Young Children's Knowledge of the "Determiner" and "Adjective" Categories

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Children's understanding of the grammatical categories of "determiner" and "adjective" was examined using 2 different methodologies. In Experiment 1, children heard novel nouns combined with either *a* or *the*. Few 2-year-olds, but nearly all 3- and 4-year-olds, subsequently produced the novel nouns with a different determiner from the modeled combination. Experiment 2 used a priming methodology. Children age 2, 3, 4, and 6 years repeated descriptions of pictures, before describing target pictures themselves. When the primes consisted of a varied determiner + noun, all age groups produced more determiner + noun descriptions. When the primes consisted of a determiner + adjective + noun, 2-year-olds showed no priming. Three- to 6-year-olds showed item-specific priming, but only 6-year-olds (and to a limited extent 4-year-olds) showed both item-specific and structural priming. These results suggest that children build an understanding of determiners and adjectives gradually, perhaps from individual lexical items, over a number of years, and that pragmatic correctness may be attained particularly late.

KEY WORDS: normal language development, preschool children, experimental research

A question under debate in child language acquisition is whether we should attribute adultlike syntactic categories such as "noun," "verb," and "adjective" to children who are just learning to talk. A variety of empirical evidence suggests that children as young as 2 or 3 years possess at least some abstract grammatical knowledge (e.g., Ihns & Leonard, 1988; Tomasello & Olguin, 1993; Valian, 1986, 1991). We focus here on two categories: "determiners" and "adjectives." These parts of speech are often part of noun phrases but have received little attention compared with nouns or verbs, the early understanding of which has been studied in some detail. The evidence that does exist about young children's knowledge of determiners and adjectives has come from a variety of experimental methodologies.

Some studies have examined children's comprehension of these categories. Several have investigated the early understanding of determiners with other function morphemes, including articles, auxiliaries, and verb inflections. Children age 1 to 3 years were shown to respond better to instructions that included the correct function morpheme (e.g., "Find *the* bird for me") than to instructions that omitted the function morpheme (Petretic & Tweney, 1977) or replaced it with an incorrect or nonsense morpheme (e.g., "Find *was/gub* bird for me"; Gerken & McIntosh, 1993). Children of 18 months interpreted novel words presented with a determiner (e.g., *a dax*) as common nouns but words presented without an article (e.g., *Dax*) as proper nouns (Gelman & Taylor, 1984). Even young children seem sensitive to the way that determiners combine with other words in spoken English.

Studies of the early understanding of adjectives have come up with a more mixed pattern of results. Infants as young as 13 or 14 months show sensitivity to some of the distinctions between novel words presented as count nouns versus adjectives, in tasks based on novelty preference (Waxman & Markow, 1995) and tasks that require children to choose the appropriate toy from an array (Waxman & Booth, 2001). However, research with older children suggests that the early understanding of adjectives may be quite limited. Some studies have focused on children's ability to map novel adjectives to other objects sharing a salient property (e.g., Mintz & Gleitman, 2002; Waxman & Markow, 1998). These have revealed that children even up to the age of 36 months generally succeed in such mapping only in very limited situations, when test objects are all drawn from the same category. Hall, Waxman, and Hurwitz (1993) found even greater difficulties with comprehending adjectives: 2-year-olds were unable to correctly interpret novel objects as referring to object properties, and 4-year-olds could do so only when the objects were familiar.

Even if very young children have some sensitivity to the properties of adjectives, it does seem that adjectives pose some real difficulties for young language learners: Both real and novel examples seem subject to relatively long learning times and numerous errors (e.g., Smith, Jones, & Landau, 1992; Smith & Sera, 1992; Taylor & Gelman, 1988). Similarly, despite their impressive performance on tasks assessing their understanding of determiners, young children often fail to include determiners in their speech (Gerken, Landau, & Remez, 1990). Not so many experiments have examined children's spontaneous production of determiners and adjectives, but it seems that young children omit determiners even in imitative speech (Boyle & Gerken, 1997; Gerken et al., 1990).

Valian (1986) examined naturalistic speech samples from 6 children between the ages of 2;2 (years;months) and 2;5 for evidence of six syntactic categories, including "determiner" and "adjective." She assigned each of the children's words to the categories that they would have been given in adult speech and then tested this category assignment against a list of syntactic criteria. Children were assumed to possess an abstract category of "determiner" or "adjective" if their use of such words satisfied these criteria. The criteria for "determiners" were that if present in a noun phrase, a determiner must appear before adjective or noun (or both, if both present), that a determiner must not constitute the whole of an utterance, and that determiners must not be sequenced. The criteria for "adjectives" were that if present in a noun phrase, an adjective must appear after the determiner and before the noun and that adjectives could constitute the whole of an utterance, could be sequenced, and could appear as predicate adjectives.

Valian's (1986) participants used determiners quite frequently (especially *the* and *a,* which made up 72% of all determiners produced) and adjectives quite infrequently. Most important, all 6 participants passed the criteria for determiners, and 5 of the 6 passed them for adjectives. However, this analysis is potentially overgenerous. Even if a child used determiners with only one particular word, or with a small set of related words, Valian's criteria could still be met, and the child credited with knowledge of the "determiner" category (Ihns & Leonard, 1988). Ihns and Leonard examined further data (speech from Brown's, 1973, participant Adam) against the same criteria. They looked at whether his combinations included a variety of words or the same words in different positions. For example, he might use *the baby* both preverb (e.g., "*the baby* crying") and postverb (e.g., "see *the baby*") but never use *the* with any other word but *baby*. This would not seem to justify the accreditation of the "noun" category. Even taking such lexical variation into account, however, Ihns and Leonard confirmed Valian's conclusions for determiners and noun phrases.

Nevertheless, Pine and Martindale (1996) argued that weaknesses remain. A child could combine a large number of correctly positioned determiners with a large number of different nouns, simply through knowing a small repertoire of rote-learned phrases, such as *Want a* + *X, Where's the* + *X,* or *A nice* + *X.* Other potential errors might not occur simply because they would be meaningless. It makes little sense, for example, to say *a* or *the* alone or to combine certain determiners, because many (e.g., *a* and *the*) have opposing meanings. Because *a* and *the* make up such a large proportion of the determiners uttered, few determiners remain for children to err on. Despite this, both Valian (1986) and Ihns and Leonard (1988) noted errors that violated the criteria (e.g., the use of *my* as a single utterance and sequencing errors such as "That's *a my* car"). The authors could account for each such error individually (e.g., "My" means *That's mine,* or "That's a" is an unanalyzed whole), but this means that it is virtually impossible for a child to fail on any criterion (Pine & Martindale, 1996).

Pine and Martindale (1996) aimed to overcome many of these problems when they looked for evidence of the abstract category of "determiner" in speech samples from 7 children, recorded twice each between ages 1;2 and 2;6. They reasoned that from a syntactic point of view, any knowledge that children have about one determiner, they should also have about other determiners. If children instead build their knowledge of syntactic categories through knowledge of limited-scope formulas, then early speech should include particular determiners only in particular formulas. Like Valian (1986) and Ihns and Leonard (1988), Pine and Martindale found some utterances that violated Valian's criteria (e.g., "My one lorry"). More important, at Time 1,

there was relatively little overlap in the contexts in which the children produced different determiners. Further, this overlap was significantly less than that of their parents, even taking into account the number of utterances produced and the number of nouns and predicates with which determiners were used by parent and child. At Time 2, 2 months later, the results were somewhat less clear. Depending on the controls made, not all of the differences in the extent of overlap between children and parents remained significant. Nevertheless, these results suggest that the context specificity of children's early determiner use is greater than would be expected on the basis of sampling considerations alone, a suggestion supported in a larger scale investigation of the naturalistic speech data of 11 children age 1;0 to 3;0 (Pine & Lieven, 1997). These studies call into question the idea that young children understand the relationship between different types of determiner, and thus throw doubt on the assertion that young children should be credited with a fully abstract "determiner" category.

