# Preschoolers' Acquisition of Novel Adjectives and the Role of Basic-Level Kind

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## 1. Introduction

How children figure out the meanings of novel words is a central question in the study of lexical acquisition. Most research on this topic has focused on acquisition of nouns, count nouns in particular. This focus was motivated, in part, by the predominance of nouns in the early lexicon. In this paper, we focus on children's emerging ability to map novel adjectives to object properties. Our goal is to identify the circumstances under which preschoolers acquiring English will successfully map a novel adjective to an object property and extend the adjective to describe other objects sharing that property.

Previous research suggests that English-speaking children expect adjectives to mark distinctions within basic-level categories (Gelman & Markman, 1985; Waxman, 1990). Indeed, at 21 months, infants succeed in mapping novel adjectives to object properties only when all objects are drawn from the same basic-level kind; in contrast, when objects are drawn from different basic-level kinds, infants fail to map adjectives to object properties (Waxman & Markow, in press). Together, these observations suggest that children's expectations about the meanings of novel adjectives may emerge initially within the context of basic-level categories.

In this paper we explore the role of basic-level kind in the acquisition of novel adjectives. In Study 1 we document that the basic level serves an essential foundational role in acquisition of novel adjectives even in preschool children. In Study 2, we identify one way in which this initial support from basic-level kinds may help children to then extend novel adjectives more broadly.

## 2. Challenges in Learning Novel Adjectives

At a very young age children are able to use syntactic information to help narrow down the meanings of novel words. Beginning as early as 21 months, English-speaking children reveal different expectations for the extensions of novel nouns and adjectives (Waxman & Markow, in press; Waxman, Stote & Philippe, 1997). They expect novel count nouns (e.g., "This is a *blick*") to extend to object *categories* and novel adjectives (e.g., "This is a *blick* one") to extend to object *properties* (Hall, Waxman & Hurwitz, 1993; Landau, Smith &


*A. Greenhill et al. (eds.), BUCLD 22 Proceedings, 442-453.*



Jones, 1988; Markman & Hutchinson, 1984; Taylor & Gelman, 1988; Waxman 1990; Waxman & Gelman, 1986; Waxman & Hall, 1993; Waxman & Kosowski, 1990; Waxman & Markow, 1995).

However, even when language learners hear a novel adjective and expect it to map to an object property, they still have a good deal of work to do to figure out exactly *what* property is the adjective's referent. The semantic content denoted by adjectives is diverse; Dixon (1982) describes seven main semantic types- Dimension, Physical Property, Color, Human Propensity, Age, Value and Speed. This suggests that there may be no default assumption for the type of property that is being described with a given adjective. In contrast, when language learners hear a novel noun, there appears to be a guiding principle that leads them to interpret the noun as a name for a basic-level object category (Golinkoff, Shuff-Bailey, Olguin & Ruan, 1995; Hall & Waxman, 1993; Hall et al., 1993; Markman & Wachtel, 1988).

Moreover, even once the language learner has successfully discerned the referent property in a given context, the goal of learning the meaning of the novel adjective may not have been completely achieved. One of the most challenging aspects of interpreting novel adjectives is that in many ways their meanings vary depending on the nouns that they modify (Bolinger, 1967; Dixon, 1982; Warren, 1988; Wierzbicka, 1986). The word *good* in a *good* teacher and a *good* meal refers to very different characteristics. A *big mouse* and a *big city* refer to different absolute measures. In fact, a *big* mouse is still a *small* animal; the same entity (a three-pound mouse) can be accurately described by two adjectives (big, small) opposite in meaning, depending upon the noun category (mouse, animal) in which its membership is being evaluated. Often the commonalities between a given adjective's referents in different contexts are rather abstract. To learn the meaning(s) of an adjective, and be able to apply this in different contexts, language learners need to abstract the meaning(s) from the instantiations with which they are provided.

