

Beyond the basics: preschool children label objects flexibly at multiple hierarchical levels*

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ABSTRACT

Although preschoolers typically accept the basic level label for an object (e.g. *dog*) and tend to resist all others (e.g. *collie*, *animal*), this tendency is not inviolable. Under certain circumstances, children accept more than one label per object. In this experiment, with 20 three- and 20 four-year-old children, we extended this body of research in three ways. We examined (1) children's production of multiple, hierarchically related labels; (2) the pragmatic consequences of the inherent asymmetry of inclusion relations; and (3) the influence of morphology (modifier + noun constructions vs. simple lexemes) at the subordinate level. Children labelled objects most frequently at the basic level, but also readily produced many non-basic level terms. Children, like adults, may prefer to label objects at the basic level, but they exhibit no general prohibition against also labelling at other, non-basic levels. Their performance challenges the notion that the ability to label objects flexibly at multiple levels is beyond the young child's capacity.

INTRODUCTION

A fundamental feature of human conceptual and semantic organization is the ability to locate an individual object (e.g. a dog) in multiple taxonomic classes at various hierarchical levels (e.g. collie, dog, animal). Across diverse languages and cultures, adults take advantage of this feature and readily acknowledge that a given object is at once a member of several different nested classes within a hierarchical system. However, unlike adults, preschool children often fail to exhibit such flexibility in labelling. Instead, they appear reluctant to acknowledge that more than one label may correctly apply to a given object. A review of the developmental literature suggests that children

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typically accept the basic level label for an object, but tend to resist all others. For example, children tend to deny that the same object (e.g. a dog) is, at once, a dog and an animal.

The recognition that objects may be labelled flexibly at multiple hierarchical levels is not an isolated developmental achievement. On the contrary, this capacity is closely related to other important advances. Notice, for example, that the ability to accept more than one label for a given object permits young children to take advantage of the explicit information adults often provide regarding hierarchical relations among objects and classes of objects. For example, adults often teach children superordinate level terms (e.g. *machine*) by mentioning several basic level kinds (e.g. *lawn mowers*, *dishwashers*, *vacuums*). Similarly, adults tend to introduce subordinate level terms in conjunction with basic level terms (e.g. 'A collie is a kind of dog') (Blewitt, 1983; Shipley, Kuhn & Madden, 1983; Callanan, 1985, 1989). A child who denies that an item may be described with more than one term would be at a distinct disadvantage in making use of this type of information.

Furthermore, in many developmental research programs, children's labelling ability assumes a central role. Indeed, children's difficulty in labelling is often taken as an index of children's conceptual limitations (Inhelder & Piaget, 1964; Anglin, 1977). It is therefore important that we characterize children's labelling abilities accurately.

In one of the most comprehensive examinations of children's labelling to date, Anglin (1977) examined two- to six-year-old children's comprehension and production of labels at subordinate, basic and superordinate levels. He reported that although his subjects readily produced basic level terms, fewer than half were able to produce superordinate or subordinate level terms. Other researchers, focusing primarily on comprehension tasks, have lent further substance to this claim. Both Macnamara (1982) and Markman (Markman & Callanan, 1983; Markman, 1984) introduced preschool children to individual objects (e.g. a dog) and asked whether these objects could be labelled at both the basic level (e.g. 'Is this a dog?') and at the superordinate level (e.g. 'Is this an animal?'). The same pattern of results emerged in both studies. Most children accepted the basic-level terms, but most denied that the objects could also be described with superordinate level terms. This comprehension data is consistent with the evidence reported in Anglin (1977).

The data reviewed thus far indicate that young children tend to accept one label (typically the basic-level label) for objects and to reject other, non-basic-level labels. Yet this tendency is certainly not inviolable (Gathercole, 1987). There are clearly some cases, even in the studies outlined above, in which children acknowledged that objects can, in fact, be labelled at multiple labels. For example, Blewitt (Blewitt & Connor, 1981; Blewitt, 1989) reported that three-year-old children do accept both basic and superordinate

labels for objects in comprehension tasks. Au & Glusman (1990) present similar data based on two-year-old children's comprehension of novel labels. Moreover, some investigators have suggested that children may be more willing to supplement their basic-level labels with subordinate-level labels than with superordinate-level labels (Clark, Gelman & Lane, 1985).

