CAMBRIDGE
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Do children treat adjectives and nouns differently as modifiers in prenominal position?

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Abstract

Usage-based theories of children's syntactic acquisition (e.g., Tomasello, 2000a) predict that children's abstract lexical categories emerge from their experience with particular words in constructions in their input. Because modifiers in English are almost always prenominal, children might initially treat adjectives similarly to nouns when used in a prenominal position. In this study, we taught English-speaking preschoolers (between 2 and 6 years) novel nouns (object labels) and adjectives (words referring to attributes) in both prenominal and postnominal positions. The children corrected both postnominal adjectives and nouns to prenominal position, but corrected modifying nouns more often than adjectives. These results suggest that children differentiate between nouns and adjectives even when they occur in the same position and serve the same function (i.e., modification). Children were increasingly likely to correct postnominal adjectives (not nouns) with increasing age. We argue that children attend to word order more when it makes a difference in meaning.

Nouns can be modified by both nouns (e.g., *fire truck*) and adjectives (e.g., *big truck*). Across languages, nouns are used as modifiers within noun-noun compounds in the same position as modifying adjectives (Beard, 1995). For example, in English, modifying nouns and adjectives generally appear prenominally while in French the default position is postnominal (e.g., *camion-citerne* 'truck-tanker', meaning *tanker truck* and *camion noir* 'truck black' meaning *black truck*). In spite of the similarity in function and positioning, linguists usually treat modifying nouns as a morphological phenomenon and therefore distinct from syntactic phenomena, like adjective-noun ordering (see Selkirk, 1982). According to usage-based theories (Tomasello, 2000a), there is no reason to think that children would distinguish morphology from syntax initially; the distinction would come as a result of learning patterns in the input, rather than children's early linguistic knowledge. The purpose of the present study was to test whether English-speaking children distinguish between noun modifiers and adjective modifiers in terms of word order.

In spontaneous speech, children have been observed to use the canonical order for their language for both nouns as modifiers (Nicoladis, 1999) and adjectives (Brown, 1973; Granfeldt, 2000). These results correspond to more general findings that, from the time children spontaneously begin uttering two-word combinations, their word order often corresponds to a grammatical order (e.g., Bloom, 1970; Brown, 1973). One possible explanation of children's early accuracy is that they have early access to linguistic categories, such as semantic categories (like agent) or lexical categories (like noun; e.g., Bloom, 1970; Braine & Brooks, 1995; Wexler & Culicover, 1980). In favor of this argument, from at least the age of two years, children can infer the meaning of novel words based on syntactic cues alone (Gertner et al., 2006; Hall et al., 2001; Jingtao et al., 2022).

However, observations of children's spontaneous speech may overestimate their knowledge. Researchers have noted that children's spontaneous speech could be ordered correctly because children produce familiar words within familiar constructions (Lieven et al., 2009; Matthews et al., 2005). Indeed, in elicitation tasks with existing words, children reliably produce some ordering errors with both nouns as modifiers (Clark et al., 1985; Nicoladis, 2002a) and adjectives as modifiers (Nicoladis, 2002b). These errors could indicate that children are still learning their lexical categories (Tomasello, 2000a).

According to usage-based theories of acquisition (e.g., Abbot-Smith & Tomasello, 2006; Behrens, 2009; Bybee & Hopper, 2001; Tomasello, 2000a, 2003), children gradually construct linguistic categories on the basis of their experience with specific exemplars. That is, children initially order words according to how they have heard those specific words in the input (Aguado-Orea et al., 2019; Lieven et al., 2009; Matthews et al., 2005, 2007). As they learn more and more word combinations, they can abstract general patterns based on those word combinations and create abstract schemas for possible word orders in their language (Abbot-Smith & Tomasello, 2010; Kemp et al., 2005). At this point in development, they can produce novel words in the target order for their language and even correct misordered novel words (Akhtar, 1999).

