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Basic Level Object Categories Support the Acquisition of Novel Adjectives: Evidence from Preschool-Aged Children

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Two experiments examined 3- and 4-year-old children's ability to map novel adjectives to object properties. Sixty-four children were introduced to a target (e.g., a bumpy object), and asked to choose between (1) a matching test object (e.g., a different bumpy object), and (2) a contrasting test object (e.g., a smooth object). Four-year-olds successfully extended novel adjectives from the target to the matching test object whether these objects were drawn from the same, or different, basic level categories. In contrast, 3-year-olds' extensions were more restricted. They successfully extended novel adjectives if the target and test objects were drawn from the same basic level category but failed to do so if the objects were drawn from different basic level categories (Experiment 1). However, if 3-year-olds ($n = 20$) were first permitted to extend a novel adjective to objects within the same basic level category, they were subsequently able to extend that novel adjective broadly to objects from different basic level categories (Experiment 2). Thus, basic level object categories serve as an initial foundation in the process of mapping novel adjectives to object properties.

INTRODUCTION

Questions concerning the acquisition of adjectives have received considerably less empirical attention than those concerning the acquisition of other grammatical forms. For example, although ample evidence documents the acquisition of count nouns and verbs, empirical evidence regarding the acquisition of adjectives has only recently begun to accumulate. However, it is already apparent that the processes underlying children's extension of novel adjectives will have consequences for theories of acquisition. For example, the developmental and cross-linguistic variability associated with the grammatical form *adjective* permits us to examine how linguistic experience itself shapes the formation of links between syntax and semantics (Waxman, 1998).

In the current experiments, we examine the acquisition of novel adjectives in English-speaking preschool-aged children and focus especially on two aspects of adjectival interpretation. First, although many adjectives, and particularly those acquired earliest, refer to properties of objects that are readily evident from simple perceptual observation (e.g., *wet*, *hot*), the interpretation of these adjectives is far from simple. On the contrary, young word learners map adjectives to object properties successfully only in limited situations. For example, when a novel adjective (e.g., *metal*) is applied to a familiar object (e.g., a cup), preschoolers extend that adjective to other objects that share the property (e.g., metal spoons). However, when a novel adjective is applied to an unfamiliar object (e.g., a garlic press), it is often extended to other objects from the same object category (e.g., other garlic presses), rather than to the property itself. What is striking about this phenomenon is that it has been observed as late as 4 years of age. Evidence that these relatively advanced word learners appear to mistakenly interpret novel adjectives as count nouns in this context suggests that there is a semantic or conceptual priority for establishing an object's kind before marking its properties (Hall, Waxman, & Hurwitz, 1993; Markman & Wachtel, 1988).

A second difficulty in interpreting novel adjectives is related to the semantic dependency of adjectives on the nouns they modify (Bolinger, 1967; Dixon, 1982; Warren, 1988; Wierzbicka, 1986). For example, although the adjective *good* can be used to describe the nouns *movie*, *teacher*, and *ice cream*, it refers to very different characteristics depending upon which noun is being modified. In addition, an adjective (e.g., *big*) can refer to very different absolute measures (compare, e.g., *big* mouse versus *big* city). Moreover, the very same entity (e.g., a 3-kilogram mouse) can be described by two antonymous adjectives, depending upon the noun being modified (e.g., *big* mouse; *small* animal). This semantic dependency of adjectives on nouns, which has been documented widely in adults (Halff, Ortony, & Anderson, 1976; Medin & Shoben, 1988), has also been observed in a connectionist model designed to model the acquisition of adjectives (Gasser & Smith, 1998). The connectionist network successfully identified instances of a given object property (e.g., *red*) in objects from many different object categories. The network, however, failed to abstract an inclusive interpretation of the adjective that cut broadly across category boundaries. Instead, it proceeded by treating

each adjective as referring to a property of particular object categories. Evidence from preschool-aged children reveals a similar phenomenon, with 3- and 4-year-old children displaying an assumption that adjectives refer to property-based distinctions within familiar basic level object categories (Gelman & Markman, 1985; Waxman, 1990). Thus, evidence gleaned from computer simulations, adults, and children converges to suggest that adjectives are most readily interpreted within the context of the basic level nouns that they modify.

Recent research with infants offers more direct evidence that basic level object categories play a key role in the early acquisition of novel adjectives. Waxman and Markow (1998) report that 21-month-olds successfully extend novel adjectives from one object (e.g., a yellow car) to another (e.g., a different yellow car), if and only if the objects are all drawn from the same basic level category (e.g., car). In contrast, infants fail to extend novel adjectives systematically if the objects are drawn from different basic level object categories (e.g., a yellow car and a yellow horse). Thus, basic level object categories appear to play an instrumental role in the acquisition of adjectives as early as 21 months of age, when adjectives first appear in the productive lexicon.