The ability to label objects flexibly at multiple hierarchical levels has serious implications for our theories of conceptual and semantic development, yet several issues remain unresolved. Therefore, in the experiment reported here, we extend the existing body of research in three principal ways. First, to provide a strong test of children's abilities, we developed a method for systematically examining children's PRODUCTION, rather than comprehension of labels at multiple hierarchical levels. A second issue, described in more detail below, concerns a pragmatic consequence of the logical asymmetry inherent in hierarchical systems of organization. Finally, we explore the hypothesis that morphological considerations may facilitate the acquisition of subordinate-level terms.

Multiple-level production. First, with the exception of Anglin, most researchers have relied primarily on comprehension tasks to assess children's ability to accept multiple labels for a given object (e.g. Blewitt & Connor, 1981; Macnamara, 1982; Markman & Callanan, 1983; Clark *et al.* 1985). Typically, the child is asked to judge whether a particular category term (produced by an adult experimenter) correctly applies to a particular object or set of objects. This reliance on comprehension measures stems, at least in part, from children's well-documented disinclination to apply labels beyond the basic level. To be sure, comprehension tasks have permitted us to reach beyond the limitations of children's basic-level labelling preferences. Unfortunately, however, comprehension tasks, which merely require children to accept or reject labels supplied by an adult experimenter, generate a fairly restricted data-base comprising a series of *yes/no* responses. In contrast, production tasks, in which children must actively generate labels, might provide us with a richer depiction of early object-labelling abilities.

Therefore, in the current experiment, we systematically examined three- and four-year-old children's PRODUCTION of multiple hierarchically related labels for a series of different familiar objects. To elicit labels beyond the preferred basic level, we took advantage of the finding that preschool children are sensitive to a contrastive principle in labelling objects (Miller & Johnson-Laird, 1976; Horton, 1983). According to the contrastive principle, the classes at any one particular hierarchical level are contrastive or mutually exclusive. For instance, if an object is a member of the superordinate class *animal*, it cannot also be a member of the superordinate class *furniture*; if it is a member of the basic class *dog*, it cannot also be a member of the basic class *cat*.

To demonstrate preschool-children's sensitivity to this principle, Horton presented children with pictures of single objects (e.g. a chair) and asked them contrast questions to elicit the objects' labels. In the contrast questions, the experimenter always mislabelled the target object, leaving the child an opportunity to produce the correct label. For example, children who heard a basic-level contrast question (e.g. 'Is this a bed?') tended to offer basic-level labels in response (e.g. 'No, it is a chair'). Other children, who heard superordinate-level contrast questions (e.g. 'Is this food?'), tended to answer with superordinate level labels (e.g. 'No, it is furniture'). Children who heard subordinate-level contrast questions (e.g. 'Is this a kitchen chair?') tended to produce subordinate-level labels (e.g. 'No, it's a rocking chair'). Thus, Horton (1983) demonstrated that children as young as three years of age are sensitive to the principle of contrast and will tailor their own responses to mirror the hierarchical level of the label embedded in the contrast question.

In the current experiment, we took this finding one step further. We employed a within-subjects design and asked each child to label pictures of objects at all three (subordinate, basic and superordinate) hierarchical levels. The advantage of this within-subjects design is straightforward. It gives individual children an opportunity to exhibit the full range of their labelling ability for each target object. However, it also introduces a pragmatic concern which is inherent in the logical asymmetry of inclusion relations.

Pragmatic consequences of asymmetry. Within any hierarchical system, the lower-order classes are, by definition, included in the subsequently higher-order classes. Therefore, by locating a particular object (e.g. Fido) within a given basic-level class (dog), we also acknowledge that object's membership in a particular superordinate class (e.g. animal). However, there are no such logical entailments when descending within a hierarchy. By including Fido in the class *dog*, we make no commitment regarding Fido's status at the subordinate level. Fido may be one of any of a vast number of different breeds.

This logical asymmetry may have pragmatic consequences in children's performance in a labelling task. Consider, for example, a child who has produced the preferred, basic-level label for a given object and then is asked to produce additional category terms. This child may be reluctant to provide a superordinate label because this would offer no new information concerning the object under consideration. In contrast, this same child may be quite willing to produce a subordinate-level term because doing so DOES provide more specific information about the object under consideration.