Many usage-based approaches assume that the basic unit of language is a construction (Goldberg, 2006). Constructions are any high frequency string (Bybee & Hopper, 2001) or any pairing of form and meaning that is not predictable from its constituents or other constructions (Goldberg, 2006). One corollary of this choice of basic unit is that the constructions that become increasingly abstract as children get older may not necessarily correspond to the conventional linguistic categories (e.g., Goldberg et al., 2004; Lieven et al., 2003). For example, English-speaking children might construct an abstract semantic category (like PATIENT) as the subject of passive constructions (like *the elephant was carried by the boy*; Nicoladis & Sajeev, 2020) and something closer to a syntactic category (like SUBJECT) as the subject of active constructions (like *the boy carried the elephant*; Akhtar, 1999). Children might rely on cues from word order to infer lexical categories.

If two words differ on lexical category but occur in the same position in a construction and serve the same semantic function (e.g., modification), usage-based theories predict that children will not (initially) differentiate the two words in terms of lexical categories. They require more experience with those words in other constructions to infer lexical categories. English-speaking children who hear both adjectives and nouns in prenominal position (e.g., *spotted dog* and *police dog*) might initially assume that all prenominal modifying words belong to the same lexical category. As they gain further experience with words in different constructions, children should learn to differentiate adjectives from nouns as modifiers.

Two previous studies testing parts of these predictions did not show supporting evidence. Nicoladis (2002b) found that four-year-old French–English bilingual children treat existing adjectives and nouns differently as modifiers. The children ordered adjective-noun constructions more accurately in spontaneous speech (i.e., over 90% accurate) than noun-noun compounds (less than 90% accurate) in both French and English. These results could mean that children can distinguish adjectives from nouns in modifying position. However, the children were four years of age, so they may have had adequate experience to learn abstract categories of adjective and noun modifiers. In this study, we include younger children in order to test for that possibility. Furthermore, because the study used real words, the children may have heard the constructions before, leaving open the possibility that the noun-noun compounds were more novel than the adjective-noun constructions.

Another study found no evidence that as children get older, they increasingly use the canonical order of novel adjectives. Nicoladis and Rhemtulla (2012) taught English-speaking children, between two and four years of age, novel words (presented as either adjectives, words referring to attributes, or nouns, words referring to objects) before and after nouns. The children were less willing to use novel adjectives postnominally (i.e., they corrected to prenominal position) than prenominally, with no change by age. The researchers concluded that by the age of two years, children have access to some kind of underlying abstract knowledge, allowing them to order adjectives according to a schema corresponding to prenominal adjectives in English. They argued that there were no age effects because the order of the adjective relative to the modified noun does not have a strong impact on the meaning of the construction (cf., Akhtar, 1999). This study did not, however, compare adjectives and nouns as modifiers.

The purpose of the present study was to test predictions from usage-based approaches about children's acquisition of nouns and adjectives as modifiers. Specifically, we tested whether children initially treat adjectives and nouns similarly and, with increasing age, differentiate the two lexical categories as modifiers in terms of order. Before turning to the details of this study, we consider how English-speaking children hear nouns and adjectives as modifiers in their input.

Nouns and adjectives as modifiers in input to children

Modified nouns serve a variety of different semantic and pragmatic functions in communication with children, both with nouns as modifiers (Krott & Nicoladis, 2005) and adjectives as modifiers (Blackwell, 2005; Tribushinina, 2018; Waxman & Klibanoff, 2000). Both noun and adjective modifiers can be used to distinguish referents (e.g., the *fire truck*, not the *cement truck*; the *blue cup*, not the *red cup*). Within usage-based approaches, patterns of frequency in children's input are intrinsically related to acquisition (Ambridge et al., 2015). Specifically, when a construction is high in token frequency, that construction is likely to be learned exactly as presented (Bybee & Hopper, 2001). For example, the past tense form *was* is high in token frequency and children often learn that word early and rarely make errors. In contrast, constructions that are high in type frequency are likely to lead to children identifying an underlying pattern and generalizing that pattern productively to novel constructions. For example, the past tense morpheme *-ed* is high in type frequency, appearing on many verbs. Children often pass through a phase of overregularization with some verbs (e.g., *catched*), suggesting that they have learned the regular pattern (Marcus et al., 1992).