One drawback of naturalistic studies is that it is impossible to tell which utterances children produce by memorizing others' utterances and which they produce creatively (Olguin & Tomasello, 1993). Experimental studies can therefore provide valuable complementary data on early category knowledge. One method has been to teach children novel words and then to test how productive they are in using these words. Children's early competence in generalizing their knowledge about the categories of "noun" (e.g., Tomasello, Akhtar, Dodson, & Rekau, 1997; Tomasello & Olguin, 1993) and especially "verb" (e.g., Berman, 1993; Olguin & Tomasello, 1993; Pinker, Lebeaux, & Frost, 1987; Tomasello & Brooks, 1998) has been extensively investigated through the use of novel words. However, young children's productivity with determiners and adjectives has received much less experimental attention. To possess a fully abstract grammatical category suggests the ability to use any of its exemplars in combination with any known or novel word and to substitute one exemplar for another in a grammatically, and ultimately a pragmatically, appropriate fashion. Researchers differ in the extent to which they credit the child with initially abstract categories. Some suggest that children build their categories one exemplar at a time, generalizing to a more abstract representation only gradually (Tomasello, 1992). Others, such as Valian (1986), suggest much earlier abstract category knowledge that can be applied to any category member. It can be difficult to distinguish these positions, because *gradualists* see abstraction as an ongoing process (Tomasello & Abbot-Smith, 2002), while those who postulate earlier, more general abstraction suggest that lexical learning, *underspecification,* and performance limitations can account for many of the results outlined above. Our own position is that linguistic

representations are initially isolated form-meaning constructions. Children start to build more abstract categories by learning an increasing range of items that enter the "slots" in these constructions and by building the structural, semantic, and pragmatic links between constructions. This leads to increasingly general and more abstract representations. In our experiments, limited, item-based use is taken to suggest that the categories under study cannot yet be used in the fully abstract manner of adult speakers.

Following on from the lexical priming literature that showed that adults could be primed by a preceding context to use a particular word, Bock (1986) first showed that adults were also more likely to use a certain syntactic construction to describe a picture if they had just repeated a sentence picture description with that same construction. For example, adults who had just repeated a prime in the passive rather than the active voice (e.g., "The referee was punched by one of the fans") were more likely to describe the following picture in the passive voice as well (e.g., "The church is being struck by lightning," rather than "Lightning is striking the church"). Similar priming effects were observed for prepositional (e.g., "The man is reading a story to the boy") versus double-object (e.g., "The man is reading the boy a story") dative constructions. Such structural priming (the tendency to produce a particular syntactic structure after a sentence with that same structure, but with few lexical items in common) suggests that adults possess some abstract representation of this structure.

Some priming-like studies have been conducted with children (Brooks & Tomasello, 1999; Whitehurst, Ironsmith, & Goldfein, 1974), but only recently has Bock's (1986) syntactic priming technique been recognized as a tool for investigating early syntactic understanding. Savage, Lieven, Theakston, and Tomasello (2003) found that children age 3, 4, and 6 years could be primed to produce both active and passive sentences to describe a novel scene. For example, the 3- and 4-year-olds often produced the passive (e.g., "It got locked by it") if they had just repeated a passive sentence sharing many lexical items and the same syntactic structure, (e.g., "It got cut by it"). This was seen as lexical (i.e., item-based) priming. However, only the 6-year-olds were primed by sentences that shared few lexical items but the same syntactic structure (e.g., "The bricks got pushed by the digger"). This was seen as structural priming. The authors concluded that although 6-year-olds seem to possess a rather abstract representation of the active and passive constructions, 3- and 4-year-olds are still building these representations, which retain a degree of lexical, item-based specificity at these ages.

In the present experiments, we set out to look at children's early representations of the syntactic categories

of "determiner" and "adjective," using tasks that require the production, rather than just the comprehension, of these words. We focused first on determiners, using a simple, novel-word methodology. We taught novel nouns with *a* or with *the* to children age 2, 3, and 4 years, because most theories of the acquisition of syntactic competence see this age range as especially important. We tested whether they were able to reproduce only the determiner–noun combinations modeled or whether they could produce creative combinations. If children can go "beyond the input" and produce a novel noun in combination with a determiner that they have not heard modeled, this will provide evidence that they have at least begun to build an abstract representation of the "determiner" category. If instead they can only reproduce the determiner–noun combinations that they have heard modeled, this will suggest that their understanding of determiners is still lexically specific and linked to particular limited-scope formulas. We did not expect that the children would consistently produce determiners in a pragmatically correct fashion (e.g., using *a* for one toy out of several but *the* for a single toy; e.g., Maratsos, 1974). Our central aim was to examine whether children were yet even able to combine determiners and novel nouns creatively, rather than whether they had yet attained pragmatic correctness. In the second experiment, we used a syntactic priming methodology to investigate 2-, 3-, 4-, and 6-year-old children's understanding of the syntactic category of "determiner" and also of "adjective."

Experiment 1

Method
Participants

The participants were 60 children age 2, 3, and 4 years, from northwest England. There were approximately equal numbers of girls and boys. Twenty additional children (19 age 2 years and 1 age 3 years) were tested but excluded from analysis because they failed to produce either of the novel nouns. There were twenty-four 2-year-olds (mean age = 2;4, range = 2;0–2;8); eighteen 3-year-olds (mean age = 3;4, range = 3;1–3;10); and eighteen 4-year-olds (mean age = 4;5, range = 4;0-4;10). All were learning English as their first language.

Procedure

The children were tested individually in a single session lasting 20–30 min, in a laboratory playroom. The child's caregiver, the experimenter (E), and a research assistant were present. E first played with the child for 10 to 15 min (or until the child began to speak to E), before introducing two novel toys. These were a *toma* (a toy with large eyes, fluffy hair, and a long purple body) and a *modi* (a red, spotted, birdlike toy with striped legs and a fluffy tail). Each session was videotaped. We wanted to know whether the children would be able to produce the novel nouns only with the determiner that they had heard E use or with other determiners as well. We hoped that participants would produce determiner–noun combinations spontaneously, but we also wanted to create a situation that would encourage the use of more than one determiner. The two novel toys were therefore shown to be essential for achieving a desirable goal and then placed out of reach to encourage the child to request them verbally, as described below.

Half the children were introduced to the toma first, and half to the modi first. One of the toys was introduced with *a* and one with *the* (counterbalanced). Each toy was presented singly and then in a group of three identical toys, or vice versa. For each toy, the child was asked two elicitation questions ("What do we need to [achieve goal]?"), once when the toy was a unique exemplar (in which case we "pulled" for, or aimed to elicit, *the X*) and once when the toy was one of three exemplars ("pull" for *a X*). Table 1 shows an example presentation order for the toys and the elicitation questions.[1] The research assistant noted the child's uses of the novel noun, and these were later checked against the videotape.

The participants were also given a similar test of their tendency to use articles with real words. (This test was introduced only after the first eight 2-year-olds and four 4-year-olds had already been tested but was conducted with all remaining participants.) E said, "Let's get out *the orange* and *the egg*" and brought out these pieces of plastic food from a toy box. She named them twice more each with the definite article, then explained that she was going to close her eyes and that the child should put either the orange or the egg in her hands. The child was instructed to remove the toy before E opened her eyes and was then asked, "Which one did you put in my hands? Can you tell me? You put…" This procedure was then repeated with "a dog" and "a mouse." Each child thus received two real-word tests, the order of which was counterbalanced across children. In both tests, *the X* is more pragmatically appropriate, but *a X* would also constitute an acceptable answer. This test was included simply to check whether children would use determiners in an elicitation task when the nouns did not pose such a memory challenge as those in the novel-word task.

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[1]This example shows a pull for *the* and then *a* for the toma, but for *a* and then *the* for the modi. However, in the experiment, each child received the same order of pulls for both toys (e.g., *a* then *the*), to keep the structure of the tasks similar.

Table 1. Example orders of training and testing given by experimenter (E).

