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NOTE

Relevance and early word learning*

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ABSTRACT

Several theorists have proposed that children may interpret an ambiguous word by attending to the dimension that is most relevant in the immediate discourse context. The current study offers a direct test of this hypothesis. Children aged 2;6 and 3;4 (N = 24 in each group) were presented with a novel object with an unusual shape and texture and were told 'This is a *dacky* one'. In the Shape-Relevant condition, two other objects' shapes were described before the target object was labelled ('This is a round one; this is a square one'). In the Texture-Relevant condition, two preceding objects' textures were described ('This is a smooth one; this is a fuzzy one'). Subsequent comprehension tests indicated that, in extending the novel adjective to other exemplars, children attended to the dimension that was most relevant to the preceding discourse context.

INTRODUCTION

Following Quine (1960), much has been made of the inherent ambiguity of reference, and its implications for children acquiring a first language. The basic question is how children can acquire words and use them appropriately if the acts of reference to which they are exposed are ambiguous. Theorists have proposed a variety of solutions to this problem of referential indeterminacy. Some posit that children come equipped with constraints or default assumptions that get word learning off the ground (Woodward & Markman, 1998; Hirsh-Pasek, Golinkoff & Hollich, 2000). Others argue that by attending to what is most salient in the context, children can map words to

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their appropriate referents (Samuelson & Smith, 1998). A third view – the one that is examined in this paper – is that children generally encounter words in meaningful social contexts and they are often able to determine what are the most RELEVANT referents in those contexts (L. Bloom, 1998; 2000).

An important question of course is how a child determines what is most relevant in a given context. Akhtar & Tomasello (2000) have argued that the young child's goal in a word learning situation (a situation in which someone uses a referential term the child has not heard before) is to determine what the speaker is calling attention to; i.e. to achieve joint focus with the speaker. To this end, young children use a variety of sources of information, including, for example, the speaker's gaze direction (Baldwin, 1991; 1993) and facial expressions (Tomasello & Barton, 1994), as well as their understanding of routine, scripted events (Akhtar & Tomasello, 1996).

Certainly what is most relevant in a given communicative context is influenced by many factors (Sperber & Wilson, 1986). One obvious candidate contributor to relevance is the topic of the discourse context. If, for example, an adult were labelling the known colours of objects, and then pointed to another object and labelled it 'periwinkle', the most relevant interpretation in this context would be that 'periwinkle' was the name for the colour of that object. Studies of the ability to 'fast map' words to referents suggest that preschoolers are sensitive to linguistic context when interpreting novel words (Carey & Bartlett, 1978; Au & Markman, 1987; Heibeck & Markman, 1987); that is, they can make use of contrastive information in sentences such as 'Bring me the chromium one, not the blue one' to interpret chromium as a colour term. Clark's (1990) PRINCIPLE OF CONTRAST states that every two forms contrast in meaning. Thus, hearing two words (one familiar, one unfamiliar) explicitly contrasted in this way aids children in determining the referent of the unfamiliar word. It remains an open question whether young children can benefit from a more implicit form of contrast (as in the 'periwinkle' example above).

There is some evidence that young children can make use of implicit information provided by the preceding discourse context when interpreting ambiguous sentences. Shatz (1978, Experiment 2) examined toddlers' responses to ambiguous sentences such as 'Can you talk on the telephone?' This question can be interpreted as a request for information or as a request for action, depending on the discourse context. When the preceding context consisted of a series of unambiguous requests for information (e.g. 'Is this red?'), children were more likely to respond to the ambiguous test sentences with information; when the preceding sentences were unambiguous directives (e.g. 'Push the button.'), they were more likely to respond to the ambiguous test sentences with action. Given the fast mapping findings and Shatz's (1978) results, it was hypothesized that young children may be able

to use implicit contrast with the preceding discourse context to interpret a novel ambiguous adjective.

The acquisition of adjectives has recently begun to receive serious empirical attention (see Klibanoff & Waxman, 2000). Some of these studies point to the importance of the process of comparison in acquiring and extending novel adjectives. For example, when preschoolers were given the opportunity to make a comparison between two objects (only one of which exemplified the target property labelled by a novel adjective), they were able to extend that adjective appropriately to other objects (Waxman & Klibanoff, 2000). In these studies, the comparison process was straightforward because the two objects varied on only a single dimension. In the current study, the objects being implicitly contrasted varied on several dimensions (shape, texture and colour), thus, the only way for children to determine the relevant dimension was by attention to the dimension (shape or texture) labelled in the previous discourse context.