We found no previous study examining the frequency both of adjectives and nouns as modifiers in child-directed speech. Most research on children's acquisition of adjectives has focused on their understanding of the meaning of adjectives (Diesendruck et al., 2006; Klibanoff & Waxman, 2000; Mintz & Gleitman, 2002; Tribushinina et al., 2014). Therefore, prior to presenting the details of the methodology of this study, we also present the results of a corpus analysis of child-directed speech on the use of prenominal nouns and adjectives.

This study

The purpose of this study was to test predictions from usage-based approaches about English-speaking preschool children's ability to differentiate prenominal adjectives and nouns used as modifiers. We used the weird word order paradigm (Akhtar, 1999) to test this hypothesis. That is, in a within-subjects design, we taught children novel words (presented either as adjectives, in that they referred to attributes and were marked morphologically as adjectives, or nouns, in that they referred to objects). We then used these novel words as modifiers, some in the canonical prenominal position and others in the weird postnominal position. Compound nouns and adjective phrases are often thought to differ in typical stress patterns in English, with primary stress on the modifier noun in a compound noun like 'cupcake and the primary stress on the modified noun in an adjectival phrase like red 'cake (Giegerich, 2009). However, English-speaking children do not reliably distinguish between these stress patterns until after nine years of age (Vogel & Raimy, 2002). For this study, we therefore assumed that the children would not use stress as a cue to infer lexical category.

We predicted that younger children would use the weird order for both adjectives and nouns as modifiers. Older children would correct the weird order of both constructions to the canonical order. The developmental trajectory of adjectives and nouns might differ, if they differ on type frequency. We present results of a corpus analysis of child-directed speech below, with the goal of exploring whether nouns and adjectives differ in type frequency. Based on those results, we can articulate a prediction as to whether the developmental trajectories of correcting weird order might differ for nouns and adjectives in postnominal position.

The weird-word-order paradigm has been critiqued on several grounds (Franck & Lassotta, 2012), particularly that researchers exclude data like response rates, that would be inconsistent with the researchers' theoretical assumptions. In this study, we include both response rates (which could provide information about whether children are avoiding some constructions) as well as the percentage of matching responses.

Method

Participants

There were 76 children (41 girls) in the final sample, aged between the ages of 26 months (2 years; 2 months) and 73 months (6 years; 1 month; mean age = 48.6 months, SD = 12.7). According to a G*Power3.1 power analysis, using a medium effect size (estimating conservatively from Nicoladis & Rhemtulla, 2012), we required at least 45 participants for a study powered at 90%. Anticipating that children would not necessarily participate in all conditions, we included more participants than the minimum requirement. For

descriptive purposes, we divided up the children into age groups (see Appendix). Fifteen children were two-years old (26-35 months), 22 three-years old (36-46 months), 22 four-years old (48-59 months), and 17 were five-years old or just turned six (60-73 months). All children were judged to be typically developing children by their parents and their teachers and had no more than passive knowledge of a few words in any language other than English. We did not collect information on the socioeconomic status (SES) of the families, but our recruitment was in university-area daycares and preschools that cater to university-educated families. Therefore, it is likely that the children were from a relatively high SES background. Children were included in the final sample if they produced at least one two-word string with a novel word in at least one condition. Five children (four two-year-olds and a five-year-old) were tested but not included in the final sample because they did not produce any two-word strings in any condition.

Input characteristics of prenominal nouns and adjectives

In order to identify the input characteristics of adjectives and nouns as modifiers, we reviewed the speech in North American English addressed to children in CHILDES (MacWhinney, 2000). We used three databases, including children between the ages of 1;9 and 8;11, namely Eric and Gia (Bloom, 1970), Peter (Bloom et al., 1974, 1975), the VanKleeck corpus and the McCabe corpus (for children up to eight years old).