Training 1a	Training 2a
E and child play with novel toy. E uses its name six times with the definite article (e.g., ''Here's *the toma!*'')	E and child play with novel toy. E uses its name six times with the indefinite article (e.g., '' Look, it's *a modi!*'')
E demonstrates that *only* this novel toy can achieve a desirable goal (to reach into a hole in a box to make a toy duck quack).	E demonstrates that this novel toy, *and* two identical novel toys, can achieve a desirable goal (to be flipped off a toy garbage can's lid).
E reminds child of toma's name (''Do you remember what this is? It's the *toma.* That's right, the *toma''*), and puts the toma and the other toys in a box out of the child's reach.	E reminds child of modi's name (''Do you remember what this is? It's a *modi.* That's right, a *modi''*) and puts the three modis and the other toys in a box out of the child's reach.

Testing 1a: Pull for *the* + X	Testing 2a: Pull for *a* + X
E asks child, ''What do we need to make the duck quack? We need...'' [*the toma*]	E asks child, ''What do we need to flip off the lid? We need...'' [*a modi*]

Training 1b	Training 2b
E introduces two more tomas without naming (''Look what else I've got!''); demonstrates that all three can achieve goal. E puts the three tomas, and other toys, in a box out of the child's reach.	E puts away two of the modis in a separate box (''Let's put these away now''); demonstrates that the one left can still achieve goal. E puts the single modi, and other toys, in a box out of the child's reach.

Testing 1b: Pull for *a* + X	Testing 2b: Pull for *the* + X
E asks child, ''What do we need to make the duck quack? We need...'' [*a toma*]	E asks child, ''What do we need to flip off the lid? We need...'' [*the modi*]

Results
Use of Determiners With Real Words

We first looked at whether the children used determiners in response to the two real-word questions. Table 2 contains the responses by children in each age group. The incidence of answers, and of determiner use, increased with age. Six of the sixteen 2-year-olds (but none of the older children) failed to produce a determiner in this task. (Combining these with the later novel-noun data revealed that in this experiment overall, all but 3 of the 2-year-olds used a determiner at least once, and all 3- and 4-year-olds did so at least twice.) Table 2 shows that the 2-year-olds nearly always used *a,* regardless of the determiner modeled. The 3-year-olds used *a* more than *the,* regardless of the model. The 4-year-olds used *the* much more than *a,* especially after *the* models. The table shows data in terms of number of children, but the number of

Table 2. Number of children in each age group who responded to the two real-word questions.

Age group	n	Response	Model *the* + X	Model *a* + X
2	16	No answer	6	5
		Noun alone	5	5
		the + X	0	1
		a + X	4	5
		Both *a* + X, *the* + X[a]	1	0
3	18	No answer	1	0
		Noun alone	2	2
		the + X	5	5
		a + X	8	9
		Both *a* + X, *the* + X[a]	2	2
4	14	No answer	0	0
		Noun alone	2	0
		the + X	12	8
		a + X	0	4
		Both *a* + X, *the* + X[a]	0	1
		Other determiner + X	0	1

Note. Age is in years.

[a]This cell includes the few children who used a given noun with more than one determiner, for example, ''A dog! You put the dog!''

Table 3. Number of children in each age group who responded to each elicitation question.

Age group	n	Response	Model *the* + X		Model *a* + X	
			Pull for *the*	Pull for *a*	Pull for *the*	Pull for *a*
2	24	No answer	4	7	4	5
		Other answer	7	10	9	6
		Noun alone	8	5	8	8
		the + X	**1**	**1**	0	0
		a + X	3	1	**2**	**5**
3	18	No answer	2	2	2	0
		Other answer	2	2	4	3
		Noun alone	1	1	2	5
		the + X	**5**	**4**	1	1
		a + X	7	9	**9**	**9**
4	18	No answer	2	1	0	0
		Other answer	1	0	0	1
		Noun alone	4	3	2	2
		the + X	**7**	**11**	6	4
		a + X	4	3	**9**	**11**

Note. Age is in years. Numbers in bold represent responses the same as the combinations modeled. Other answers included, e.g., ''I don't know,'' ''The box,'' and ''We need a quack.''

responses also increased across age groups. The 2-year-olds produced 13 nouns alone and 15 with determiners; the 3-year-olds, 10 alone and 44 with determiners; and the 4-year-olds, 3 alone and 25 with determiners.

Use of Determiners With the Novel Nouns in Response to Elicitation Questions

When it came to the novel nouns, all 60 children included in the analyses responded to at least one of the four elicitation questions, or "pulls," but they did not all respond to all four. Table 3 shows the number of children who responded to each question, for each age group. Of course, the correct use of *a* and *the* in response to these pulls depends on semantic–pragmatic knowledge that we did not necessarily expect the youngest participants to have yet attained. However, we used these pulls in the hope of encouraging the use of more than one determiner. As expected, the number of children who used the novel nouns, and who included a determiner in their responses, increased with age. Many of the 2-year-olds were unable to remember the novel nouns, or else used them with no determiner at all, but the 3- and 4-year-olds were better at producing determiner–noun combinations. The 2- and 3-year-olds tended to use *a* more than *the*, whereas the 4-year-olds used *the* and *a* approximately equally. In terms of the number of responses, the 2-year-olds responded with 31 nouns alone and 13 with determiners; the 3-year-olds produced 9 alone and 45 with determiners; and the 4-year-olds produced 12 alone and 55 with determiners.

Table 3 suggests that there was no consistent effect of pull type, and this was confirmed in Wilcoxon signed-ranked tests conducted separately for each age group. When the pull was for *a*, the 2- and 3-year-olds produced significantly more *a* + X than *the* + X responses ($p < .05$, and $p < .01$, respectively). However, when the pull was for *the,* the 3-year-olds again produced more *a* + X responses, and the difference was not significant for other age groups. Further, no age group used *a* + X any more often when the pull was for *a* than for *the,* nor *the* + X any more often when the pull was for *the* than for *a*. It thus appears that the children did not use determiners in a pragmatically appropriate way in this study, possibly because the task was so difficult. Data were therefore collapsed across pull type in all further analyses.

Our main question was whether children were able to use the novel nouns only with the determiner that they had heard modeled, or whether they were able to produce them with a different determiner, in a creative combination. Table 3 shows the number of children who responded to each question but does not reveal exactly how many of the children were creative overall. We therefore categorized the children into those who had produced at least one creative determiner–noun combination and those who had produced only copied combinations, both overall, and for uses of *a* + X and *the* + X. Table 4 shows the number of children in each of these categories, for each age group.

As shown in Table 4, all the 3- and 4-year-olds, but only about half the 2-year-olds, answered at least one

Table 4. Number of children who produced one or more creative, or only copied, determiner–noun combinations.

		One or more creative responses			Only copied responses		
			Response			Response	
Age group	*n*	Overall	*a + X*	*the + X*	Overall	*a + X*	*the + X*
2	24	4	4	0	7	6	1
3	18	12	11	2	6	5	6
4	18	12	5	8	6	9	5

Note. Age is in years. *a* and *the* responses do not always add up to *Overall* responses because some of the children who were creative with or copied *a + X* were the same children who were creative with or copied *the + X*.

elicitation question with a determiner–noun response. Twelve 3-year-olds and twelve 4-year-olds gave creative determiner–noun responses (rather than copied or no-determiner responses). A chi-square test confirmed that this number was significantly greater than that for the four 2-year-olds who gave creative responses, $\chi^2(1, N = 42) = 10.89, p < .01$. This suggests that two-thirds of the 3- and 4-year-olds, but just one-sixth of the 2-year-olds, had a sufficiently strong representation of the determiner category to add determiners to novel nouns in creative combinations.

Table 4 also shows that children age 2 and 3 years, but not 4 years, tended to be more creative with *a* than with *the*. It was not possible to test the significance of this difference for the 2-year-olds in a chi-square test, as 3 of the 4 expected frequencies were <5. However, two other chi-square tests confirmed that 3-year-olds used $a + X$ creatively significantly more often than $the + X$, $\chi^2 (1, N = 36) = 9.75, p < .01$, but that 4-year-olds were equally creative with $a + X$ and $the + X$, $\chi^2(36) = 1.08, p > .05$.