The majority of studies of adjective acquisition have focused on children 3;0 or older. Waxman & Markow (1998) included children aged 1;8 to 1;10, but they did not systematically examine the process of comparison. Heibeck & Markman (1987) included a group of children ranging in age from 2;2 to 2;11 but examined only explicit contrast, and the contrasted objects differed on only one dimension. We therefore included two groups of children in the present study: one consisted of children ranging in age from 2;3 to 2;10, the other of children from 3;0 to 3;8. In the training phase, children were shown the target object (with a novel shape and novel texture) and were told 'This is a *dacky* one.' In the Shape-Relevant condition, the topic of discourse prior to this sentence was the shape of other objects; i.e. two objects' shapes were described before the target object was labelled ('This is a round one; this is a square one'). In the Texture-Relevant condition, the two preceding objects' textures were described ('This is a smooth one; this is a fuzzy one'). Children were given comprehension trials on which they were shown sets of test objects and then asked 'Which one is the *dacky* one?' They also received trials designed to control for preference of the relevant dimension. The hypothesis was that children would choose objects that matched the target (relevant) dimension on the comprehension trials more frequently than on the corresponding preference trials.

METHOD

Participants

Twenty-four children (11 girls) ranging in age from 2;3 to 2;10 ($M = 2;6$) and 24 children (12 girls) ranging from 3;0 to 3;8 ($M = 3;4$) participated. Participants' parents were volunteers from a predominantly middle-class community. Testing took place in a laboratory playroom.

Materials

Training stimuli. In both conditions, children first saw two objects. In the Shape-Relevant condition, one was circular (a green piece of styrofoam-like material covered in transparent plastic wrap), and one was square (a green piece of styrofoam). In the Texture-Relevant condition, one was a smooth rectangular orange piece of wood, the other was a ball covered with curly orange artificial hair. All of the training and test stimuli had two eyes.

The training stimuli consisted of two sets of specially constructed novel objects (three objects in each set) that varied in shape and texture. There were three distinct shapes and three distinct textures. In Set 1, the three objects were beaded hooks (a set of connected plastic bathroom hooks covered with white modelling clay topped with red and blue pronged beads); a U-shaped metal clamp covered with white modelling clay and painted with bright orange puffy paint in zig-zag stripes; and a piece of curved PVC pipe covered with lime green floam (a novel modelling substance containing flecks of styrofoam). In Set 2, the three objects were a bright yellow ball-triangle (formed by gluing three spheres together) covered with shiny purple sequins; an object formed by gluing two bright orange styrofoam egg shapes together at the centres; and a styrofoam pentagon covered with blue and orange round beads. Each child received one object from Set 1 and one from Set 2 as training objects (see below).

Test stimuli. The test stimuli also consisted of two sets of specially constructed novel objects that varied systematically in shape and texture. Each set of 18 test objects contained combinations of the shapes and textures of the corresponding training set, but they differed in colour from all of the training objects. On each test trial children were shown three different objects, each with a different texture, shape, and colour; e.g. for Set 2, on one trial children were presented with these three objects: a red pentagon covered with gold sequins, a blue ball-triangle with beaded texture, and a dark green egg-shape with styrofoam texture. To appeal to young children, all novel objects in the training and test sets had two eyes, and all objects within each set were approximately equal in size.

Design and procedure

Counterbalancing. Children in each age group were randomly assigned to either the Shape-Relevant condition or the Texture-Relevant condition. In the Shape-Relevant condition, the dimension labelled was the shape of the initial objects: 'This is a round one; this is a square one'. Each shape (e.g. for Set 1: hooks, clamp, PVC pipe) served as the target dimension for four children in each age group. In the Texture-Relevant condition, the dimension labelled was the texture of the initial objects: 'This is a smooth one; this is

a fuzzy one'. Each texture (e.g. for Set 1: puffy paint, floam, beads) was assigned as the target dimension for four children within each age group. Each child experienced a Training-and-Comprehension phase and a Training-and-Preference phase. The order of these two phases was counterbalanced within each age group, condition, and target dimension. Half of the children in each condition in each age group saw Set 1 first; half saw Set 2 first.

Training trials. Children were seated at a small table. On each set of training trials, a female experimenter initially showed children a set of three objects, one at a time. In the Texture-Relevant condition, the experimenter picked up the first object (e.g. the ball covered with hair) and said, 'Look, this is a fuzzy one. It's a fuzzy one, isn't it? That's a fuzzy one', and then handed the object to the child. (Half of the children in the Texture condition saw the fuzzy object described first; half saw the smooth object first.) She then showed the child the second object and said, 'Look, this is a smooth one. It's a smooth one, isn't it? That's a smooth one'. Finally, she described the novel target object by saying 'This is a *wuggy/dacky* one'. (The word *wuggy* was used to describe objects in Set 1, and *dacky* was used for objects in Set 2.) In the Shape-Relevant condition, one of the initial training objects was described as round, the other as square.