In the input, we identified all instances of adjectives and nouns modifying nouns. We excluded any compound nouns with pronunciation changes that might impede the identification of the two words as individual words (e.g., *Christmas, cupboard*). Table 1 summarizes the results. For token numbers, we counted the number of times adjectives and nouns appeared as modifiers of nouns. As can be seen in Table 1, adjectives and nouns appeared as modifiers in somewhat equivalent token numbers. For types, we counted the number of different modifying adjectives and nouns. There were more noun types that served as modifiers than there were adjective types (see Table 1). Another important point is that just over half (50.1%) of nouns in the input modified one and only one noun. For example, *pocket* only modified the noun *book* (although *pocketbook* appeared 87 times) and *doll* only modified *house* (8 tokens). In contrast, only 14.0% of adjectives modified a single noun (e.g., the adjective *Vietnamese* only modified the noun *hat*). Most adjectives modified more than one noun type (see similar results in Blackwell, 2005).

In sum, children's input provides them with many nouns as modifiers in high token frequency constructions, characteristics that are often associated with learning constructions as they appear in the input (Bybee & Hopper, 2001). In contrast, adjectives are used as modifiers with a large number of different modified nouns, characteristics often associated with children's learning constructions productively. It is therefore possible

Table 1. Adjectives and nouns as modifiers in input to children

	Adjective	Noun
# Tokens	2,545	2,481
# Types	262	401
% Modifier types modifying only one noun type	14.0%	50.1%

that children will learn the canonical word order of adjectives as modifiers before nouns as modifiers.

Materials

The experiment was designed as a play situation. Materials consisted of toys which were pre-selected – some of which were created by the authors. There were four experimental conditions for every child. Two conditions included adjective-noun constructions and two conditions included noun-noun compounds, both in the canonical order and a weird word order. The toys used for each condition, including the available objects that could be modified by the novel words, are listed in Table 2. Our novel adjectives both ended in -*y*, allowing children a potential morphological cue that these words were adjectives. We chose to use these forms because previous research has shown that the meaning of adjectives can be difficult to infer (Tribushinina, 2018) and -*y* is the most frequent (in type frequency) morphological marker of early acquired adjectives in English (Blackwell, 2005). Additional examples of familiar noun-noun compounds were used to demonstrate the canonical order of the noun-noun compounds. A money box, an animal box, a cement truck, and a garbage truck, were used as examples of a noun modifying another noun. Additional examples of the objects that were modified with adjectives were also available (e.g., a solid pink star in contrast to "the tilly star"). Other toys used in the play session included a farm setting with trees, a barn, and fences. A video camera was used to record each session for later analysis.

Procedure

The experimenter started the play session by setting up the farm set with the child; allowing time for the child to become acquainted with the experimenter. For each experimental condition, the experimenter first introduced the familiar item (such as a star, a duck, etc.). Then the child was shown the novel item and an explanation was given. For example, for the adjective-noun constructions the experimenter would say "Look at this star. It's a star with two colors so we say it's a *tilly star*. It's *tilly* because it has two colors". The child was then shown the contrasting object and said, "This one isn't *tilly* because it only has one color. It's a pink star." This procedure was followed when demonstrating the noun-noun compounds, too. The experimenter said, "Look here is a

Table 2. Description of Novel Words and Materials

Lexical Category	Novel Word	Meaning	Order used by Experimenter	Objects Modified by Novel Word
Adjective	Tilly	Having two colors	Canonical	Star, ball, duck
Adjective	Bicky	Having no legs	Weird	Horse, pig, cow
Noun	Breet	A fuzzy thing with eyes	Canonical	Box, bowl, bag
Noun	Dax	A springy thing with eyes	Weird	Truck, boat, car

Canonical order refers to Modifier-Noun order; Weird order refers to Noun-Modifier order.

truck with a *dax* in it. We call it a *truck dax* because it has a *dax* in it". To contrast with another object, the experimenter might say something like, "This one isn't a *truck dax*, it's a garbage truck." As in this example, we used canonically ordered contrasting constructions in the weird-word condition.