Use of Determiners With the Novel Nouns Spontaneously

Many of the children used the novel nouns spontaneously, as well as in response to the elicitation questions. These spontaneous uses almost always involved labeling, sometimes with *a* and *the* and some-

times with other determiners instead (e.g., "another modi!" or "two tomas"). Table 5 shows the number of spontaneous uses of the novel nouns in copied or creative combinations for each age group. The number of both types of combination increased with age, especially in terms of the number of creative combinations from age 2 to age 3 and 4. For the 2- and 3-year-olds, the greater the use of the novel nouns, the greater the use of creative combinations with these nouns ($r = .48, p < .05$, and $r = .62, p < .01$, respectively), but this relationship was not significant for the 4-year-olds.

Use of Determiners With the Novel Nouns Overall

The total number of uses of the novel nouns (elicited and spontaneous combined) increased from 51 by the 2-year-olds to 94 by the 3-year-olds to 130 by the 4-year-olds. As before, we categorized the children into those who had produced at least one creative determiner–noun combination and those who had produced only copied combinations. Table 6 contains the number of children in each of these categories, for each age group, as well as the number of children who produced the novel nouns alone, with no determiner.

For those 2-year-olds who did use a determiner with the novel nouns, about half reproduced only the combination that they had heard modeled, but the other half

Table 5. Number of children who used novel nouns spontaneously and number of each type of spontaneous utterance per age group.

			No. spontaneous uses of nouns overall		
Age group	*n*	No. children who used nouns spontaneously	Noun alone	Copied combination	Creative combination
2	24	8	2	3	5
3	18	13	5	5	18
4	18	16	11	10	19

Note. Age is in years. Many children made several spontaneous uses of the novel nouns, so the number of spontaneous uses may exceed the number of children.

Table 6. Use of determiners with novel nouns overall.

Age group	n	Noun alone	Copied combination	Creative combination
2	24	10	8	6
3	18	0	2	16
4	18	0	1	17

Note. Age is in years.

managed to produce a creative combination. In contrast, all the 3- and 4-year-olds used a determiner at least once, and nearly all produced a creative determiner–noun combination. Because the numbers for the 3- and 4-year-olds were so similar (16 vs. 17 out of 18), we combined them for a chi-square analysis. We compared the children's use of creative versus noncreative utterances and confirmed that overall, fewer 2-year-olds were creative than were 3- and 4-year-olds, $\chi^2(1, N = 42) = 28.1, p < .01$. Again, it seems that the representation of the determiner category is more limited at the age of 2 years than at 3 or 4 years.

Discussion

This study attempted to elicit uses of a novel noun in combination with a determiner, in children age 2, 3, and 4 years. Unfortunately it proved difficult for the younger participants to learn and recall the novel nouns well enough to reproduce them when asked, especially with a determiner. This raises the concern that the cognitive demands of the task may have depressed the children's ability to make use of what syntactic knowledge they had (a possibility discussed later in the section). In the novel-word task, only about half the 2-year-olds used a determiner with a noun in response to any of the elicitation questions, and most did so for only one or two of the four questions. Nevertheless, at least some 2-year-olds, and many 3- and 4-year-olds, answered at least one elicitation question with a determiner–noun combination, and children of 3 and 4 years were significantly more likely to produce creative combinations than children of 2 years. When we added these elicited combinations to the participants' spontaneous combinations, we found that a quarter of the 2-year-olds, and virtually all 3- and 4-year-olds, produced creative combinations. It seems that these children had a sufficiently abstract representation of "determiners" to know that one could be substituted for another when used with a novel noun.

Although the 3- and 4-year-olds were equally creative in their determiner–noun utterances, a more detailed inspection of their responses revealed differences in the determiners that they were able to produce.

The 4-year-olds were equally creative with $a + X$ and $the + X$, but the 2- and 3-year-olds were more likely to use $a + X$ even if they had not heard it modeled. In fact, none of the 2-year-olds and only 2 of the 3-year-olds used $the + X$ creatively at all. It may be that children begin to build a category of "determiner" on the basis of individual lexical items from very early on but that it takes at least several years before this representation becomes fully abstract. The present results suggest that the indefinite article a may play a privileged role in children's early understanding of determiner use. Children may have a (limited) ability to use this determiner in a variety of contexts before seeing a common pattern and building a stronger and more general representation of the "determiner" category as they learn that other determiners can be used in these places. We return to this idea in the General Discussion.

Some caution should be exercised in interpreting these results. The cognitive demands of memorizing, recalling, and producing the novel nouns may have caused the younger children, especially, to revert to omitting determiners or to failing to use the whole range of determiners with which they were familiar. Boyle and Gerken (1997) found that even when imitating adult models, 2-year-olds were more likely to omit articles from sentences that contained novel nouns and verbs than from sentences that did not. Although in each age group, children who produced determiner–noun combinations did so in similar numbers across real and novel nouns, it seems that the youngest participants found the novel words more of a challenge. When answering elicitation questions, the 2-year-olds used determiners 54% of the time with real nouns but only 30% of the time with novel nouns. In contrast, the 3- and 4-year-olds used determiners at very similar rates for real nouns (81% and 89%, respectively) and novel nouns (83% and 82%, respectively). It seems unlikely that performance constraints can explain the 2-year-olds' strong preference for a with the novel nouns, because they used a nearly exclusively for real words as well. However, the 3-year-olds, who used a creatively with novel nouns only rarely, used the with real nouns more often, and this difference may be attributable to task demands.

This study also provides some data on the pragmatics of determiner use. At least in this task, none of the age groups were yet consistently able to use determiners in a pragmatically correct manner in conjunction with the novel nouns. They were no more likely to use the when asking for a single toy than for one toy of several and no more likely to use a when asking for one toy of several than for a single toy. (However, they did use two and $another$ appropriately in their spontaneous utterances.) This finding is not unexpected: Children frequently make pragmatic errors with determiners (e.g., Karmiloff-Smith, 1979; Thomas, 1989).

Maratsos (1974) showed that children of 3 and 4 years had difficulty using *a* and *the* in a pragmatically appropriate manner, to answer questions about a story they had just heard. After hearing a story about "some *X*s," children were expected to talk about "a *X,* " but after hearing about "a *X,*" they were expected later to refer to "the *X.* " High-performing 4-year-olds (those better able to copy adult-sentence models) usually used *a* and *the* appropriately. However, the 3-year-olds and low-performing 4-year-old participants (those poorer at copying adult sentences) were accurate only about 75% of the time. These children were using real words that they had heard. The added difficulty of remembering and using the unfamiliar words in the present study may have reduced our participants' ability to obey pragmatic constraints. However, in our real-word task, even the 4-year-old children were influenced by the determiner modeled. When *the* was modeled, all responses used *the,* but when *a* was modeled, both *a* and *the* were used. The demands of this simple task were presumably not high for 4-year-olds, and so it does seem possible that children may not fully master the pragmatics of the use of definite and indefinite articles until relatively late.

Examining children's productive use of novel nouns has the obvious advantage of immediately identifying any novel determiner–noun combination as creative, but the potential difficulty of unfamiliar words brings disadvantages as well. Nevertheless, the use of novel nouns provided a stringent test of children's understanding of the "determiner" category and was able to reveal differences between children of different age groups. In the next experiment, we used syntactic priming with real, familiar words, to further examine children's knowledge of the "determiner" category and of the "adjective" category as well.

Experiment 2

This experiment used syntactic priming to look for evidence of item-specific and/or structural priming of determiners and adjectives in young children. Savage et al. (2003) showed that *lexical* priming (in which primes shared many of the same lexical items) occurred in children of 3 and 4 years. However, *structural* priming (in which primes shared the same syntactic structure but virtually no lexical items) did not occur until the age of 6. Although our first experiment's results suggest that children have a relatively abstract representation of "determiners" by the age of 4 years (although pragmatic correctness does not yet seem to have been achieved), it seems possible that children might not have a full grasp of the "adjective" category until later. The present experiment therefore included children of 2, 3, 4, and 6 years of age.