To examine this possibility, we divided children into two experimental conditions. In the ASCENDING condition we elicited subordinate labels first, followed by basic, and finally superordinate-level labels. In the DESCENDING

condition we elicited superordinate labels first, followed by basic and finally subordinate-level labels. If children are influenced by this pragmatic concern, then children in the ascending condition may find it redundant to label the same object at increasingly inclusive levels. As a consequence, children in the ascending condition should offer fewer labels per object than those in the descending condition.

The influence of morphological transparency at subordinate levels. Our third principal focus concerns the morphological characteristics of subordinate-level terms. Clark and her colleagues (Clark *et al.* 1985) articulated the view that when children begin to relinquish their insistence on one label per object, they should be more likely to accept subordinate- than superordinate-level terms. They argue that this may be attributed to a linguistic feature that characterizes subordinate-level terms. Many subordinate-level terms (e.g. *apple tree*) are created by combining a familiar basic-level noun (e.g. *tree*) with a modifier (e.g. *apple*) to mark a particularly salient distinction. Several different researchers have demonstrated that modifier + noun (M + N) constructions, either noun phrases (Gelman & Markman, 1985; Waxman, 1985, 1990) or compound nouns (Clark *et al.* 1985; Gelman, Wilcox & Clark, 1989) highlight categorical distinctions, particularly at the subordinate level.¹ Perhaps the 'transparency' of such terms (which incorporate a preferred, basic level label), is instrumental in leading children to accept subordinate, in addition to basic level, terms.

To evaluate the role of transparency, *per se*, requires a direct comparison of children's use of those subordinate terms that incorporate that basic-level terms and those that do not. In the experiment reported here, for half of our target items, the subordinate labels were transparent: they incorporated the basic-level terms (e.g. *palm tree*). For the remaining targets, the subordinate labels were opaque: they were simple lexemes with no explicit reference to the basic level term (e.g. *rose*). If children are more likely to provide M + N construction than simple lexemes at the subordinate level, then we will have support for the transparency hypothesis.

[1] Both M + N and compound nouns are constructions consisting of a head noun used in conjunction with a modifier. Nonetheless, there are differences between the two types of linguistic construction. For instance, M + N phrases carry a light-heavy stress pattern (as in *black 'bird*) while compounds typically have the stress on the first element (as in *'blackbird*). However, in the context of this experiment, it was difficult to control precisely for such differences in stress pattern. Therefore, for the purposes of this experiment, we do not specify whether children interpreted our labels specifically as compounds or as M + N phrases.

METHOD

Subjects

Twenty three-year-old (mean age = 3;6, ranging from 3;2 to 3;11) and twenty four-year-old (mean age = 4;7, ranging from 4;1 to 4;11) children were drawn from several preschools serving a middle-class population in Cambridge, MA. Approximately equal numbers of boys and girls were included in each age-group and condition. One three-year-old, who failed to complete the procedure, was replaced.

Stimuli

Eight coloured photographs from magazines and catalogues were selected as targets. Each was mounted on an 18 x 25 cm cardboard backing. There were two targets from each of the following four superordinate categories: animal, plant, clothing and furniture. We restricted ourselves to these superordinates in an effort to select targets for which children would be likely to produce labels at multiple levels. In preliminary work with a different group of preschool children we found that these were the only superordinate-level terms that were produced consistently by three- and four-year-old children. For half of the targets, the subordinate-level label (in the adult lexicon) was an M+N construction (e.g. *palm tree*); for the remaining targets the subordinate-level label (in the adult lexicon) was a simple noun (e.g. *rose*). See Table 1 for a complete list of targets and contrast questions.

TABLE 1. Complete list of target items and contrast questions

Target	Contrast questions: 'Is this a(n) _____?'		
	Subordinate	Basic	Superordinate
rose	dandelion	tree	animal
palm tree	pine tree	flower	animal
eagle	owl	dog	plant
fire dog (dalmatian)	bulldog	bird	plant
crib	bunk	chair	clothing
rocking chair	highchair	bed	clothing
sandal	boot	shirt	furniture
dress shirt	t-shirt	shoe	furniture

Procedure

Children were tested individually in a quiet room in their preschools. The procedure lasted approximately 15 minutes and was audiotaped for later transcription. To begin each session, the experimenter enlisted the child's

assistance in teaching a puppet 'all the different names' for each target. To model this task, the experimenter then revealed a coloured photograph of a garbage truck and explained that it could be called a 'garbage truck', a 'truck', or a 'vehicle'.