In the experiments reported here, we pursue this phenomenon by examining the role of basic level object categories in English-speaking preschool-aged children's extension of novel adjectives. Although preschoolers have acquired a fairly extensive repertoire of adjectives, and although they extend these *familiar* adjectives broadly to include objects from different basic level object categories (e.g., *wet* diapers, *wet* grass; *hot* bath, *hot* stove), virtually no evidence documents the process by which these adjectives are initially acquired. We consider two possibilities.

First, because preschoolers extend familiar adjectives broadly to objects from diverse basic level categories, one might expect them to extend novel adjectives broadly as well. Another possibility, however, is that when first mapping a novel adjective to an object property, preschoolers may restrict their extensions to members of the same basic level object category. In the experiments reported here, we examine these possibilities directly.

EXPERIMENT 1

The goal of Experiment 1 was to examine preschoolers' range of extension for novel adjectives applied ostensively to familiar objects. Previous research reveals that after hearing a novel adjective label a single familiar object, 4-year-olds are successful in mapping the novel adjective across different basic level categories; however, the literature is mute with respect to the abilities of 3-year-olds (Hall et al., 1993; Markman & Wachtel, 1988). To fill this gap, we compared the performance of 3- and 4-year-olds. Children were shown a target object (e.g., a bumpy object) and then asked to choose between (1) a matching test object (e.g., another bumpy object), and (2) a contrasting test object (e.g., a smooth object). Half of the children were introduced to a novel adjective for the target (Adjective condition); the remaining children participated in a non-linguistic control task (No Word condition).

To discover whether preschoolers' extension of novel adjectives is initially restricted to objects from within the same basic level category, we systematically varied the relation between the target and the test objects. For half of the children in each condition, the target (e.g., a bumpy horse) and test objects (e.g., another bumpy horse versus a smooth horse) on a given trial were drawn from within the same basic level category (Within-Basic condition). For the remaining children, the target (e.g., a bumpy rhinoceros) and test objects (e.g., a bumpy horse versus a smooth horse) on a given trial were drawn from across different basic level categories (Across-Basic condition).

We took several steps to support children's efforts to map the novel adjectives to the target object properties. First, we presented objects from familiar basic level categories, because preschoolers are more likely to map novel adjectives to object properties when they are applied to *familiar*, as opposed to *unfamiliar* objects (Hall et al., 1993; Markman & Wachtel, 1988). Second, we presented test objects that differed only along a single dimension (the target property). Third, we presented the novel adjectives in syntactic contexts that were unambiguously adjectival (e.g., "This is a very *blickish* horse. Can you find another horse that is *blickish*?"). All novel adjectives incorporated the suffix *-ish*, were modified by the adverb *very*, were presented in both prenominal and predicative frames (Prasada, 1997), and were "anchored" to familiar basic level names (Callanan, 1985).

If preschoolers extend novel adjectives broadly to objects from diverse basic level categories, then children hearing novel adjectives should select the matching test objects in both the Within-Basic and Across-Basic conditions. If preschoolers initially restrict their extension to members of the same basic level category, then children hearing novel adjectives should select the matching test objects in the Within-Basic but not the Across-Basic condition.

Method

Participants

Thirty-two 3-year-olds (*range* = 3,0–3,11, M = 3,8) and thirty-two 4-year-olds (*range* = 4,0–4,11, M =

4,6) participated. All were enrolled in preschool programs serving primarily European American, middle- to upper-middle-class families in Evanston, IL. Numbers of males and females in each condition were approximately equal.

Stimuli. Stimuli were 72 small, lightweight objects that were easily handled by the subjects (see Table 1).