Often the children were asked to repeat the name of the novel item to ensure that they could say the words. However, because these repetitions were the direct result of the experimenter asking for an imitation (e.g., "can you say *breet box*?") these were not counted as imitations in the analysis. Open-ended questions were posed to the children to allow opportunities for them to use the novel word combinations (for example, "Which one do you want to play with? Which one is your favorite? Which one should we put away next?").

After the first few novel items were presented and the child had opportunities to learn and use the novel words, another object was presented with the same characteristics as the previous novel words. Before the experimenter said the name of the new object, the child was first asked to name it, in order to see if the child generalized the novel adjective or noun to a new object and in which order they would use it. The order in which the novel adjectives and novel nouns were used was randomly assigned for each child.

Coding and analysis

Children's two-word productions of the novel modifier with a noun were classified as either consistent with the input order or reversed. Some previous work in this paradigm has distinguished two types of consistent responses: imitations and extensions (Akhtar, 1999). The children did not produce enough extensions to allow for that distinction (see Supplementary Material; Table 2). The dependent variable in this study was the percent of children's strings that were in the same order as the experimenter used.

Our main analysis was a general linear mixed model (GLMM) with age in months, order (weird or canonical), lexical category (adjective or noun), and the interaction between order and lexical category as fixed effects. Children's data were only included in the GLMM if they used at least one two-word construction in all four conditions; in order to include the maximum number of children in our analyses, we also performed paired t-tests (see Appendix). These results replicate those of the GLMM, suggesting that those included in the GLMM analysis are representative of all the children's performance. Treatment coding was employed for the predictors (i.e., word order and lexical category), as is the default in the lme4 package in R (R Development Core Team, 2005). In accordance with the importance of transparent reporting of coding choices (Brehm & Alday, 2022), this means that explicitly specifying treatment coding provides a clear and interpretable way to understand the model's results. Finally, to better understand the GLMM results with age, we used Pearson correlations by condition.

Results

Number of strings

Table 3 shows the number of two-word strings the children produced in each condition. To test whether children were avoiding producing strings, particularly in the weird-word-order conditions, we analyzed the number of strings with a GLMM. Table 4 summarizes the results of the GLMM. Age was a significant predictor of the number of strings. That is,

Table 3. Number of strings children produced in each condition

	Weird	Canonical
Adjective	3.7 (2.3)	5.2 (3.3)
Noun	4.5 (3.6)	3.2 (2.2)

Table 4. Summary of GLMM Results for Number of Strings Produced

	Estimate (B)	S.E.	t-value	p-value
Intercept	1.60	1.27	1.26	> .05
Order	0.10	1.58	0.06	> .05
Lexical category	−1.36	1.58	−0.85	> .05
Age	0.07	0.02	2.99	< .001*
Order x Lexical category	1.22	2.24	0.54	> .05
Order x Age	−0.03	0.03	−1.05	> .05
Lexical category x Age	−0.01	0.03	−0.43	> .05
Three-way interaction	0.03	0.04	0.75	> .05

*p < .05

as age increased, the number of strings produced also increased. The main effects of order and lexical category were not significant. The three-way interaction effect between order, lexical category, and age was not significant. Random intercepts for order of presentation accounted for some variance, $\sigma^2 = 2.92$. The residual variance, indicating individual differences in total responses, was $\sigma^2 = 6.05$. In sum, while the children produced more strings as they got older, there was no evidence that they were avoiding the weird constructions.