Participants were shown series of pictures and were asked to name target pictures within these series. The grammatical structure of the children's spontaneous descriptions was noted first, and then the experimenter described subsequent pictures with either a determiner–noun, or a determiner–adjective–noun combination. For half the children, the determiners (and adjectives) were varied within each series, and for the other half they remained unvaried. To ensure that the children were attending to the primes, they were asked to repeat each one. At the end of each series of pictures, the participants were asked to name a target picture. If children produce increased numbers of determiners/adjectives after unvaried primes, this would constitute priming at a lexical, or item-based, level. If they produce increased numbers of determiners/adjectives after varied primes, this would constitute priming at a structural level. Structural priming presumably requires the child to recognize that the priming words belong to a common category and to come up with another word from that category. This would constitute evidence for an understanding of the syntactic category at an abstract level. Of course, performance constraints could also limit responses, but this task was designed to pose as few difficulties as possible even to young children.

Method
Participants

Participants were 192 children (104 girls and 88 boys) from northwest England. There were forty-eight 2-year-olds (mean age = 2;7, range = 2;3-2;11), forty-eight 3-year-olds (mean = 3;7, range = 3;0-3;11), forty-eight 4-year-olds (mean = 4;5, range = 4;0-4;10), and forty-eight 6-year-olds (mean age = 6;7, range = 6;0-7;0). All but 6 were monolingual speakers of English.

Materials and Design

We used 60 colored pictures (downloaded from ClipArt) of common objects. These depicted mainly animals, items of food, furniture, vehicles, and distinctive people (e.g., a clown). Each picture was printed on a separate sheet of paper and secured in a binder. There was a warm-up and a test binder, each containing a different set of 30 pictures. The pictures were chosen so that each one could be named (as unambiguously as possible) with a single noun of 1, 2, or occasionally 3 syllables. The nouns were the commonest easily depictable nouns used by the 12 children between the ages of 2;0 and 3;0 in the Manchester corpus (Theakston, Lieven, Pine, & Rowland, 2001). Each picture could also be described with an adjective of 1 or 2 syllables, also

chosen to be among the adjectives most commonly used by the same group of children.

The pictures were presented in blocks of five. Every four *prime* pictures preceded a *target* picture, which the child was asked to name. These target pictures depicted especially high frequency nouns (as used by the Manchester corpus children) such as *cat, baby,* and *car*. Each was distinctive in several ways, so that it would be easy for a child to use an adjective to describe it if he or she wished. For example, the cat was pink and angry-looking, the baby was clearly crying and unhappy, and the car was a shiny red sports car. (See Appendix for details of the *prime* and *target* pictures.)

The 30 pictures (including 6 *target* pictures) in the warm-up binder were presented to gain a baseline indication of the children's spontaneous picture naming. The 30 pictures (including 6 target pictures) in the test binder were presented in one of four between-subjects conditions, in which the experimenter named each of the four preceding *prime* pictures before asking the child to name the *target* picture. In both the warm-up and the test binders, the target was covered by a flap of cardboard, which was lifted for the child to name the picture underneath. One set of 24 *prime* pictures was always used in the warm-up, and the other set of 24 (different) pictures was always used in the test. However, the 12 target pictures were presented approximately equally often in the warm-up and in the test. This was because we wanted to be sure that any change in the descriptions given for the target pictures was due solely to the preceding primes (if any) rather than to any differences in the pictures themselves, which might have encouraged more or less use of determiners or adjectives.

The four conditions in which the test words were presented were as follows:

Condition 1 (unvaried determiner + noun). The experimenter named the *prime* pictures in each block with an unvarying determiner before each noun. Each block used one of six determiners: *a, the, this, that, our,* or *another*. Example block: "A bird, a monkey, a flower, a biscuit," followed by a *target* picture of a (pink, angry) cat.

Condition 2 (unvaried determiner + unvaried adjective + noun). The experimenter named the *prime* pictures in each block with an unvarying determiner–adjective pair preceding the noun. The primes were the same as in Condition 1, but with one of six high-frequency adjectives inserted between determiner and noun for each block. Example block: "A little bird, a little monkey, a little flower, a little biscuit," + *target* picture.

Condition 3 (varied determiner + noun). The experimenter named each *prime* picture with a varying determiner before the noun. The six determiners (the same as those listed in Condition 1) were varied sys-

tematically so that the combination of determiners in each block of four primes was always different. Example block: "A bird, the monkey, this flower, that biscuit," + *target* picture.

Condition 4 (varied determiner + varied adjective + noun). The experimenter named each *prime* picture with a varying determiner and adjective before the noun. The primes were the same as in Condition 3, but with a different high-frequency adjective inserted between each determiner and noun. Example block: "A little bird, the naughty monkey, this lovely flower, that crunchy biscuit," + *target* picture.

The number of syllables for each priming sentence was controlled as much as possible. They could not be identical for each item, as some conditions required primes of two words and others of three, and the determiner *another* was longer than the other five monosyllabic determiners. All of the adjectives used were of 1 or 2 syllables, and the nouns were of 2 or 3 syllables. We ensured that the number of syllables for each prime in Condition 1 was 3–5, in Condition 2 was 4–6, in Condition 3 was 3–4, and in Condition 4 was 4–5. The order of the priming pictures within each block was systematically varied, as was the order in which each block was presented, so as to produce eight different presentation orders. The orders were presented approximately equally often to children in each of the four conditions. The order of the target pictures was also varied systematically. Each target was presented approximately equally often in the warm-up phase as in the test phase and after each of the 12 blocks of primes.

Procedure

Each child was seen individually in a single session of 10 to 15 min, in a lab playroom or in a quiet room in his or her nursery school. The experimenter (E) explained that she was going to show the child some pictures. In the warm-up phase, she showed the nontarget pictures one at a time, occasionally saying "Look!" or "Oh, look at that" and discouraging the child from naming those pictures. When she came to a covered-up (target) picture, E said "Your turn" and allowed the child to lift the flap and name the picture. If the child did not name it spontaneously, E asked "What's that?" and, if necessary, "What's that a picture of?" However, these questions were avoided as much as possible, to avoid presenting the test as a simple labeling game.

To introduce the test phase, E presented the second binder and explained that this time she was going to name the pictures and see if the child could copy her but that the child would still get to name the covered-up pictures, as before. E turned the page to each prime

Table 7. Mean number of determiner + noun and determiner + adjective + noun responses to each prime type.

	Response							
	D + N				D + A + N			
	Warm-up		Test		Warm-up		Test	
Age group	M	SD	M	SD	M	SD	M	SD
uD + N								
2	**3.25**	**2.05**	**2.92**	**2.07**	0.08	0.29	0.17	0.39
3	**3.33**	**1.92**	**4.25**	**1.36**	0.08	0.29	0.25	0.62
4	**4.17**	**1.70**	**4.08**	**1.51**	0.33	0.65	0.25	0.45
6	**2.83**	**1.90**	**4.17**	**1.80**	0.42	0.67	0.58	1.16
uD + uA + N								
2	2.08	1.93	1.50	2.02	**0.17**	**0.58**	**0.25**	**0.45**
3	2.50	2.54	1.58	1.83	**0.17**	**0.58**	**2.17**	**2.21**
4	2.67	2.02	2.50	1.78	**0.42**	**0.67**	**2.00**	**2.13**
6	3.08	1.62	2.50	2.02	**0.33**	**0.49**	**1.67**	**1.83**
vD + N								
2	**3.08**	**2.11**	**3.50**	**1.68**	0.17	0.39	0.33	0.49
3	**3.33**	**2.50**	**4.33**	**1.78**	0.08	0.29	0.08	0.29
4	**3.42**	**2.35**	**4.50**	**2.20**	0.17	0.58	0.00	0.00
6	**3.00**	**2.13**	**4.33**	**1.30**	0.83	1.03	0.58	0.90
vD + vA + N								
2	3.25	2.45	2.50	2.24	**0.00**	**0.00**	**0.42**	**0.67**
3	4.75	1.71	4.17	1.34	**0.25**	**0.45**	**1.00**	**0.95**
4	3.33	2.10	2.92	2.23	**0.08**	**0.29**	**0.92**	**1.16**
6	3.17	1.99	3.33	0.98	**0.17**	**0.39**	**1.92**	**1.16**