Next, the experimenter presented each of the eight target cards one at a time, in random order. The experimenter attempted to elicit three different labels for each target by asking a series of three contrast questions concerning the subordinate, basic and superordinate levels. For example, for the picture of the rose the experimenter asked 'Is this a dandelion?' (subordinate contrast question), 'Is this a tree?' (basic contrast question) and 'Is this an animal?' (superordinate contrast question).

Children were randomly assigned to one of two experimental conditions, which varied only in the order in which the contrast questions were posed for each target. In the ascending condition, for each target, the experimenter elicited the subordinate label, then the basic label, and finally the superordinate label. In the descending condition, this order was reversed.

Scoring

All the labels produced by each child were recorded. There was a maximum of three possible labels for each target (subordinate, basic and superordinate). Because we were primarily interested in children's ability to produce multiple labels for each target object, we included all of the children's category labels in our analyses, even if they did not match precisely the correct label in the adult lexicon. For example, if a child labelled the eagle as a *parrot*, we accepted *parrot* as a label.

On a few occasions a child answered 'yes' to a contrast question. For instance, when one child was shown the picture of the palm tree and was asked 'Is this a pine tree?' (the subordinate-level contrast question), the child replied in the affirmative, effectively blocking her opportunity to PRODUCE a subordinate label. Although we could have corrected such responses and asked for another response, we felt that this might discourage children and lead them to be more cautious in their production of other targets. Therefore, we accepted their 'yes' responses and went on with our production.²

We also noticed that children sometimes replied 'no' to a contrast question, but then failed to produce a label of their own, despite the experimenter's prompting. In such cases, in which the child neither accepted

[2] We tabulated children's responses in two different ways. In one tabulation we used the criteria described in the text, coding all 'yes' responses as if the child had actually produced a label. We also tabulated the data using a stricter criterion, coding all 'yes' responses as if the child had failed to produce a label. We conducted separate analyses of variance on each of these tabulations. Both analyses revealed the same main effects. In this article, we report the results of the ANOVA based on the first method of tabulation.

not produced a label at that particular hierarchical level, they were given no credit for labelling at that particular level.

RESULTS

The children in this experiment approached the multiple-level labelling task with enthusiasm. They seemed to enjoy teaching words to the puppet and were perfectly willing to produce more than one label per object. Three-year-olds produced an average of 1.68 (S.D. = 0.23) labels per target; four-year-olds produced an average of 2.11 (S.D. = 0.31) labels per target.

We submitted the labelling data to a three-way mixed ANOVA, with age (three years, four years) and condition (ascending, descending) as between-subject variables and level (subordinate, basic, superordinate) as a within-subject variable. This analysis revealed a main effect for age, $F(1, 37) = 24.38$, $p < 0.0001$, which indicated that four-year-olds produced significantly more labels than did three-year-olds. The ANOVA also revealed a main effect for level $F(2, 74) = 174.75$, $p < 0.0001$. Children produced basic level labels for 89% of the targets; they produced subordinate labels for 77% of their targets, and superordinate labels for only 22% of their targets. *Post hoc* analyses revealed significant differences between all pairwise comparisons, Newman-Keuls, all p 's < 0.05 . Clearly, children in both age-groups and in both conditions were more likely to supplement their basic-level labels with subordinate than with superordinate category terms. The order in which we presented the contrast questions (ascending vs. descending) had no effect on children's production.

The main effects were qualified by a marginal age \times level interaction, $F(2, 74) = 3.09$, $p = 0.05$, depicted in Fig. 1. Children at both ages were equally adept at producing basic-level labels. However, the four-year-olds produced significantly more non-basic level (subordinate and superordinate) labels than did the three-year-olds, Newman-Keuls, all p 's < 0.01 . Thus, between the ages of three and four, children acquire many category terms beyond those at the basic level.

To evaluate the hypothesis that M+N constructions make it easier for children to label objects at the subordinate level, we conducted a separate analysis, based on children's subordinate-level productions only. In this analysis, we compared children's responses to contrast questions containing M+N constructions with those containing simple lexemes. This analysis revealed that children were equally likely to produce subordinate-level terms in response to transparent contrast questions containing M+N constructions (e.g. 'Is this a pine tree?') and opaque single terms (e.g. 'Is this a dandelion?').