Table 1 Complete List of Stimuli for Experiment 1

		Test Trial Objects	
Property	Target	Matching	Contrasting
Bumpy	Within-Basic	Trial 1:	
	bumpy green horse	bumpy purple horse	smooth purple horse
	Across-Basic	Trial 2:	
	bumpy green rhinoceros	bumpy yellow horse	smooth yellow horse
Bumpy	Within-Basic	Trial 1:	
	bumpy green lizard	bumpy purple lizard	smooth purple lizard
	Across-Basic	Trial 2:	
	bumpy green pig	bumpy yellow lizard	smooth yellow lizard
Curly	Within-Basic	Trial 1:	
	curly blue straw	curly green straw	straight green straw
	Across-Basic	Trial 2:	
	curly beige noodle	curly purple straw	straight purple straw
Curly	Within-Basic	Trial 1:	
	curly beige cord	curly green cord	straight green cord
	Across-Basic	Trial 2:	
	curly red ribbon	curly purple cord	straight purple cord
Shiny	Within-Basic	Trial 1:	
	shiny red hippo	shiny blue hippo	dull blue hippo
	Across-Basic	Trial 2:	
	shiny red bug	shiny green hippo	dull green hippo
Shiny	Within-Basic	Trial 1:	
	shiny red duck	shiny blue duck	dull blue duck
	Across-Basic	Trial 2:	
	shiny red turtle	shiny green duck	dull green duck
Clear	Within-Basic	Trial 1:	
	clear (uncolored) soap dish	clear red soap dish	opaque red soap dish
	Across-Basic	Trial 2:	
	clear (uncolored) cup	clear green soap dish	opaque green soap dish
Clear	Within-Basic	Trial 1:	
	clear (uncolored) bottle	clear red bottle	opaque red bottle
	Across-Basic	Trial 2:	
	clear (uncolored) saucer	clear green bottle	opaque green bottle
Spotted	Within-Basic	Trial 1:	
	spotted green snake	spotted black snake	solid black snake
	Across-Basic	Trial 2:	
	spotted green dog	spotted white snake	solid white snake
Spotted	Within-Basic	Trial 1:	
	spotted green frog	spotted purple frog	solid purple frog
	Across-Basic	Trial 2:	
	spotted green elephant	spotted yellow frog	solid yellow frog
Holey	Within-Basic	Trial 1:	
	holey black spoon	holey white spoon	solid white spoon
	Across-Basic	Trial 2:	
	holey blue basket	holey metal spoon	solid metal spoon
Holey	Within-Basic	Trial 1:	
	holey blue bowl	holey white bowl	solid white bowl
	Across-Basic	Trial 2:	
	holey green spatula	holey metal bowl	solid metal bowl

The objects were selected to represent six different object properties (*bumpy, curly, shiny, clear, spotted*, and *holey*). The objects were organized to form sets; each set included five discriminably different objects, including a target object (e.g., a bumpy object) and two pairs of test objects (e.g., bumpy versus smooth objects).

Test objects. As can be seen in Table 1, for each target object (e.g., bumpy green horse), we developed two different pairs of test objects. Within each pair, the test objects (1) were members of the same basic level category (e.g., two horses), (2) were painted the same color (e.g., purple), and (3) had roughly the same contours and orientation. In fact, the only difference between the matching and contrasting test objects in a given pair was the property under consideration (e.g., bumpy versus smooth); this ensured that the target property was the only possible consistent interpretation for the novel adjective.

Target objects. As can be seen in Table 1, the only difference between the Within-Basic and Across-Basic conditions was the choice of target object. In the Within-Basic condition, the target (e.g., a horse) was a member of the same basic level category as the test objects; in the Across-Basic condition, the target (e.g., a rhinoceros) was drawn from a different basic level category. In each set, the target and its matching test object were identical with respect to the target property. For example, in creating the bumpy target and test objects, we placed bumps of the same size, same material, and same degree of density on the target and matching test objects. Although in the Within-Basic condition, the target and matching test objects were members of the same basic level category and shared the same object property, they were nonetheless readily discriminable because they differed in color as well as contour and orientation.

Stimulus selection. To ensure that the object categories we selected were indeed familiar to preschool-aged children, we conducted an examination with an independent sample of six 3-year-olds. (Hall et al., 1993 provide a full description of the procedure.) These children either produced or comprehended the familiar basic level names for the objects at a mean rate of 98%.

Procedure

Children were tested individually in a quiet room in their preschool. To begin, the experimenter introduced a handpuppet ("Gogi") and explained that Gogi didn't speak English. Next, the experimenter introduced a target object and then asked the child to select between the first pair of test objects. Once the child made a selection, the experimenter removed the first test pair and presented the second. The target object remained in view at all times.

Children at each age (3 versus 4 years) were assigned randomly to either the Within-Basic or Across-Basic conditions. In each condition, children were assigned randomly to either the Adjective or No Word conditions. In the Within-Basic/Adjective condition, the experimenter pointed to the target saying, for example, "Let's look at this horse. Gogi says this is a very *blickish* horse." Then, indicating the two test objects, she asked, "Can you give Gogi another horse that's *blickish*?" In the Across-Basic/Adjective condition, she said, for example, "Let's look at this rhinoceros. Gogi says this is a very *blickish* rhinoceros. Can you give Gogi a horse that's *blickish*?" After the child made a selection, the experimenter removed the first test pair and presented the second, explaining, "Now Gogi wants another *blickish* horse. Can you give him another horse that's *blickish*?" The novel adjectives were *dakish*, *zavish*, *wuggish*, *feppish*, *talish*, and *blickish.* The procedure in the No Word condition was identical, except that no novel words were introduced. In the Within-Basic/No Word condition, for example, children heard, "Let's look at this horse. Gogi says this is a horse. Can you give Gogi another horse?"

Each child completed this procedure for all six properties, with two different target objects representing each property and two test trials for each target. This yielded a total of 24 trials per child. These trials were presented in two blocks; each block included one target object representing each of the six properties. In the Adjective conditions, the same novel adjectives were applied consistently to the properties in the first and the second blocks. Within each block, order of presentation was counterbalanced. Children received no corrective feedback.

