptual or only functional cues). Rather, they are capable of recognizing invariances of many different kinds, and consequently have a variety of methods of classification at their disposal.
- 2) The concepts governing children's early use of words are not necessarily either exclusively complexive, as earlier theorists maintained, or exclusively superordinate (i.e., with features held in common by all members of the category), as recent theorists have implicitly assumed. Nor do superordinate categories necessarily replace complexive ones over time. Rather, concepts of both types can exist contemporaneously, neither one being more 'primitive' than the other.
- Finally, 3) the representation of children's word meanings in terms of feature sets or lists of conditions that must be satisfied is not incompatible with representation in terms of prototypes or 'best exemplars'. Rather, both can and should be incorporated within a single model, just as Rosch and Mervis (1975) have advocated in connection with adult semantic categories.

Notes.

1. The characterization presented in this paper of the 'semantic features' associated with various words is intended as schematic rather than definitive, for two primary reasons. First, the extent to which certain features should be broken down is not clear. E.g., should 'sitting' and 'astraddle' be listed

separately in the meaning of [gi]? Should 'horse' be given as a unitary feature of [gi] or should it receive some finer analysis? Second, it is obvious that an adequate representation of the meanings of these words must involve more than a listing of features; some sort of relationship holding between the features must be specified. For example, the temporal co-occurrence of a waving limb and sudden contact would not be sufficient to elicit 'kick': the two must be connected. No attempt at dealing with these problems will be attempted here, however (but see the treatment of relationships holding between semantic components in Haviland and Clark, 1974; McCawley, 1971, and other linguists).

2. A number of Christy's and Eva's overextensions of verbs reflect their awareness of cross-situational similarities or invariances that are not explicitly recognized in the way English words are used but that are formally noted in the way other languages group referents under lexical items. For example, one 'opens' the water in Spanish and one 'opens' the TV or radio in Finnish. An interesting research question is whether there is a correlation between the frequency with which children make certain overextensions in one language (e.g., 'open' for the water faucet in English) and the frequency with which the corresponding classification is formalized in other languages. A high correlation would indicate a close relationship between the cognitive factors governing the way in which children classify, i.e., what similarities among objects or events are salient to them, and the way in which the semantic categories of natural languages develop. See Clark (1974a) for some related evidence supporting the hypothesis that there is a relationship between children's overextensions and the semantic categories of natural languages.
3. There may appear to be a discrepancy between the claim made here that the child can analyze referents for words like 'open' into sets of attributes at an early age and the claim made in an earlier paper (Bowerman, 1974) to the effect that causative verbs (including 'open') are initially 'unanalyzed' by the child. In fact, however, the two arguments are not incompatible because the objects of analysis in the two cases are different: the referent event in the case of 'semantic features' of the sort discussed in this paper and the word itself, in terms of its semantic relationships to other words, in the case of the discussion of causative verbs. See Bowerman (1976a) for further discussion of this distinction, which corresponds to the distinction linguists have

often made between two aspects of meaning, reference (the relationship of a word to the (class of) item(s) which it symbolizes) and sense (the relationship the word contracts with other words in the lexicon) (e.g., Lyons, 1968).

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