The target object was labelled 'a *wuggy/dacky* one' three times. After labelling it, the experimenter placed it on the table in front of the child, along with the two other objects. These objects were consequently available for inspection during the comprehension and preference trials.

Comprehension and preference trials. Each set of training trials was immediately followed by a set of six Comprehension trials or six Preference trials. On each Comprehension trial children were shown three test objects and were told to look at all three objects and were then asked 'Which one is the *wuggy/dacky* one?' On each trial, one object matched the shape of the target object, one matched the texture of the target object, and one matched neither (i.e. was a completely separate shape and texture). On Preference trials, the same procedure was followed but children were asked 'Which one is your favourite one?'. The number of correct responses (i.e. shape matches in the Shape-Relevant condition, and texture matches in the Texture-Relevant condition) expected purely on the basis of chance was 2. Children were given one point for each trial on which they chose the object that matched the target dimension. Thus, every child in every condition had a potential score of 0–6 for Comprehension and 0–6 for Preference.

TABLE 1. *Mean frequency of target dimension choices (out of 6) for each trial type in each condition. (Standard deviations are in parentheses)*

	Age			
	Two		Three	
Trial type	Shape	Texture	Shape	Texture
Comprehension	3·50 (1·83)	3·00 (2·00)	4·25 (2·14)	3·58 (2·31)
Preference	1·33 (1·23)	1·67 (1·30)	1·25 (0·97)	1·33 (1·30)

TABLE 2. *Mean frequency of shape-matching choices (out of 6) for each age group in each condition. (Standard deviations are in parentheses)*

	Age	
Condition	Two	Three
Shape	3·50 (1·83)*	4·25 (2·14)*
Texture	2·00 (1·76)	1·50 (2·02)

* $p < 0·05$ (one-sample t-test).

RESULTS AND DISCUSSION

Mean scores in each of the conditions are shown in Table 1. Initial analyses revealed no effects of order or gender. A mixed ANOVA with two between-subjects factors (age: 2, 3; and dimension: shape, texture) and one within-subjects factor (trial type: comprehension, preference) revealed a main effect of trial type ($F(1, 44) = 39·08$; $p < 0·001$). No other main effects or interactions reached significance. Repeated-measures ANOVAs conducted separately for each of the age groups also revealed reliable effects of trial type ($p < 0·003$).

The main effect of trial type indicates that, in determining the reference of a novel adjective, children attended to the dimension most relevant to the discourse context. This was true for both age groups: both were able to use the preceding discourse context to disambiguate the meaning of the novel adjective. When the relevant dimension was shape, they extended the novel adjective to objects of the same shape as the target object. When the relevant dimension was texture, they extended the word to objects with the same texture as the target object. Performance on the corresponding preference trials indicated that these findings were not due to a nonlinguistic preference for the relevant dimension.

It is important to note, however, that on the preference trials, the children seemed to avoid choosing the target dimension (all means $< 2·0$). It is quite possible that they had indeed acquired the novel adjective and had interpreted

the preference request ('Show me your favourite one') as 'Show me something that is NOT dacky/wuggy'. If so, the preference trials may not be true control trials. For this reason, a separate analysis excluding the preference data was conducted on the number of shape-matching responses in the two conditions (see Table 2 for the means).

A(2) × (2)ANOVA with age and dimension as between-subjects factors resulted in a significant main effect of dimension, $F(1, 44) = 14{\cdot}34$, $p < 0{\cdot}01$, indicting there were more shape-matching responses in the Shape-Relevant condition ($M = 3{\cdot}88$, S.D. $= 1{\cdot}98$) than in the Texture-Relevant condition ($M = 1{\cdot}75$, S.D. $= 1{\cdot}87$). The results of one-sample t-tests comparing the means for each age group against a hypothesized population mean of 2·0 (that expected by chance) confirmed that this was true for both age groups (see Table 2). The mean number of shape-matching responses was significantly greater than chance only in the Shape-Relevant condition.

In general, these findings are consistent with previous reports of two-year-olds' sensitivity to discourse context. They can use information from the preceding discourse context to determine how to respond to an ambiguous sentence (Shatz, 1978). Children aged 2;0 also understand that adults use language for things that are novel to the discourse context, and they can use this understanding to acquire novel object labels (Akhtar, Carpenter & Tomasello, 1996). The current findings extend these results and show that two-year-olds can use the topic of the immediate discourse context to disambiguate the intended referent of a novel adjective.