Ordering

We next tested whether the children used the same order as the experimenter. Table 5 summarizes the results of the GLMM (see Figure 1 for descriptive statistics by condition). The three-way interaction between order and lexical category and age in months was significant. The interaction between order and lexical category was significant. This indicates that the impact of order on the percentage of matching order was not consistent across adjectives and nouns. As seen in Figure 1, the interaction effect was due to little difference in matching order between adjectives (M = 97.0%, SD = 10.8%) and nouns (M = 98.1%, SD = 8.4%) in canonical conditions and more matching order with adjectives (M = 76.3%, SD = 30.9%) than with nouns (M = 44.4%, SD = 31.9%) in weird conditions. The interaction between order and age was also significant, suggesting that the older children were less likely to produce matching order than younger children.

To better understand the GLMM results showing interactions with age, Table 6 summarizes the correlations between age and percentage of matching-ordered strings. The only correlation to reach significance is the negative correlation between age and

Table 5. Summary of GLMM Results for Matching Order

	Estimate (B)	S.E.	t-value	p-value
Intercept	0.96	0.10	8.78	< .001*
Order	0.12	0.15	0.78	> .05
Lexical category	0.03	0.16	0.21	> .05
Age	0.00	0.00	0.10	> .05
Order x Lexical category	−0.72	0.23	−3.03	< .01*
Order x Age	−0.00	0.00	−2.05	< .05*
Lexical category x Age	−0.00	0.00	−0.17	> .05
Three-way interaction	0.01	0.00	1.00	< .05*

*p < .05
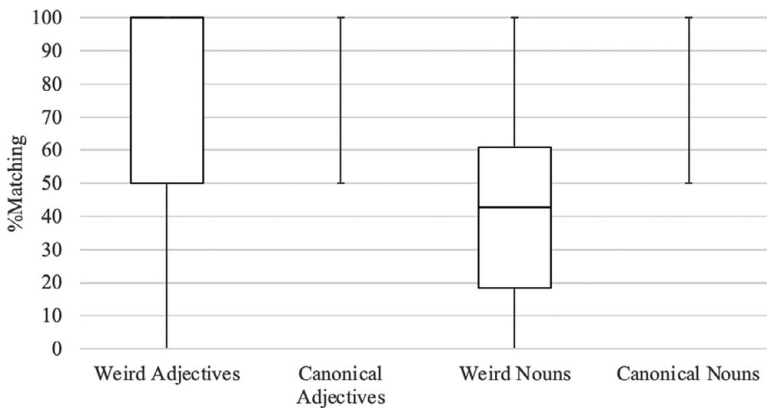
Figure 1. Percentage strings matching the experimenter's order
Note: This graph includes data from the 55 children included in the GLMM; see Appendix for summary of all children's data. Top of box shows third quartile; the bottom of the box the first quartile; the middle line shows the median. The error bars show the minimum and maximum scores. For the weird adjectives, the median and the third quartile were identical (i.e., 100%).

Table 6. Correlations between age (in months) and number of strings produced/percent consistent with input by condition

	Correlation between age and percent consistent with input
Weird adjective	−.248* (N = 73)
Canonical adjective	.031 (N = 71)
Weird noun	.050 (N = 61)
Canonical noun	−.050 (N = 64)

*p < .05

weird adjectives. The older children were more likely than the younger children to correct the weird order.

In sum, these results show that the children treated adjectives and nouns in modifying position differently. Even the youngest children corrected weirdly ordered noun-noun compounds (see Appendix), with no change with age. In contrast, while children corrected more weirdly ordered adjective-noun constructions than canonically ordered constructions, they corrected fewer than weirdly ordered noun-noun compounds. Moreover, they increasingly corrected weirdly ordered adjectives with increasing age.

Discussion

The purpose of this study was to test predictions from usage-based approaches about children's acquisition of nouns and adjectives as modifiers of nouns. Specifically, we predicted that younger children would be willing to use weird word order for both adjectives and nouns as modifiers. With increasing age, children would become less willing to use the weird word order, perhaps earlier with adjectives than nouns, as adjectives are higher in type frequency in the input. The results did not unambiguously support these predictions.