Coding. We calculated two dependent measures. The first measured the proportion of trials on which children selected the matching test object. For this measure, chance responding is .50. We also developed a more stringent measure by calculating the proportion of sets on which children *consistently* selected the matching test objects on *both* the first and the second test trials for a given target. The probability of making *consistently property-based selections* is .25 (.50 on Trial 1 $\times$ .50 on Trial 2). Analyses based on these dependent measures revealed precisely the same effects. We report the results based on the latter, more stringent measure.

Results

The results of Experiment 1 are depicted in Figure 1. The data were submitted to an ANOVA with Word (Adjective versus No Word), Level (Within-Basic versus Across-Basic), and Age (3 versus 4 years) as between-subject factors and using children's consistently

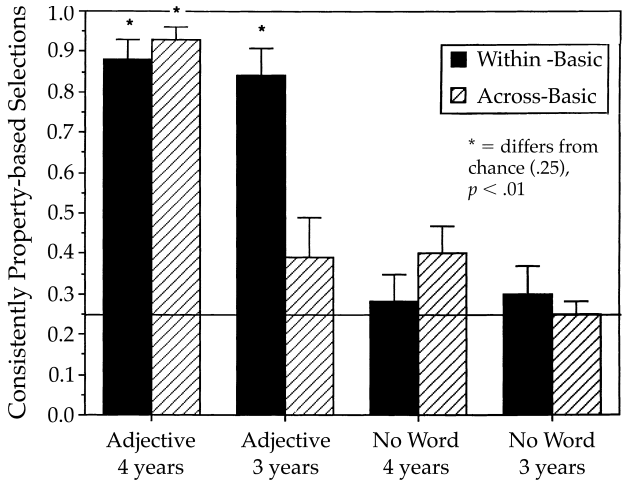

Figure 1 Experiment 1: Mean proportion of consistently property-based selections as a function of age, word, and level.

property-based selections used as a dependent measure. The analysis revealed a main effect for Word, $F(1, 56) = 79.629$, $p < .001$, with children in the Adjective condition ($M = .76$, $SD = .28$) more likely to consistently select the matching test objects than children in the No Word control ($M = .31$, $SD = .22$). This was qualified by a Word × Level interaction, $F(1, 56) = 5.388$, $p < .05$. Children in the Adjective condition made more consistently property-based selections on the Within-Basic sets ($M = .86$, $SD = .15$) than on the Across-Basic sets ($M = .66$, $SD = .34$), Tukey Honestly Significant Difference (HSD), $p < .05$. Performance in the No Word control did not differ as a function of level.

A main effect of Age indicated that 4-year-olds ($M = .62$, $SD = .35$) were more likely than 3-year-olds ($M = .45$, $SD = .30$) to consistently select the matching test objects, $F(1, 56) = 11.943$, $p < .01$. This was qualified by an Age × Word interaction, $F(1, 56) = 4.919$, $p < .05$, which indicated that in the Adjective condition, 4-year-olds ($M = .90$, $SD = .11$) were more likely than 3-year-olds ($M = .62$, $SD = .33$) to make consistently property-based selections, Tukey HSD, $p < .01$. In the No Word control, performance did not differ as a function of Age. An Age × Level interaction, $F(1, 56) = 11.241$, $p < .01$, revealed that at 3 years, children in the Within-Basic conditions ($M = .57$, $SD = .33$) made more consistently property-based selections than those in the Across-Basic conditions ($M = .32$, $SD = .21$), Tukey HSD, $p < .01$. At 4 years, performance did not differ as a function of Level.

We also compared performance at each age and each condition with the level expected by chance (.25). This analysis highlighted differences in 3- and 4-year-olds' extensions of novel adjectives (see Figure 1). At 3 years, children hearing novel adjectives made more consistently property-based selections than would be expected by chance on Within-Basic sets, $M = .84$, $SD = .19$, $t(7) = 9.029$, $p < .001$; on Across-Basic sets, 3-year-olds performed at the chance level, $M = .39$, $SD = .28$, *ns.* By 4 years, children consistently extended novel adjectives to object properties on both Within-Basic sets, $M = .88$, $SD = .13$, $t(7) = 14.031$, $p < .001$, and Across-Basic sets, $M = .93$, $SD = .08$, $t(7) = 23.189$, $p < .001$. In the No Word control, performance did not differ from chance at either Age or Level, which demonstrates that children did not have a priori preferences for test objects. In a subsequent analysis, we considered the possibility that children's performance was related to their familiarity with the words for the target properties.[1] However, there was no relation between familiarity and performance at either age.