Further inspection of the children's subordinate labels reveals that in addition to matching their responses according to hierarchical level, children also tended to match their responses for linguistic form. They had an

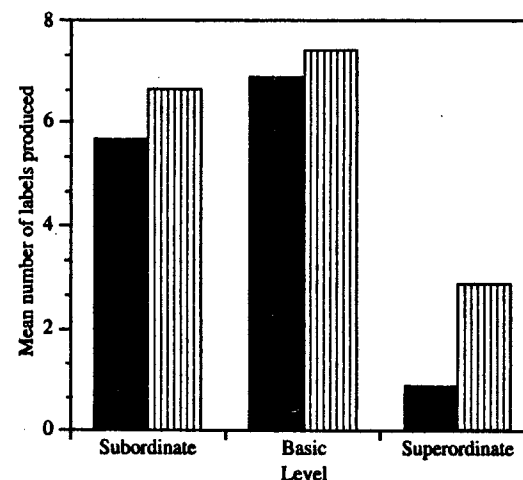


Fig. 1. The interaction of age and hierarchical level. ■, 3-year-olds; ▨, 4-year-olds.

overwhelming tendency to produce M+N phrases or compounds in response to contrast questions containing M+N constructions (97%) and to produce single labels in response to contrast questions containing simple lexemes (94%).

Response patterns of individual subjects. An analysis based on the response patterns of individual subjects provides additional support for the hypothesis that children readily supplied more than one label for the target objects. For this analysis, we tallied the number of targets for which each individual child gave more than one label. We found that 75% of the three-year-olds and all but one of the four-year-olds (92%) produced more than one label on at least 50% of their trials. This fortifies the argument that children in this experiment evidenced no reluctance to apply more than one label to a given object.

DISCUSSION

Children's performance in this production task calls into question the notion that the ability to label objects flexibly at several different hierarchical levels is beyond the conceptual and semantic capacity of the preschool child. The fact that three- and four-year-old children were able to produce multiple, hierarchically related labels for a given object is relevant to several unresolved issues in semantic and conceptual development.

Multiple-level production

First, the production data reported here provide a rich depiction of preschool children's object-labelling abilities and augment the predominantly comprehension-based literature on this important topic. Children in this experiment labelled objects most frequently at the basic level, but also readily produced many non-basic level terms. This suggests that although children, like adults, prefer to label objects at the basic level, they exhibit no general prohibition against also labelling objects at other hierarchical levels. By three years of age, children readily produce more than one label for a given object.

In most existing research, an experimenter presents an object (e.g. a dog) and asks whether a correct, non-basic-level label applies (e.g. 'Is this an animal?'). Characteristically, preschool-aged subjects reject the non-basic level label and insist upon the basic-level term (e.g. 'No, it's a doggy') (Anglin, 1977; Macnamara, 1982). Anglin described this as the 'dominant name response'. However, in the experiment reported here, we posed our questions differently. By using contrast questions that included an *incorrect* label (e.g. 'Is this a plant?'), we were able to overcome the 'dominant name response'. Preschool children in our task corrected our erroneous labels, and in so doing successfully matched their responses to the hierarchical level of the term embedded in the contrast questions. This result serves as further documentation of preschool children's sensitivity to the contrastive principle of hierarchical organization (Miller & Johnson-Laird, 1976; Horton, 1983). Indeed, it was their sensitivity to this principle that made it possible to elicit successfully their production of multiple, hierarchically related terms.

Pragmatic considerations regarding asymmetry

On pragmatic grounds, we had expected that children in the descending condition might produce more labels per object than those in the ascending condition. Although we failed to find support for this position, we suspect that in future research it may be possible to devise a more sensitive test of this hypothesis.

Morphological considerations

Children were quite sensitive to morphology, as evidenced by their tendency to produce labels that mirrored the linguistic form (M + N phrases vs. simple lexemes) of the category term embedded in each contrast question. However, they were equally adept at producing subordinate terms in response to questions containing morphologically transparent terms and those containing the more opaque single lexemes. Therefore these data do not provide evidence for the claim that the morphological transparency characteristic of some subordinate-level terms serves to facilitate their acquisition (Clark *et al.* 1985; Gelman *et al.* 1989).