Evidence from adults and computer simulations, as well as from children, demonstrates this semantic dependency of adjectives on the nouns that they modify. Adults' similarity ratings of adjectives in different contexts show that they recognize that adjectives have different meanings depending on the nouns that they modify (Halff, Ortony & Anderson, 1976; Medin & Shoben, 1988). For example, subjects rated the adjectives used in the phrases "gray hair" and "white hair" as more similar than those in "gray hair" and "black hair", although conversely, the adjectives used in the phrases "gray clouds" and "black clouds" were rated as more similar than those in "gray clouds" and "white clouds". Further evidence of the semantic dependency of adjectives on nouns comes from a connectionist model simulating the acquisition of adjectives (Gasser & Smith, 1996). The network learned adjectives as terms marking distinctions within noun categories without recognizing the property shared by objects labeled with the same adjective. In other words, while the network could

accurately identify *red* things in many different basic-level categories, it did so without isolating the commonality shared by all things labeled *red*.

In light of these data, it is important to ask whether children are sensitive to the semantic dependency of adjectives on nouns, and whether this affects the acquisition of adjectives. Research with preschoolers has shown that adjectives highlight distinctions within basic-level categories. Waxman (1990) found that 3- and 4-years-olds spontaneously labeled subordinate-level classes using an adjectival phrase that included a head noun to refer to the basic-level category and an adjective to modify it (e.g., "big dogs"). In addition, hearing novel adjectives facilitated children's subordinate level classification, although it exerted no demonstrable effect on basic- or superordinate-level classification. Similarly, a study by Gelman and Markman (1985) using *familiar* adjectives showed that preschoolers interpret adjectives as implying contrasts between members of the same basic-level noun category. Thus, evidence from adults, computer simulations and preschoolers converge to suggest that adjectives may be represented as distinctions within a basic-level kind.

In addition, there is striking evidence that basic-level kind plays an important role in the early *acquisition* of novel adjectives. In a study by Waxman and Markow (in press), 21-month-olds were able to learn novel adjectives *only* when they marked distinctions within a single basic-level category. Children succeeded in mapping novel adjectives to object properties if the stimulus objects were all drawn from *within* the same basic-level kind, but they failed when stimulus objects were drawn from *across* different basic-level kinds. At this early stage of language acquisition, the acquisition of novel adjectives appears to depend upon support from the basic-level kind.

## 3. Research questions and plan

In this paper, we examine the role of basic-level kind in the acquisition of novel adjectives in preschool children. In our first study, we ask whether three- and four-year-olds, like the 21-month-olds, are more successful in mapping novel adjectives to properties when objects are drawn from within rather than across basic-level kinds. By age three or four, children produce adjectives, and appear to use the same adjectives appropriately in different contexts, to modify different nouns. This suggests that preschoolers might be better able than the 21-month-olds to recognize when adjectives refer to the same properties across different basic-level kinds. On the other hand, because preschoolers tend to use adjectives to mark distinctions within basic-level kinds, it might be easier for them to map novel adjectives to properties when stimulus objects are drawn from within, rather than across, basic-level kinds. In our second study, we examine how *initial* support from the basic-level kind might help children to then extend novel adjectives more broadly.



### 3.1 Simplification of task demands

In order to focus on the effects of drawing objects from within versus across basic-level kinds, we simplified the demand characteristics of our tasks, capitalizing on what we already know about children's acquisition of adjectives. First, because preschoolers are more likely to map novel adjectives to object properties when the stimulus objects are familiar than when they are unfamiliar (Hall et al., 1993; Markman & Wachtel, 1988), we used stimulus objects drawn from familiar basic-level kinds. In addition, we used the basic-level object label for the stimulus objects in conjunction with the novel adjective to ensure familiarity (e.g., "This is a very *blickish* snake"). Second, we used target properties for which preschool children already recognized an adjectival label, as determined by a pretest with an independent sample of three- and four-year-olds.

Third, we introduced the novel word in a syntactic context that was unambiguously adjectival. All novel adjectives were placed in the prenominal modifier position (e.g., "a *blickish* snake") as well as the predicative position (e.g., "a snake that is *blickish*"). In addition, all novel adjectives incorporated the adjectival suffix *ish*, and were modified by the adverb *very*. Fourth, the two test objects in each trial differed from each other *only* on the target property (e.g., spotted), so there were no other consistent interpretations possible for the novel adjective.

## 4. Study 1: Role of Basic-Level Kind in Acquisition of Novel Adjectives in Preschool-Aged Children

In our first study, we adapted the match-to-sample task used with 21-month-olds (Waxman & Markow, in press) for use with three- and four-year-olds (N= 64). We predicted that (1) children would be more likely to attend to properties when hearing adjectives than when hearing no novel words, and (2) that children would be more likely to map novel adjectives to object properties when stimulus objects are drawn from within the same basic-level kind than when they are drawn from across different basic-level kinds.