Note. D = Determiner; N = Noun; A = Adjective; u = unvaried; v = varied. Age is in years. Numbers are in boldface when response structure matches prime structure.

picture and named it according to the condition, by pointing to the picture and saying, for example, "A little bird!" If necessary, E asked, "Can *you* say that?" If the child did not respond, or responded with only part of the priming sentence, E repeated the prime and asked the child to copy her again. When a target picture appeared, E lifted the flap, or allowed the child to do so, and looked expectant until the child named the picture. If the child did not respond, E said "Your turn!" and, if necessary, "What's that?" or "What's that a picture of?" E manually recorded the children's response to the target pictures and their repetitions of the primes. The sessions were also tape-recorded and checked later.

Results

The participants described the *target* pictures in a variety of ways. In the warm-up phase, the commonest response was of determiner (usually *a*) + noun, closely followed by the use of a noun alone. There were occasional responses constructed of determiner + adjective +

noun, and rarely of adjective + noun, or no response at all. In the test phase, the pattern of responses changed, at least for the 3-, 4-, and 6-year-olds, apparently as a result of the priming sentences. For these older age groups, the number of determiner + noun responses increased with determiner + noun primes but decreased with determiner + adjective + noun primes. Conversely, the number of determiner + adjective + noun responses seemed to increase with determiner + adjective + noun primes but to decrease with determiner + noun primes. The number of *noun alone* responses decreased in the test phase, and the small number of other responses remained about the same.

The mean number of productions of each of the responses of experimental interest (determiner + noun and determiner + adjective + noun) for each age group in each condition is shown in Table 7. Changes in the children's uses of each main response type (determiner + noun and determiner + adjective + noun) from warm-up to test, for each condition, were examined in a series of repeated measures analyses of variance (ANOVAs). Each had one within-subjects factor, phase (warm-up or test) and one between-subjects factor, age group (2, 3,

4, or 6 years). We wanted to be sure that any increase in the children's production of determiner + noun or determiner + adjective + noun responses was the result of the nature of the primes rather than the children simply becoming more verbal as they warmed to the task. For this reason, we looked at the increase in the number of both response types, from warm-up to test, after each of the four conditions.

Determiner + Noun Responses

We first examined the children's use of determiner + noun responses after each of the four types of primes. ANOVAs revealed that when determiner + noun primes were unvaried (Condition 1), there was a trend toward an effect of phase, $F(1, 44) = 3.49$, $p = .07$, with the number of determiner + noun responses increasing from warm-up to test. There was no significant effect of age group, and there was a nonsignificant trend toward an interaction between age group and phase, $F(1, 44) = 2.62$, $p = .06$. It seems that the participants experienced only a trend toward item-specific priming for determiners. When determiner + noun primes were varied (Condition 3), there was a main effect of phase: Children's use of determiner + noun responses increased significantly from warm-up to test, $F(1, 44) = 16.9$, $p < .01$. There was no significant effect of age group and no significant interaction. This suggests that all four age groups experienced structural priming for determiners.

After determiner + adjective + noun primes, whether unvaried (Condition 2) or varied (Condition 4), there were no significant effects of phase or age group and no significant interactions between the two. Determiner + adjective + noun primes clearly did not increase determiner + noun responses.

Determiner + Adjective + Noun Responses

We then examined the children's determiner + adjective + noun responses after each of the four prime types. After determiner + noun primes, whether unvaried (Condition 1) or varied (Condition 3), there were no significant effects of phase nor of age group and no significant interaction. Clearly, the use of determiner + adjective + noun responses did not increase after determiner + noun primes.

In contrast, children's determiner + adjective + noun responses did increase after determiner + adjective + noun primes. When these primes were unvaried (Condition 2), there was a significant effect of phase, with an increase in the number of determiner + adjective + noun responses from warm-up to test, $F(1, 44) = 25.7$, $p < .01$. There was no significant effect of age group, but there was a near-significant interaction between

age group and phase, $F(1, 44) = 2.80$, $p = .05$. Post hoc Newman–Keuls tests were conducted on this interaction. These revealed a significant increase in the number of determiner + adjective + noun responses from warm-up to test in the 3- and 4-year-olds ($p < .01$) and also the 6-year-olds ($p < .05$), while the 2-year-olds showed no differences. This suggests that the 3-, 4-, and 6-year-olds experienced item-specific priming, but the 2-year-olds did not (see below for evidence that priming was indeed item specific). Post hoc tests also showed no differences between the age groups in the number of determiner + adjective + noun responses at warm-up, but at test, the 2-year-olds produced significantly fewer such responses than any other age group ($p < .05$).

When the determiner + adjective + noun primes were varied (Condition 4), there was again a significant effect of phase, with an increase in the number of determiner + adjective + noun responses from warm-up to test, $F(1, 44) = 41.2$, $p < .01$. There was also a main effect for age group, $F(1, 44) = 4.67$, $p < .01$. Post hoc tests showed that this was due to the 6-year-olds providing significantly more determiner + adjective + noun responses than any other age group ($p < .05$). There was also a significant interaction between phase and age group, $F(1, 44) = 3.82$, $p < .05$. Newman–Keuls post hoc tests demonstrated that the increase in determiner + adjective + noun responses from warm-up to test was carried by the 6-year-olds ($p < .01$) and (just) by the 4-year-olds ($p = .05$). It seems that only the 6-year-olds, and to some extent the 4-year-olds, experienced structural priming. Post hoc tests also showed that there were no differences between age groups in the number of determiner + adjective + noun responses produced at warm-up, but at test, the 6-year-olds produced significantly more than any other age group ($p < .01$).

Determiners and Adjectives: Same as or Different From Primes?

Finally, we examined the specific determiners and adjectives in the children's responses and whether these were the same as, or different from, the words used in the primes. We first considered the children's determiner + noun responses (collapsed across age groups, as there were no significant effects for age). In the warm-up phase, *a* was virtually the only determiner used ($M = 3.13$ out of 6, compared with means of 0.02 or less for *the*, *that*, and *another*). In the test phase, after determiner + adjective + noun primes (Conditions 2 and 4), *a* was also virtually the only determiner used in these determiner + noun responses. Means for the other determiners ranged from 0 to 0.08 out of 6. After determiner + noun primes (Conditions 1 and 3), other determiners appeared as well, usually repeating the determiner used in the last prime. However, *a* was still by far the most frequent

determiner, regardless of prime. This is a very similar result to that shown in Experiment 1, in which the 2- and 3-year-olds generally used *a*, regardless of the determiner modeled.

We then considered the children's choice of words in their determiner + adjective + noun responses. In the warm-up phase, there were hardly any responses with this structure. In the test phase, after determiner + noun primes (Conditions 1 and 3), there were still very few. After determiner + adjective + noun primes (Conditions 2 and 4), determiner + adjective + noun responses were much more common. After unvaried primes (Condition 2), responses that repeated both the same determiner and adjective as in the prime ($M = 0.96$ out of 6) were more frequent than those that used only the same determiner ($M = 0.13$) or adjective ($M = 0.10$) or neither of the same lexical items ($M = 0.35$). After varied primes (Condition 4), responses that included a determiner and adjective that were both different from those in the final prime ($M = 0.63$) were more frequent than those that used the same determiner ($M = 0.33$) or adjective ($M = 0.06$) or both of the same lexical items ($M = 0.04$). (Perusal of the means for each determiner type revealed that by far the commonest different determiner used was *a*.)