Table 2 Experiment 1 Individual Patterns: Numbers of Children (Out of a Possible 8) Displaying Consistently Property-based Behavior

	Level	
	Within-Basic	Across-Basic
Adjective		
3-year-olds	7	2
4-year-olds	8	8
No word		
3-year-olds	1	0
4-year-olds	1	2

Finally, we examined each individual child's pattern of response. Following the binomial formula and setting $p \leq .05$, children who consistently selected the matching test object on both test trials for at least 7 of the 12 targets can be characterized as displaying *consistently property-based behavior* ($M = 10.45$ correct sets). As can be seen in Table 2, in the Adjective conditions 3-year-olds' performance varied systematically as a function of Level. In the Within-Basic condition, seven (out of eight) displayed consistently property-based behavior; in the Across-Basic condition, only two did so. In contrast, 4-year-olds hearing novel adjectives displayed consistently property-based behavior in both the Within-Basic and Across-Basic conditions. Children hearing no novel words were unlikely to display consistently property-based behavior at either age or level. These individual patterns mirror well the results of the parametric analyses based on group means.

[1] For this comparison, we relied on data from an independent investigation (Klibanoff & Waxman, 2000) in which we tested children's comprehension of the words for the target properties.

Table 3 Complete List of Stimuli for Experiment 2

		Initial Trial Objects		Test Trial Objects	
Property	Target	Matching	Contrasting	Matching	Contrasting
Bumpy	Initially Within-Basic bumpy green seal	Trial 1: bumpy yellow seal	smooth yellow seal	Trial 3: bumpy blue horse	smooth blue horse
	Initially Across-Basic bumpy green pig	Trial 2: bumpy blue seal	smooth blue seal	Trial 4: bumpy yellow horse	smooth yellow horse
Bumpy	Initially Within-Basic bumpy green bear	Trial 1: bumpy yellow bear	smooth yellow bear	Trial 3: bumpy blue lizard	smooth blue lizard
	Initially Across-Basic bumpy green rhino	Trial 2: bumpy blue bear	smooth blue bear	Trial 4: bumpy yellow lizard	smooth yellow lizard
Curly	Initially Within-Basic curly red noodle	Trial 1: curly beige noodle	straight beige noodle	Trial 3: curly green straw	straight green straw
	Initially Across-Basic curly white shoelace	Trial 2: curly green noodle	straight green noodle	Trial 4: curly purple straw	straight purple straw
Curly	Initially Within-Basic curly pink ribbon	Trial 1: curly purple ribbon	straight purple ribbon	Trial 3: curly green cord	straight green cord
	Initially Across-Basic curly black pipe cleaner	Trial 2: curly yellow ribbon	straight yellow ribbon	Trial 4: curly purple cord	straight purple cord
Shiny	Initially Within-Basic shiny red bug	Trial 1: shiny blue bug	dull blue bug	Trial 3: shiny blue hippo	dull blue hippo
	Initially Across-Basic shiny red cat	Trial 2: shiny green bug	dull green bug	Trial 4: shiny green hippo	dull green hippo
Shiny	Initially Within-Basic shiny red turtle	Trial 1: shiny blue turtle	dull blue turtle	Trial 3: shiny blue duck	dull blue duck
	Initially Across-Basic shiny red crab	Trial 2: shiny green turtle	dull green turtle	Trial 4: shiny green duck	dull green duck

(*Continued*)

Discussion

The results of Experiment 1 illustrate that preschool-aged children are more likely to focus on object properties in the context of hearing a novel adjective than in a nonlinguistic control task. In addition, they revealed an interesting, but unanticipated, difference between 3- and 4-year-olds' extensions. Four-year-olds extended novel adjectives broadly to objects from diverse basic level object categories, but 3-year-olds were more restricted in their extensions. When the target and test objects were drawn from within the same basic level category, 3-year-olds successfully extended novel adjectives to object properties. However, when the target and test objects were drawn from across different basic level categories, they failed to extend novel adjectives systematically. This suggests that basic level categories, rather than higher order (e.g., animal, artifact) categories, support the initial acquisition of adjectives.

This developmental difference is intriguing because we know that 3-year-olds can extend *familiar* adjectives broadly to properties of objects from different basic level categories. This suggests that in some circumstances, 3-year-olds will begin to extend *novel* adjectives beyond the limits of basic level categories. We reasoned as follows: If basic level object categories provide support for the initial extension of novel adjectives, then 3-year-olds should more successfully extend a novel adjective broadly across different basic level categories if they are *first* provided with an opportunity to map that adjective within a given basic level category. In Experiment 2, we tested this hypothesis.