Superordinate vs. subordinate-level labels

Both three- and four-year-old children produced a greater number of subordinate- than superordinate-level terms. The magnitude of the difference between the production of superordinate and subordinate terms was surprising, particularly because we had specifically selected stimuli from superordinate categories which children at this age are most likely to have mastered. Although we cannot, on the basis of this experiment, pinpoint precisely why children encountered so much difficulty producing superordinate labels for these photographs of individual objects, we can rule out one leading hypothesis.

It is necessary to remember that a child who responded 'no' to a contrast question, but then failed to produce a label of his or her own, received no credit toward labelling at that particular hierarchical level. For example, when shown a picture of an eagle and asked, 'Is this a plant?', the child might respond in the negative but fail to supply an additional label. This scenario was especially prevalent at the superordinate level. The child's silence on such occasions may be interpreted in one of two ways. First, the silence may reflect a reluctance to accept more than one label for a given object. Alternatively, it may reflect the fact that, although the child knew that the label offered in the contrast question was incorrect, he or she did not know the appropriate label for the object at that particular level of abstraction (e.g. 'animal').

A close examination of the data ruled out the first of these alternative interpretations. In most instances, when a child failed to produce a superordinate label, he or she did, in fact, provide both basic and subordinate labels for that target. Thus, children's failure to produce superordinate labels was not a consequence of a general reluctance to accept more than one label for a given object. Instead, any obstacle encountered in multiple-level labelling appears to be focused specifically at the superordinate level.

How might we account for the fact that children in this experiment produced so few superordinate-level labels? One possibility is that children make a 'collection error' when interpreting the meaning of superordinate labels (Callanan & Markman, 1982; Macnamara, 1982). The argument is that children think that superordinate terms refer to COLLECTIONS (e.g. army, forest) rather than to classes of object (e.g. men, trees), and that as a consequence they suspect that such terms do not refer to an individual object, but only to a collection of individuals. Another possible explanation concerns the input conditions under which children typically hear superordinate labels. Adults rarely use such terms when referring to typical individuals of a given superordinate-level class. Instead, they tend to use superordinate labels when referring to either more than one object, or to atypical members (Shipley *et al.* 1983; Callanan, 1985). These arguments suggest that, had we

presented pictures of two, rather than one, target object, children might have produced superordinate terms more frequently.

The principles of mutual exclusivity and contrast

Finally, these data are relevant to two different principles that have been invoked in current accounts of semantic development. The principle of contrast (Clark, 1987) states that no two words in a given language carry precisely the same meaning. The fact that children in this experiment produced multiple hierarchically related labels for individual objects is consistent with this principle of language.

However, children's performance was not consistent with the principle of mutual exclusivity (Markman, 1989) which makes the more stringent claim that children assume that any two words (e.g. *dog* and *animal*) will refer to mutually exclusive sets of objects. (See Markman (1989) and Merriman & Bowman (1989) for thorough reviews of this position.) Markman has argued that children's rejection of multiple labels for a given object is a direct consequence of their adherence to this principle. Noting that this principle serves to impede the acquisition of labels at different hierarchical levels, Markman argues that children must eventually learn to relax this principle, and that they do so only when they are presented with clear evidence that violates the principle.

Au & Glusman (1990) have recently proposed a limit on the application of the principle of mutual exclusivity. Their interpretation is consistent with the data we report here. They suggested that very young children adhere to the mutual-exclusivity assumption when learning labels for classes at the SAME hierarchical level (e.g. seal, lemur), but that they are quite willing to override this principle if they have reason to believe that the labels refer to categories at DIFFERENT levels of abstraction (e.g. animal, lemur). Au and Glusman reported comprehension data from a word-learning paradigm in support of their position. In their comprehension task, as in our production task, children freely accepted more than one label for a given object.

CONCLUSION

Early in lexical development, children acquire a great many count nouns which refer to concrete objects. Their earliest words are primarily basic-level nouns. As development proceeds, children have an opportunity to learn additional nouns, many of which refer to the same objects, but at superordinate and subordinate levels. The data presented here reveal that children do not reject these labels, insisting that each object must have one and only one label. Instead, by age three, and perhaps even earlier (Waxman & Senghas, 1990; Waxman, Heim & Markow, 1990), children have incorporated non-basic level terms into their emerging lexicons. This finding is consistent with the view that very young children construct conceptual and

semantic hierarchical systems of organization (Blewitt, 1989; Taylor & Gelman, 1989; Waxman, 1990; Waxman & Senghas, 1990).

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