Children were shown a target object with a salient property (e.g., a spotted object) and then asked to choose between two test objects. The matching-property test object (e.g., another spotted object) shared the salient property with the target object; the contrasting-property test object (e.g., a solid-color object) contrasted with the target on that dimension. Test objects differed from each other *only* in the presence or absence of the target property; in all other ways, they were identical.

Half of the children at each age were assigned to the Within-Basic Level Condition, in which in each set the target object (e.g., a purple-spotted green snake) was drawn from within the same basic-level kind as the two test objects

Figure 1
Study 1: Examples of a Within-Basic and an Across-Basic Stimulus Set

| Condition | Target | Test Objects | |
|---|---|---|---|
| | | Matching Object | Contrasting Object |
| Within Basic |  |  |  |
| Across Basic |  | | |

(e.g., a blue-spotted white snake or a solid-color white snake). The other half of the children were assigned to the Across-Basic Level Condition, in which the target object (e.g., a purple-spotted green dog) was drawn from a different basic-level kind than the two test objects. Children in the two conditions saw the same test objects, but different target objects. This design permitted us to compare children's abilities to map novel adjectives to object properties within versus across basic-level kinds. See Figure 1 for examples of stimulus sets used in the experiment.

Once a selection was made between the first pair of choice objects, children were asked to choose between a second pair of choice objects (e.g., a yellow-spotted black snake and a solid-color black snake). Within each condition, half of the children heard novel adjectives, and the other half heard no novel words. A puppet ("Gogi") who "had his own words for things" was employed to provide a rationale for the study. In the Adjective conditions children would hear, for example, "Let's look at this snake. Gogi says this is a very *blickish* snake. Can you give Gogi another snake that's *blickish*?" In the No Word condition they would hear instead, "Let's look at this snake. Gogi says this is a snake. Can you give Gogi another snake?"

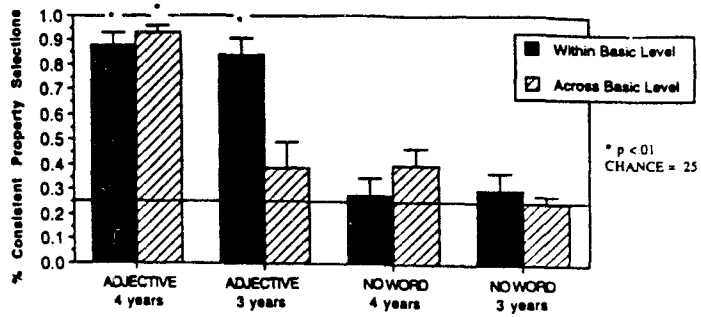
Our dependent variable was the proportion of sets in which children made *consistent property-based selections*, choosing the matching-property test object on both the first and the second trials for a given target. The probability that children would select the matching-property choice on both the first and the second trial is .25.

**4. Results and Discussion**

The results are displayed in Figure 2. Data were subjected to a three-way ANOVA with Word (Adjective vs. No Word) , Level (Within- vs. Across-Basic), and Age (3 vs. 4 years) as between-subject factors. Consistent with our



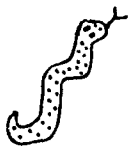
Figure 2
Study 1: Proportion of Consistent Property-Based Selections




first prediction, the main effect of Word, $F(1, 56) = 79.629$, $p < .001$, revealed that children at both ages were more likely to make consistent property-based selections when hearing novel adjectives than when hearing no novel words. We also found evidence in support of our second prediction. Three-year-olds were able to map novel adjectives to properties *only* when stimulus objects were drawn from within the same basic-level kind; they failed when stimulus objects were drawn from across different basic-level kinds. In contrast, four-year-olds could successfully map novel adjectives to properties whether stimulus objects were drawn from within or across basic-level kinds. Thus, there appeared to be a developmental difference in the effect of support from the basic level. Three-year-olds in the Adjective Within-Basic condition, and four-year-olds in both Adjective conditions, made consistent property-based selections at rates significantly greater than chance (all $p$'s $<.001$), and significantly greater than children at either age in the No Word conditions or three-year-olds in the Adjective Across-Basic condition (Tukey's HSD, all $p$'s $<.05$). At neither age did children in the No Word conditions make consistent property-based selections at a rate greater than chance.