Two ANOVAs were conducted to look at whether children produced the same or a different adjective from that in the final prime. Each analysis had one between-subjects factor, condition (1, 2, 3, or 4). In terms of same adjective responses, there was a main effect for condition, $F(3, 191) = 16.33$, $p < .001$. Post hoc tests showed that children repeated the adjective in the final prime significantly more often after unvaried determiner + adjective + noun primes (Condition 2) than after any other primes ($p < .01$), which did not differ significantly. It seems that the unvaried primes did induce item-specific priming, as children so often used the same lexical item. In terms of different adjective responses, there was again a main effect for condition, $F(3, 191) = 6.92$, $p < .001$. Post hoc tests showed that children used a different adjective from that in the final prime significantly more often after varied determiner + adjective + noun primes (Condition 4) than after any other primes ($p < .05$), which did not differ significantly. This suggests that the varied primes indeed encouraged structural priming, in that children used different lexical items from the same abstract category in their responses.

Discussion

The 2- to 6-year-olds participants in this experiment showed clear evidence of priming. The children's descriptions of target pictures were often significantly influenced by the types of words used in the series of descriptions that they had just heard. We first discuss the results for the conditions that examined children's understanding of determiners alone. Regardless of age group, children who heard a series of pictures described with a determiner + noun showed an increased tendency to name target pictures with a determiner + noun and a decreased tendency to name pictures with a determiner + adjective + noun. This finding reached significance only when the priming determiners were varied but not when they were unvaried. Thus, even children as young as 2 years were primed by different exemplars from an abstract category (structural priming), but not significantly by specific lexical items (item-specific priming).

This structural priming seems to suggest a more abstract representation of the category of determiner than that shown by many of the younger participants in Experiment 1. However, in Experiment 2's less challenging task, we may have given the children a better opportunity to show the beginnings of their understanding: It seems that even 2-year-olds had a sufficiently well developed representation of determiners to notice the commonality in the varied input and to respond with a determiner themselves. Experiment 1's more difficult requirement of coming up with creative determiner–novel noun combinations may have necessitated a more abstract representation of determiners, and only a subgroup of 2-year-olds attained success on this task.

Note that the children did not use a range of determiners in this study but stayed nearly exclusively with *a*, across all age groups, in both the warm-up and the test phases. One could hypothesize that the children were just beginning to build a productive knowledge of the determiner category and that *a* was the only determiner that they were yet able to use with ease. However, this seems implausible, given that the use of *a* was prevalent even among the 6-year-olds, and Experiment 1 showed creative use of determiners even among younger children. It seems more likely that the picture-labeling nature of the task encouraged the use of *a* above all other determiners.

It was unexpected that this structural priming seemed to have occurred in the absence of significant item-specific priming, especially as Savage et al. (2003) consistently found lexical before structural priming. We had thought that the younger children, at least, would find it easier to copy the determiner that they had heard repeatedly modeled (after unvaried primes) than to come up with their own determiner (after varied primes). There was, however, a trend toward greater use of determiner + noun responses after unvaried determiner + noun primes ($p = .07$) and a trend toward an interaction with age group ($p = .06$). In the unvaried

determiner + noun condition, children heard *a* in only one of the six unvaried blocks of primes. The other unvaried blocks consisted of less frequent determiners (e.g., *our or another*). The pragmatics of these primes may have inhibited participants' tendency to use determiners. After a block of pictures labeled *our*, for example, children may have had some idea that this was the correct determiner to use but may have been reluctant to do so, because it is not very pragmatically appropriate. Primed against using their favorite determiner, *a*, participants may have ended up simply using no determiner at all and therefore not have shown item-specific priming. A look at the means provides support for this conjecture: Mean determiner use after unvaried determiner + noun primes was about three times larger after blocks of *a* primes than after blocks of any other type of determiner.

We now discuss the results for the conditions that examined children's understanding of adjectives, combined with determiners. The effects of the determiner + adjective + noun primes varied with age group. The 2-year-olds showed no priming at all: They did not alter their picture-naming tendencies, regardless of whether the primes were varied or unvaried. The 3-year-olds showed item-specific priming only: They increased their use of determiner + adjective + noun descriptions when the primes were unvaried but not when they were varied. Only the 6-year-olds and, to a lesser extent, the 4-year-olds, showed both item-specific and structural priming, as only they were influenced by both the varied and unvaried primes. These findings seem to suggest that 2-year-olds have not yet developed an abstract representation of adjectives and cannot yet put together determiners and adjectives in new combinations. Children of 3 years seem to be in the process of building an understanding of adjectives and of how they can combine these with determiners, perhaps on the basis of specific lexical items. Only the 6-year-olds, and to some extent the 4-year-olds, appeared to have developed a sufficiently abstract representation of adjectives to combine them with words from the abstract category of determiner.

These conclusions must be viewed with some caution. The finding that younger children showed no priming, or item-specific priming only, does not definitively rule out the possibility that they had any representation of "adjectives" as an abstract category. Two- and 3-year-olds may have recognized the commonality between the priming words but been unable to produce a three-word response (although they had few problems repeating the three-word primes) or unable to think of a different adjective from the one that they had just repeated.

Nevertheless, these results largely mirror those of Savage et al. (2003), despite the difference in the parts of language under study (early knowledge of syntactic categories rather than of certain grammatical constructions). They seem to represent another example of linguistic knowledge to which children may show only limited sensitivity at age 2 that they build up, perhaps on a word-by-word basis, and develop into more abstract representations by 4 to 6 years and perhaps beyond.

General Discussion

These experiments used two different methodologies to examine young children's knowledge of two grammatical categories, "determiners" and "adjectives," that often form part of noun phrases but have received less experimental attention than some other parts of speech. In Experiment 1, children's tendency to combine novel nouns with various determiners differed with age. Of the 50% of 2-year-olds who did use determiners, about half just copied the particular combination that they had heard modeled by the experimenter, but the remainder were able to produce creative determiner–noun combinations. Nearly all the 3-year-olds were able to produce new combinations. However, even when they were creative, virtually all of the 2-year-olds and most of the 3-year-olds used the indefinite article, *a*. Only the 4-year-olds appeared able to use a range of different determiners in a consistently productive way. The task proved quite a challenge to the younger participants, and the difficulty of recalling the novel words may have reduced their capacity to use determiners. Nevertheless, the results seem to suggest that some 2-year-olds, and virtually all 3- and 4-year-olds, have a sufficiently abstract representation of the "determiner" category to be able to combine novel nouns creatively with determiners.

At least when faced with a challenging task, even 4-year-olds did not consistently use determiners in a pragmatically appropriate way. This particular aspect of determiner use appears to be the most difficult to grasp and the last to develop. Children often incorrectly use definite rather than indefinite articles with first-mention nouns, in English and in other languages as well (e.g., Karmiloff-Smith, 1979; Power & Dal Martello, 1986; Warden, 1976), and Maratsos (1974) found that 3-year-olds tended to overuse *a,* but 4-year-olds with poorer language skills tended to overuse *the* in answering a questions about a story.

If the children in this experiment had a fully abstract representation of the "determiner" category, we would have expected all age groups to have combined the novel nouns with a range of determiners. If they had also had a complete grasp of the pragmatics involved, their combinations would have differed according to the elicitation questions asked rather than the models

provided. The present results suggest that although children age 2 to 4 years have begun to build an abstract representation of "determiners," they still have more to learn about using determiners creatively and pragmatically appropriately with novel nouns. However, the difficulty of this task, and the consequently tentative nature of our conclusions, led us to design a second, easier task, using real words.