EXPERIMENT 2

In Experiment 2, we examined further 3-year-olds' ability to extend novel adjectives broadly to describe objects from different basic level object categories. However, we first provided them with an opportunity to map those adjectives to object properties. Half of the children were given an opportunity to map adjectives to properties of objects from the same basic level category (Initially Within-Basic condition). The remaining children were given an opportunity to map adjectives to properties of objects from different

Table 3 *Continued*

		Initial Trial Objects		Test Trial Objects	
Property	Target	Matching	Contrasting	Matching	Contrasting
Clear	Initially Within-Basic clear (uncolored) cup	Trial 1: clear red cup	opaque red cup	Trial 3: clear red soap dish	opaque red soap dish
	Initially Across-Basic clear (uncolored) fork	Trial 2: clear green cup	opaque green cup	Trial 4: clear green soap dish	opaque green soap dish
Clear	Initially Within-Basic clear (uncolored) saucer	Trial 1: clear red saucer	opaque red saucer	Trial 3: clear red bottle	opaque red bottle
	Initially Across-Basic clear (uncolored) toothbrush	Trial 2: clear green saucer	opaque green saucer	Trial 4: clear blue bottle	opaque blue bottle
Spotted	Initially Within-Basic spotted green fish	Trial 1: spotted purple fish	solid purple fish	Trial 3: spotted black snake	solid black snake
	Initially Across-Basic spotted green rabbit	Trial 2: spotted yellow fish	solid yellow fish	Trial 4: spotted white snake	solid white snake
Spotted	Initially Within-Basic spotted green elephant	Trial 1: spotted purple elephant	solid purple elephant	Trial 3: spotted purple frog	solid purple frog
	Initially Across-Basic spotted green dog	Trial 2: spotted yellow elephant	solid yellow elephant	Trial 4: spotted yellow frog	solid yellow frog
Holey	Initially Within-Basic holey blue basket	Trial 1: holey white basket	solid white basket	Trial 3: holey black spoon	solid black spoon
	Initially Across-Basic holey white paper	Trial 2: holey purple basket	solid purple basket	Trial 4: holey metal spoon	solid metal spoon
Holey	Initially Within-Basic holey blue sock	Trial 1: holey white sock	solid white sock	Trial 3: holey white bowl	solid white bowl
	Initially Across-Basic holey green spatula	Trial 2: holey green sock	solid green sock	Trial 4: holey metal bowl	solid metal bowl

basic level categories (Initially Across-Basic condition). If basic level object categories serve as the foundation for children's subsequent broader extensions, then children in the Initially Within-Basic condition should be more likely than those in the Initially Across-Basic condition to map novel adjectives broadly and systematically at test.

Method

Participants

Twenty 3-year-olds (*range* = 3,0–3,11, *M* = 3,6), drawn from the same population as in Experiment 1, were randomly assigned to either the Initially Within-Basic or Initially Across-Basic conditions. The mean ages were approximately equal in the two conditions. In each condition, there were 8 females and 2 males.

Stimuli

Stimuli were 120 small, lightweight objects that were easily handled by the subjects. See Table 3 for a complete list of stimuli. The objects were organized into sets, following the logic of Experiment 1, but with two modifications. First, on all test trials, the target (e.g., a seal or a pig) and test objects (e.g., horses) were drawn from different basic level categories. Second, each pair of test trials was preceded by a pair of initial trials. For children in the Initially Within-Basic condition, these initial trials involved a target object (e.g., a seal) and test objects (e.g., other seals) from the same basic level category. For children in the Initially Across-Basic condition, these initial trials involved a target object (e.g., a pig) and test objects (e.g., seals) from different basic level categories. The same target was used on the initial and subsequent (test) trials. The only difference between stimuli in the Initially Within-Basic and Initially Across-Basic sets was the target object (e.g., a seal versus a pig).

Procedure

The procedure was identical to that of Experiment 1, except that all participants heard the Adjective script, and each pair of test trials was preceded by a pair of

initial trials (either Initially Within-Basic trials or Initially Across-Basic trials). Children received no corrective feedback.

Results

The results of Experiment 2 are depicted in Figure 2. As predicted, 3-year-olds were more likely to extend novel adjectives broadly across basic level categories when they were first provided with an opportunity to map the adjective within a given basic level category. In addition, in the absence of any initial mapping opportunities, 3-year-olds successfully extended novel adjectives within, but not across, basic level object categories (as in Experiment 1).

Test trials. We first examined the impact of initial mapping opportunities on 3-year-olds' subsequent ability to extend adjectives broadly across basic level categories on test trials. As can be seen in Figure 2, 3-year-olds in the Initially Within-Basic condition ($M = .66$, $SD = .38$) were more likely than those in the Initially Across-Basic condition ($M = .26$, $SD = .11$) to make consistently property-based selections, $t(18) = 3.21$, $p < .01$. Performance in the Initially Within-Basic condition was significantly greater than chance, $t(9) = 3.42$, $p < .01$; performance in the Initially Across-Basic condition did not differ from chance, *ns.*

An examination of each individual child's patterns of response (computed as in Experiment 1) revealed the same outcome: Performance at test varied systematically as a function of Level. In the Initially Within-Basic condition, 7 out of 10 children displayed *consistently property-based behavior*; in the Initially Across-Basic condition, none did so (see Table 4).