The developmental difference between the four-year-olds' ability, and the three-year-olds' inability, to map novel adjectives across different basic-level kinds is intriguing. We suspect that 3-year-olds' pattern of performance is related to the semantic dependency of adjectives on nouns. However, we also suspect that there are circumstances in which three-year-olds *would* map adjectives across basic-level kinds, and many factors that could help them to do so. In Study 2 we examined the effects of one factor that might enable three-year-olds to extend novel adjectives across basic-level kinds.

Figure 3
Study 2: Examples of a Within-Basic Practice and an Across-Basic Practice Stimulus Set

| Condition | Target | Practice Objects | | Test Objects | |
|---|---|---|---|---|---|
| | | Matching | Contrasting | Matching | Contrasting |
| Within-Basic Practice |  |  |  |  |  |
| Across-Basic Practice |  | | | | |

## 5. Study 2: The Effects of Practice on Three-Year-Olds' Mapping of Novel Adjectives Across Basic-Level Kinds

In this second study we asked whether three-year-olds (N=20) would be more successful in mapping a novel adjective across basic-level kinds if they *first* had practice mapping the adjective within basic-level kinds. We proposed that this practice could help them to isolate the target property and then recognize it in another context. To test this hypothesis, we compared the effects of two kinds of practice, practice within basic-level kinds and practice across basic-level kinds. We proposed that it was *specifically* mapping within the same basic-level kind, and not just practice in general, that would prove helpful.

The procedure in the second study was modeled after that of the first. In Study 2, all subjects were three-year-olds, all heard novel adjectives, and all were tested on their ability to map novel adjectives from a target object (e.g., a fish or a rabbit) to test objects drawn from a different basic-level kind (e.g., a snake). The main procedural difference was the addition of practice trials just before the test trials. The practice trials were *just* practice--- children were given an opportunity to map the adjective, but received no corrective feedback.

We compared (between-subjects) the effects of two different kinds of practice- within-basic level practice and across basic-level practice. As can be seen in Figure 3, the only difference between these conditions was the target object present. In the Within-Basic Practice Condition, each target (e.g., a spotted fish) was drawn from the same basic-level kind as its practice-trial stimuli (e.g., spotted vs. solid-color fish), but a different basic-level kind as its test-trial stimuli (e.g., spotted vs. solid-color snakes). In the Across-Basic Practice Condition, each target (e.g., a spotted rabbit) was drawn from a basic-level kind different from both its practice-trial and its test-trial stimuli.

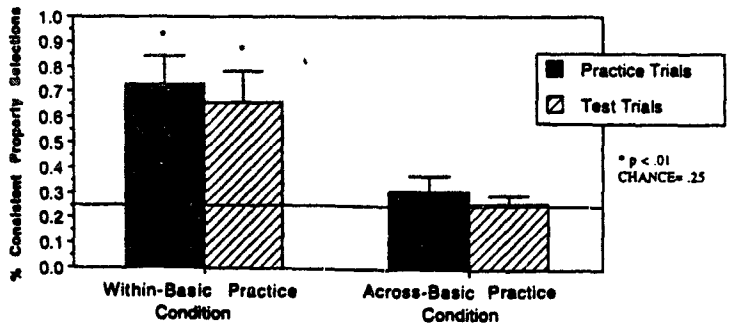


### 5.1 Results and Discussion

The data from the practice trials replicated that of Study 1, again demonstrating that three-year-olds succeed in mapping novel adjectives to properties when stimuli are drawn from within, but not across, basic-level kinds. In the practice trials, children in the Within-Basic Practice condition made significantly more consistent property-based selections than children in the Across-Basic Practice condition, and significantly more than expected by chance; the performance of children in the Across-Basic Practice condition did not differ from chance. See Figure 4.