The findings are also related to those of fast-mapping studies in which children use linguistic context to determine the domain of reference of a novel word. Most of these studies have been conducted with children aged three and older, but one by Heibeck & Markman (1987, Study 1) also included younger children. In their study, using the standard fast-mapping paradigm, they introduced unfamiliar words to children by pointing out two objects that differed on only one dimension and asking them to, for example, 'Bring me the chartreuse book, not the red one, the chartreuse one'. Three domains were tested (colour, shape, and texture) and the two-year-olds performed above chance on comprehension of the unfamiliar terms in each of these domains. These data suggest that children were able to take advantage of the explicit contrast between the known word and unfamiliar word (Clark, 1990) to determine the meaning of the latter. In a second study, however, Heibeck & Markman examined children's ability to use the nonlinguistic context alone to determine the meaning of the unfamiliar term. In one condition they told children to 'Bring me the chartreuse one, not the other one'. Because the two objects contrasted on only one dimension (e.g. two books identical except for colour), children were able to fast map in this situation as well. It is important to note that in the current study the training objects (the target object and the two objects used to set up the discourse

topic) differed from one another on at least two dimensions (shape and texture); consequently, the children could not have relied on nonlinguistic context alone to aid them in determining the meaning of the novel adjective. Furthermore, the target object's shape and texture were both novel (nameless) and were therefore both plausible candidate target meanings for the novel adjective. The current data indicate that two-year-olds can use implicit contrast between the target word and words used in the immediately preceding context ('This is a round one; this is a square one; this is a *dacky* one') as a cue to the referential intentions of a speaker and can thereby disambiguate the reference of a novel adjective used by that speaker.

It is possible then that being sensitive to the discourse context in which novel words are encountered may help young children reduce considerably the problem of referential indeterminacy. If they are able to determine which element of the context is most relevant to the speaker's referential intentions, they may not face the infinite number of possible interpretations that theorists have posited. It is important to note, however, that in the current study it was language itself (the descriptions of the initial objects) that provided the information as to which dimension was relevant. Thus, children had to understand the language used to set up the topic to determine the meaning of the novel adjective in this study. An important question remains as to how children who do not yet comprehend much language disambiguate reference (i.e. determine what is most relevant to the speaker's intentions) and acquire their earliest words. Two mechanisms have been proposed.

One relies on the observation that it is within repetitive interactions where the child has a nonverbal understanding of the context that children acquire their earliest language (Bruner, 1983). Routines or scripts 'create, with no need of a conventional language whatsoever, a shared referential context within which the language of the adult makes sense to the prelinguistic child' (Tomasello, 1992: 70). When children develop a nonlinguistic understanding of the situations they experience regularly, they begin to anticipate the objects and actions within a given routine. Because they do not have to expend effort to understand the situation and what is going to happen next, they can focus their attentional resources on the language used by others within the routine (Nelson, 1986; Akhtar & Tomasello, 1996). Sharing an understanding with their social partners about the goals and sequence of the activity (e.g. diapering or feeding) allows infants to focus on what their partner is focused on and thereby begin to comprehend some of the language used within the activity.

The second mechanism relies on the observation that, just as interactions between caregivers and children are repeated, so are words. Indeed, several researchers have proposed that referential indeterminacy may be significantly reduced if children can engage in cross-situational learning (Gleitman, 1990; Pinker, 1994; Zukow-Goldring, 1997). That is, if children are able to pay

attention to (and remember) the element that remains constant across different situations in which the same word is used, the hypothesis is that they will then be able to determine the appropriate meaning of this word. Recent data indicate that two-year-olds can do so (Akhtar & Montague, 1999); thus, cross-situational learning is another mechanism by which children can disambiguate reference without knowledge of language itself.

In summary, the current study demonstrates that two- and three-year-olds are able to make use of the preceding discourse context to determine the meaning of a novel ambiguous adjective. The syntactic frame in which the adjective was used may have informed them that an attribute of the novel object was being labelled, but it could not tell them which dimension was being labelled (shape or texture). The data show quite clearly that both age groups attended to the dimension that was most relevant to the preceding context. Although it will be important to document in naturalistic studies to what extent this type of contextual information (implicit contrast) is available in the speech young children hear, children's sensitivity to discourse context and many other cues to referential intent (Akhtar & Tomasello, 1998) suggests that referential indeterminacy does not necessarily present an intractable induction problem for young word learners (Smith, 1995).

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