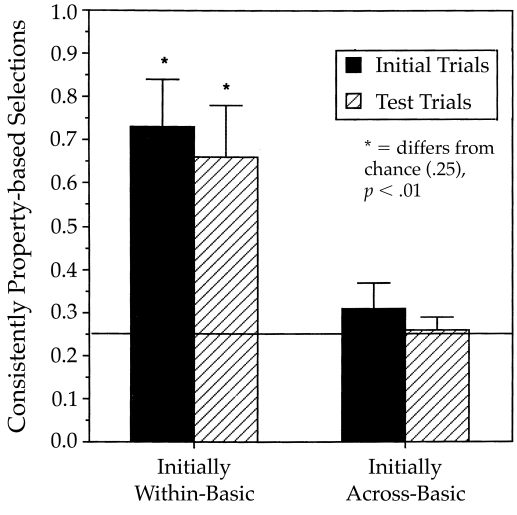

Figure 2 Experiment 2: Mean proportion of consistently property-based selections in initial and test trials.

Table 4 Experiment 2 Individual Patterns: Numbers of Children (Out of a Possible 10) Displaying Consistently Property-based Behavior

Condition	Initial Trials	Test Trials (always across-basic)
Initially Within-Basic	8	7
Initially Across-Basic	1	0

Initial trials. To provide a point of comparison with Experiment 1, we also examined children's performance on the initial trials themselves. Three-year-olds were more likely to map novel adjectives consistently to object properties on initial trials involving objects from the same basic level category (Initially Within-Basic condition, $M = .73$, $SD = .36$), than on initial trials involving objects from different basic level categories (Initially Across-Basic condition, $M = .31$, $SD = .18$), $t(18) = 3.38$, $p < .01$. Performance on Initially Within-Basic trials exceeded the rate expected by chance, $t(9) = 4.30$, $p < .01$; performance on Initially Across-Basic trials did not. Moreover, examination of Table 4 reveals that individual patterns of performance on the initial trials varied systematically as a function of Level. In the Initially Within-Basic condition, 8 out of 10 children displayed *consistently property-based* behavior; in the Initially Across-Basic condition, only 1 did so.

Discussion

An analysis of the test trials of Experiment 2 reveal that an initial opportunity to map a novel adjective to an object property within a basic level category supports 3-year-olds' subsequent broader extension of that adjective to properties of objects from different basic level categories. Importantly, providing children with initial opportunities to map novel adjectives across different basic level categories confers no such advantage. An analysis of the initial trials of this experiment replicates those of Experiment 1: In the absence of any initial mapping opportunities, 3-year-olds successfully extended novel adjectives within, but not across, basic level object categories.

GENERAL DISCUSSION

The current experiments were designed to examine the processes by which preschool-aged speakers of English extend novel adjectives, applied ostensively to individual objects, to properties of objects. This is

an important issue because, although preschoolers have fairly large repertoires of adjectives and although they extend these familiar adjectives broadly to properties of objects from different basic level object categories (e.g., *wet* diapers, *wet* grass), evidence documenting the processes underlying the acquisition of these adjectives is scanty. The experiments reported here yielded two main findings, both of which are consistent with the proposal that basic level object categories support the initial extension of novel adjectives.

First, although 4-year-olds successfully extended novel adjectives from the target to the matching test object, whether these objects were drawn from the same, or different, basic level categories, 3-year-olds' extensions were more restricted. They successfully extended novel adjectives if the target and test objects were drawn from the same basic level category but failed to do so if the objects were drawn from different basic level categories (Experiment 1). Second, when 3-year-olds were first provided with an opportunity to map a novel adjective within a basic level category, they were subsequently able to extend that adjective broadly to properties of objects from different basic level categories. However, providing an initial opportunity to map adjectives across different basic level categories conferred no such advantage (Experiment 2).

These results reveal that novel adjectives unfold within the support of familiar basic level object categories. This outcome is consistent with recent evidence from infants as young as 21 months of age (Waxman & Markow, 1998). It also accords well with evidence for the semantic dependency of adjectives on the (basic level) nouns that they modify (Bolinger, 1967; Dixon, 1982; Gasser & Smith, 1998; Gelman & Markman, 1985; Halff, Ortony, & Anderson, 1976; Medin & Shoben, 1988; Warren, 1988; Waxman, 1990; Waxman & Markow, 1998; Wierzbicka, 1986). Thus, there appears to be considerable developmental continuity in the foundational role of basic level categories in the acquisition of novel adjectives. However, the experiments reported here cannot specify precisely the mechanism or mechanisms by which basic level categories exert their influence. A thorough investigation of this issue will involve consideration of lexical, perceptual, and conceptual factors underlying this phenomenon (Klibanoff & Waxman, 2000; Waxman & Markow, 1998).