This study showed that from the age of two years on, children treat nouns as modifiers differently from adjectives. The children were more likely to correct noun-noun compounds than adjective-noun constructions in the weird order. In other words, they allowed the weird word order more frequently when adjectives were modifying nouns. This finding suggests that even the youngest children were differentiating the lexical categories of the modifiers. The results therefore challenged the prediction that children initially have a construction like MODIFIER-NOUN.

Furthermore, we found a significant negative correlation between age and percentage of matching-to-the-experimenter's-order only in the weird adjective order condition. In other words, children were showing early sensitivity to noun-noun ordering and protracted development of sensitivity to adjective-noun order, despite the higher type frequency of adjectives as modifiers. Previous studies have found that English-speaking children use noun-noun compounds early in development, including novel ones (Clark et al., 1985; Nicoladis, 1999). Many researchers have argued that English-speaking children have early access to the lexical category NOUN (Tomasello, 2000b; Wexler & Culicover, 1980). The results of this study further add to the evidence that children's sensitivity to NOUN is already developed by the age of two years when used as a modifier of another noun.

The protracted development of the lexical category ADJECTIVE is consistent with usage-based arguments that children gradually become sensitive to word order in their language (e.g., Akhtar, 1999; Matthews et al., 2005). This protracted development is inconsistent with the argument that children have early access to lexical categories (Wexler & Culicover, 1980), at least the lexical category ADJECTIVE. The age-related results contrast with those of Nicoladis and Rhemtulla (2012), who found no correlation between age and willingness to match a weird adjective order. There is, however, a difference in age range between our study and theirs. Our study included children between two and six years while their study included children between two and four years. In our study, if we only include the two- to four-year-olds, there is no significant correlation between age and matching order for weird adjectives, r (56) = −.121, *ns.* Thus, much of the age effect in this study is likely due to the oldest children's correcting the weird order of adjectives.

While the results did not correspond to our predictions generated from usage-based approaches, it is possible that our predictions did not include all the relevant theoretical aspects of usage-based theories. Tomasello (2000b) has argued that English-speaking children might construct the lexical category noun quite early in development (see also Huebner & Willits, 2021; Mintz & Gleitman, 2002). While this point is rarely explicitly mentioned by usage-based theorists, it could help explain the present results. That is, part of the reason that even the youngest children in this study corrected weirdly ordered noun-noun constructions was that they had already constructed the NOUN lexical category.

Another important variable to consider is that the meaning of compound nouns is highly dependent on the order of the nouns (e.g., *fire truck* and *truck fire* have decidedly different referents). In giving this example, it is important to underline that we are not claiming that children need exposure to compound nouns with the same words in opposite orders in order to learn that the ordering of the constituents of compound nouns matters. Research has shown that children's language learning is distributed across exemplars (Wang et al., 2023). Preschool English monolingual children make some errors based on misordering novel compound constituents (e.g., calling a chair with flowers on it a *chair flower* or interpreting a *sun bag* as a kind of sun) in both comprehension (Nicoladis, 2003) and production (Nicoladis, 2002a). However, even at the age of three years, the misordering errors are rare, suggesting that children have learned which word is the modifier and which is the head noun. In other words, these results suggest that children have learned that order of the nouns matters in the meaning.