Data from the test trials support our hypothesis that practice mapping novel adjectives within the same basic-level kind would facilitate three-year-olds' ability to map novel adjectives across different basic-level kinds. Three-year-olds mapped novel adjectives across basic-level categories significantly more often when they had first been given practice mapping *within* basic-level categories (Within-Basic Practice condition) than when they had first been given practice mapping *across* basic-level categories (Across-Basic Practice condition). In addition, test trial performance in the Within-Basic Practice condition, but not in the Across-Basic Practice condition, exceeded the rate predicted by chance. This suggests that it is *specifically* practice mapping *within* the same basic-level category, and not just practice in general that helped. Practice mapping novel adjectives within basic-level categories appeared to help three-year-olds to isolate the target properties and then to recognize them in other contexts.

Figure 4
Study 2: Proportion of Consistent Property-Based Selections in Practice and Test Trials



## 6. General Discussion

Together, these studies suggest that preschoolers' ability to map novel adjectives to object properties emerges with the support of a familiar basic-level kind. We suspect that the basic-level kind plays an important role in the acquisition of adjectives across development; the results of Study 1 suggest that our procedure is sensitive enough to pick this up in children as old as three years. In addition, the results of Study 2 demonstrate that mapping a novel adjective *initially* within a basic-level kind can help children to subsequently extend the adjective more broadly. The results of these studies are consistent with earlier evidence demonstrating a semantic dependency of adjectives on the basic-level nouns that they modify (Gasser & Smith, 1996; Gelman & Markman, 1985; Halff, Ortony & Anderson, 1976; Medin & Shoben, 1988; Waxman, 1990; Waxman & Markow, in press).

These results suggest some issues for further study; in particular, these studies do not pinpoint precisely *why* acquisition of novel adjectives might emerge with the support of the basic-level kind. Basic-level categories have at least two characteristics that could help in the mapping of novel adjectives. First, basic-level categories are extremely inductively rich and are very salient conceptually (Anglin, 1977; Gelman & Coley, 1990; Gelman & Markman, 1986; Gelman & O'Reilly, 1988; Gelman, 1988; Johnson & Mervis, 1994; Mervis, Johnson & Mervis, 1994; Mervis & Rosch, 1981; Shipley, 1992; Waxman, Lynch, Casey & Baer, 1997; Waxman, Shipley & Shepperson, 1991). If, due to an expectation that novel adjectives refer to distinctions within noun categories, category membership *itself* aids in the mapping of novel adjectives, it is worth noting that basic-level kinds form very salient categories.

Second, basic-level categories also enjoy considerable perceptual support. The more similar two entities are to each other, the easier it is to recognize both similarities and differences between them (Gentner & Markman, 1994; Gentner & Ratterman, 1991; Goldstone & Medin, 1995; Kemler Nelson, 1983; Smith, 1984, 1989, 1993). The perceptual similarity within a basic-level category could help children to isolate the target property, making it easier for them to map a novel adjective to it.

We suspect that conceptual and perceptual factors work together to explain the foundational role the basic level plays in the acquisition of adjectives. A question arises concerning whether keeping stimulus objects within the same noun categories at hierarchical levels *other than* the basic level might also facilitate the acquisition of novel adjectives. Examining set effects in the two studies reported here partially informs this question. In both of the studies, half of the stimulus sets were composed of natural kinds, and half were artifacts. Stimuli in the natural kind Across-Basic sets were members of the same superordinate category (i.e., all were animals), and stimuli in the artifact Across-Basic were all members of the same global category (i.e., inanimate objects).



Although three-year-olds successfully mapped adjectives to properties when objects were drawn from the same basic-level category, they failed when objects were drawn from different basic-level kinds within the superordinate category "animal" or the global category "inanimate object". This suggests that it is basic-level categories in particular, but not superordinate or global categories, that facilitate the acquisition of novel adjectives.

One related consideration is that in the studies reported here, each stimulus object was labeled with its basic-level object name ("a very *blickish* snake"). This could have highlighted basic-level category membership. To explore this possibility, we are currently examining performance without the basic-level label ("This is a blickish *one*"). Preliminary results indicate that providing the basic-level label is not necessary to call attention to basic-level category membership (Klibanoff & Waxman, in preparation). The results of these studies together show that, with or without basic-level names, basic-level category membership facilitated the mapping of novel adjectives, while superordinate-level or global-level category membership did not.

The acquisition of adjectives is a complex task. It depends upon syntactic, linguistic and conceptual knowledge. In these studies, we have identified an important role of the basic-level kind in children's acquisition of novel adjectives. Further research will explore more fully the nature of the support provided by the basic-level kind.

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