Experiment 2 used a priming paradigm, a method which has only recently been adapted for use with young children rather than adults (Savage et al., 2003). The success of this method in the present study provides further evidence that it is a valuable new way of examining early grammatical understanding. Children between the ages of 2 and 6 years were more likely to describe a picture with a determiner + noun if they had recently heard pictures described with a series of varied determiner + noun primes. Unvaried determiners did not produce significant priming, perhaps because the blocks of repeated determiners made the children confused about which determiner to use. Further, the exact type of prime seems important: Priming of determiner + noun responses did not occur after the presentation of determiner + adjective + noun descriptions. For all age groups, the most commonly used determiner was *a*. The pattern of results was similar for children as young as 2 years of age or as old as 6 years of age. Given that some of the 2-year-olds in Experiment 1 also showed some abstract knowledge, we can perhaps suggest that the process of abstraction starts rather early for the determiner category.

Children's apparently greater ability to manipulate determiners in Experiment 2 than Experiment 1 probably arose from differences in the nature of the two tasks. The nouns used in the priming task were all familiar, high-frequency words, illustrated with pictures. Producing the target nouns in Experiment 1 was a more difficult task: The nouns were novel and had to be learned from a limited number of models and recalled at a later point. Requiring children to produce novel words has indeed been shown to affect their omission of function words. Children are less likely to produce sentence subjects in their spontaneous speech when a verb is newly learned (Bloom, Miller, & Hood, 1975). Even when they can copy an adult model, 2-year-olds are more likely to omit articles from sentences containing novel, rather than familiar, nouns and verbs (Boyle & Gerken, 1997). It may be that children needed a less abstract representation of determiners to succeed in Experiment 2 than in Experiment 1. It seems that only a subgroup of the 2-year-olds in Experiment 1 had a sufficiently strong representation of the "determiner" category to be able to combine determiners with novel nouns creatively, given the cognitive load imposed by having to remember and recall the novel nouns.

In both experiments, *a* was by far the most heavily used determiner. It is not clear whether this preference for *a* is reflected in children's spontaneous speech: Both Valian (1986) and Pine and Lieven (1997) calculated that their young participants used *the* slightly more than *a,* but the 2- to 3-year-olds in the Manchester corpus (Theakston et al., 2001) used *a* more than *the* (although 11 of the 12 mothers used *the* more than *a*). In experimental contexts, children do seem to prefer *a*. Two-year-olds who were taught a novel noun modeled with *the* later reproduced it with *a* and *my* but never with *the* (Tomasello et al., 1997). It may be that children build a representation of the "determiner" category by first using *a* productively and then learning to use other determiners (especially *the*) in similarly productive ways (see below for a more detailed discussion).

The findings with adjectives were clearer. There was no evidence of any priming in the 2-year-olds, but there was evidence of item-specific priming (by unvaried primes) in the 3-6-year-olds and of both item-specific and structural priming (by varied primes) in the 6-year-olds and, to a limited extent, the 4-year-olds. As discussed earlier, younger children's smaller vocabularies and less efficient word retrieval may have constrained their ability to come up with adjectives of their own after varied primes. Further, we cannot rule out the possibility that children who were primed by specific lexical items did not also experience structural priming. However, the clear differences in the extent of priming after varied versus unvaried primes suggest that younger children experienced less structural priming than older children. Bearing these cautions in mind, we can draw some tentative conclusions from our results.

At age 2, children do not seem to have a sufficiently strong representation of "adjectives" to recognize them as belonging to a category or to come up with a word from that category. At age 3 to 6, children produced adjectives in response to a series of repeated adjectives, which might suggest that their representation of "adjectives" was still based on individual lexical items. Only by the age of 6 years (but beginning at 4 years) did our participants appear to have developed a sufficiently abstract idea of "adjectives" to respond to a series of varied adjectives with a new adjective of their own. This age-related pattern of results closely matches that found by Savage et al. (2003). If all age groups had indeed had a fully abstract understanding of "adjectives," we would have expected that the 2-, 3-, and 4-year-olds would all have behaved similarly to the 6-year-olds in showing structural priming of adjectives.

These results may suggest that rather than being attributable to children as young as 2 years (e.g., Valian, 1986), the representation of "adjectives" as an abstract category might take several years to construct. Although

children are sensitive to many properties of adjectives from before the age of 2 (e.g., Waxman & Markow, 1997), they might need extensive experience with spoken language before their mental representations become sufficiently abstract for the words to be used fully productively (Dabrowską & Lieven, in press). For example, the tendency to distinguish between count nouns and adjectives only when objects come from the same category seems to persist in children age 2 and even 3 years (Mintz & Gleitman, 2002; Waxman & Markow, 1997) but seems to be largely overcome by age 4 (Klibanoff & Waxman, 2000). Further, the predicative use of adjectives seems to develop much earlier than the attributive use (e.g., Braine, 1976; Nelson, 1976). As the present results suggest, it seems that merely having some awareness of a word's properties or uses does not necessarily confer a sufficiently abstract understanding of its syntactic category to allow structural priming in the task described.

Overall, the findings from our two studies provide some evidence against the idea that children possess a fully abstract representation of the grammatical categories of "determiner" and "adjective" at the age of 2 years (e.g., Ihns & Leonard, 1988; Valian, 1986). They instead fit in more easily with the conclusions made by Pine and Lieven (1997) and Pine and Martindale (1996) in their work on the "determiner" category. Here, too, we can suggest that children start off with very limited, lexically specific knowledge of the relationship between category members and other parts of speech. As they learn more about language, children may gradually analyze out "slots" into which category members can fit and eventually generalize across lexically specific frames, to achieve a fully abstract representation of a particular category. This process takes place at varying rates for different categories and constructions and also for different children. From our present results, it seems that a representation of the abstract category of "determiner" may be built up earlier than for that of "adjective." It may be that some *critical mass* of exemplars needs to be acquired before the child is able to notice analogies and to begin to develop the appropriate syntactic category (Tomasello, 2000). These conclusions also fit in well with the classic accounts of Bowerman (1982), who provided evidence that syntactic categories are not necessarily required to explain early speech, and of Braine (1976), who argued for the importance of limited-scope formulas in children's early language acquisition.

In using two contrasting methodologies in the current studies, we aimed to overcome some of the difficulties associated with each. Future research should continue to use evidence from naturalistic speech and experimentally elicited responses, with real words and novel words, to build a better picture of children's acquisition and understanding of abstract syntactic categories.

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Appendix. Blocks of primes presented in test phase.

Condition 1 (unvaried determiner + noun). A birdie, a monkey, a flower, a biscuit. Our bucket, our doggy, our jumper, our bicycle. This lady, this panda, this orange, this horsie. That apple, that ice cream, that umbrella, that lorry. The dolly, the pencil, the teddy, the balloon. Another chair, another tractor, another table, another window.

Condition 2 (unvaried determiner + unvaried adjective + noun). A little bird, a little monkey, a little flower, a little biscuit. Our new bucket, our new doggy, our new jumper, our new bicycle. That big apple, that big ice cream, that big umbrella, that big lorry. The pretty doll, the pretty pencil, the pretty teddy, the pretty balloon. Another old chair, another old tractor, another old table, another old window.

Condition 3 (varied determiner + noun). A birdie, the monkey, this flower, that biscuit. Our bucket, another dog, a jumper, the bicycle. This lady, that panda, our orange, another horse. That apple, this ice cream, the umbrella, a lorry. The dolly, a pencil, another bear, our balloon. Another chair, our tractor, that table, this window.

Condition 4 (varied determiner + varied adjective + noun). A little bird, the naughty monkey, this lovely flower, that crunchy biscuit. Our new bucket, another good dog, a warm jumper, the red bicycle. This nice lady, that hungry panda, our juicy orange, another brown horse. That big apple, this cold ice cream, the wet umbrella, a long lorry. The pretty doll, a broken pencil, another soft bear, our blue balloon. Another old chair, our green tractor, that round table, this clean window.

Target pictures. (Pink, angry, spiky, funny) cat, (crying, sad, unhappy) baby, (chocolate, Easter, brown) rabbit, (big, birthday) present, (dirty, muddy, messy) pig, (funny, silly, pretty, colorful) hat, (big, blue) elephant, (fat, big, greedy) boy, (red, shiny, new, fast) car, (big, pink, birthday) cake, (buzzy, happy, little) bee, (toy, little, colorful) train.