In contrast, the meaning of misordered adjective-noun constructions might be recoverable (e.g., a *cup pink*; see Nicoladis & Rhemtulla, 2012). Children might be particularly likely to attend to word order when it made a notable difference in the meaning of the construction as a whole (Nicoladis & Rhemtulla, 2012). In support of that argument, children show early sensitivity to the order of other constructions in which the order corresponds to an important difference in meaning. For example, children as young as two years of age show sensitivity to the order of verb-noun constructions (Abbot-Smith et al., 2001; Chan et al., 2009). In those constructions, the order of the verb and the noun correspond to the semantic/syntactic role (e.g., subject, agent, object). Future studies can test this interpretation with other lexical categories. For example, adverb placement does not usually have a large impact on meaning. If our interpretation is correct, then children who are taught novel adverbs in various orders should show similar patterns of production as those we observed here with adjectives. To date, most studies with children's acquisition of adverbs has concerned spontaneous speech and shown that they generally order adverbs according to the canonical order of their language(s) (e.g., Pirvulescu et al., 2022). It is important to complement these studies with other studies that include novel words. If future studies confirm our argument that children attend early on to word order when meaning is deeply impacted, this is an important factor to add to usage-based theories for the purposes of formulating predictions for future studies (see Ibbotson, 2013, for a broader discussion of current strengths and weaknesses in usage-based theories).

There are a number of important limitations to this study that can only be addressed in future studies. For example, we collected no measures of the children's racial/ethnic background or their families' socioeconomic status (SES). Findings to date suggests that SES has little impact on the kinds of simple syntactic constructions included in this study (Vasilyeva et al., 2008). Nevertheless, future studies can collect such measures to verify that. Another important limitation of this study is that we used only one set of objects for every condition. It is possible that there was something about our objects that affected

children's use of particular word orders. Future studies can either vary objects across word-order conditions or retain the same objects. Yet another important limitation of this study is that there are some critical aspects of the input that remain unknown. Notably, while we know that adjective-noun constructions and noun-noun compounds can serve some of the same functions in interactions (Krott & Nicoladis, 2005; Tribushinina, 2018), studies have not compared the functions of the two constructions directly. It remains therefore possible that the children showed different patterns of development of the two constructions because they had had different experience with the two in terms of function. Future studies can address this possibility.

In conclusion, we found that preschool children treat adjectives and nouns as modifiers differently from the age of two years on. Children show early sensitivity to word order with nouns as modifiers and protracted development of word order with adjectives as modifiers. These results only partially supported the predictions we generated based on our interpretation of usage-based theories. We argue that children are more likely to correct a weird word order when the order makes a big difference to meaning (Nicoladis & Rhemtulla, 2012; see also Slobin, 1973). Future studies can test this argument with other constructions.

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Appendix: Average (SD) percentage of matching order by age group

	Weird	Canonical
Two-year-olds (N = 15)		
Adjective	95.2% (17.8%) (N = 14)	96.0% (11.3%) (N = 13)
Noun	41.7% (39.1%) (N = 6)	100% (-) (N = 8)
Three-year-olds (N = 23)		
Adjective	77.7% (30.4%) (N = 22)	100% (-) (N = 22)
Noun	38.1% (25.0%) (N = 20)	100% (-) (N = 21)
Four-year-olds (N = 22)		
Adjective	80.2% (27.9%) (N = 22)	93.8% (15.3%) (N = 20)
Noun	57.4% (33.9%) (N = 20)	94.6% (13.8%) (N = 19)
Five-year-olds (N = 17)		
Adjective	63.6% (37.8%) (N = 15)	100% (-) (N = 16)
Noun	46.1% (39.7%) (N = 15)	100% (-) (N = 16)
All children who produced at least one string (N = 77)		
Adjective	78.9% (30.6%) (N = 73)	97.5% (9.7%) (N = 71)
Noun	46.8% (33.4%) (N = 61)	98.4% (7.8%) (N = 64)

To include as many children in the analysis, we performed paired t-tests in the weird conditions and in the canonical conditions. For the 60 children who produced strings in both weird conditions, they produced significantly more matches in the adjective condition (M = 76.4%, SD = 30.7%) than in the noun condition (M = 46.3%, SD = 33.5%), $t(59) = 5.12$, $p < .001$. For the 61 children who produced at least one string in both canonical conditions, there was no difference between the adjective (M = 97.1%, SD = 10.4%) and the noun (M = 98.3%, SD = 8.0%), $t(60) = .69$, $p = .49$.