Consider, for example, the potential influence of lexical factors in children's interpretation of novel adjectives. Recall that in the current experiments, the experimenter explicitly mentioned the familiar basic level name for each object as it was presented (e.g., "This is a very *blickish* rhinoceros"). Doing so may have drawn children's attention toward basic level categories and away from higher order categories, thereby suppressing their ability to extend adjectives across different basic level categories. If this is the case, then when basic level names are not mentioned explicitly, 3-year-olds should be more likely to map novel adjectives across different basic level categories. In a recently completed series of experiments, we tested this possibility by replacing basic level count nouns with pronouns (e.g., "This is a very *blickish* one"). However, 3-year-olds' difficulty mapping novel adjectives across different basic level persisted (Klibanoff & Waxman, 1999). In addition, Mintz and Gleitman (1998) found that 2- and 3-year-olds who received explicit training mapped novel adjectives across basic level categories more successfully when the basic level names of the stimulus objects *were* mentioned than when they were not. Therefore, 3-year-olds' limited extension of novel adjectives in the studies reported here cannot be attributed to the explicit mention of the basic level names.

Another possibility is that children's familiarity with the target properties influenced performance. For example, children who are more familiar with words for the target properties may have an advantage because learning a new word for a previously acquired adjective could involve a different process than acquiring a novel adjective that has not previously been lexicalized. Although a preliminary analysis failed to reveal an effect of familiarity (Experiment 1), this possibility is currently under closer investigation.

We have also considered the influence of perceptual or conceptual factors on children's extension of novel adjectives. For example, our task required children to make explicit comparisons among triads of objects to identify the target property (e.g., bumpy, spotted, etc.). Clearly, the process of comparison itself is powerfully influenced by similarity among the objects under consideration: The greater the similarity between objects, the more readily adults and children come to recognize similarities and differences among them (Gentner & Markman, 1994; Gentner & Rattermann, 1991; Goldstone & Medin, 1994; Kemler, 1983; Kotovsky & Gentner, 1996; Smith, 1989, 1993). Moreover, young children appear to have particular difficulty with comparisons involving objects that vary along more than a single dimension (Aslin & Smith, 1988; Kemler, 1983; Shipley & Kuhn, 1983; Smith, 1993). These findings are directly relevant because in the current experiments, the objects in the Within-Basic condition were clearly more similar to one another than were objects in the Across-Basic condition. We suspect that the similarity among objects in the Within-Basic condition facilitated the process of comparison, increased the salience of the target property

(e.g., bumpy, spotted), and in this way supported the extension of novel adjectives.

This interpretation may also account for the (unanticipated) developmental difference in Experiment 1. If both 3- and 4-year-olds have repertoires of familiar adjectives that they extend appropriately to properties of objects from diverse basic level categories, then why did 3-year-olds fail to extend novel adjectives broadly across basic level categories in our task? We have argued that this failure reflects their initial reliance on basic level categories in the extension of novel adjectives. More specifically, we propose that this foundational role derives, at least in part, from the conceptual and perceptual similarity among objects at the basic level. Because the objects in the Within-Basic sets exhibited considerable similarity, the process of comparison was relatively easy, and as a result, the target properties were identified with ease and the novel adjectives were readily extended. In contrast, because the objects in the Across-Basic sets were less similar to one another, the process of comparison was more demanding and required greater processing capacities. As a result, 4-year-olds, but not 3-year-olds, identified the target properties and extended them to other objects. Four-year-olds' success may well be related to their greater processing capacities (Halford, 1992, 1993).

This interpretation may also help to account for the results of Experiment 2. In the Initially Within-Basic condition, where the initial process of comparison was relatively simple, children identified the target properties successfully. Because they had identified the target property in advance, the processing demands associated with the subsequent Across-Basic test were substantially reduced. As a result, even the more limited 3-year-olds were then able to map the novel adjectives broadly to objects from different basic level categories. This is consistent with earlier work demonstrating that prior experience with a related simpler task led to better performance on a subsequent more difficult task (DeLoache, 1991; Kotovsky & Gentner, 1996).

In sum, the current experiments support the hypothesis that basic level categories serve as a foundation for mapping novel adjectives to properties of objects. Although many adjectives appear to refer to object properties that are available from simple observation, the interpretation of these adjectives is not simple. Instead, adjectives seem to be mapped to object properties first within the context of basic level categories. This finding has consequences for theories of language and conceptual acquisition because it suggests that object properties and adjectives are not interpreted independently but rather are interpreted within the context of fundamental object categories and the nouns that describe them.[2]

In future work, it will be important to pursue the contribution of basic level categories, to identify the processes underlying the ability to extend novel adjectives beyond the limits of basic level categories, and to tease apart the relative contributions of lexical, perceptual, and conceptual factors in extension of novel adjectives.

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[2] Our interpretation of the results is consistent with evidence documenting that the predictive value of object properties varies as a function of object kind (Medin & Shoben, 1988; Springer & Keil, 1991). For example, the property curved has greater signal value for boomerangs than for bananas (Medin & Shoben, 1988; Murphy & Medin, 1985). It is also consistent with the view that nouns provide the foundation for the acquisition of other grammatical categories, including verbs and adjectives (Gillette, Gleitman, Gleitman & Lederer, 1999; Grimshaw, 1990; Waxman, 1999).

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