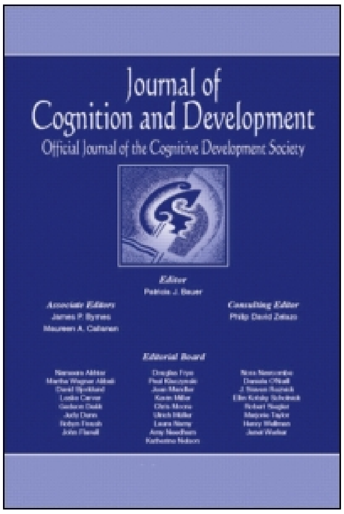

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ARTICLES

Acquiring Non-Object Terms: The Case for Time Words

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We address the issue of children's understanding of abstract words with two studies on preschoolers' knowledge of the time-duration words *minutes, hours, days,* and *years.* The first study examines 4- and 5-year-olds' ability to answer questions about durations of common phenomena with duration terms. The second study examines 4- to 6-year-olds' comprehension of duration terms with a forced-choice pointing task. Both show that preschoolers' knowledge of such words is incomplete, but that it adheres to the pattern proposed in previous work with toddlers for abstract words. More specifically, children form lexical domains for such words even before they know their individual meanings, thereby allowing the children to often respond appropriately but not usually correctly to questions about abstract dimensions like time.

Abstract lexical terms, such as words for time, present a special problem for the young language learner. Unlike words for objects, they do not stand for categories of readily observable referents, and one cannot point out

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referents for these sorts of words to ease the child into an understanding of their meaning. Gleitman, Cassidy, Nappa, Papafragou, and Trueswell (2005) argue that words fall on a continuum from concrete to abstract, with concrete object terms easier to learn than more abstract ones, like verbs for which meanings can be difficult to ascertain from context. Posing still more difficulty are abstract words that do not refer even to actions or events and are also multifunctional. Words such as those in the lexical domains of color, quantity, and time duration can be descriptors for a variety of objects or events; they can be used metaphorically (e.g., *living green*) or in idioms (*just a minute*; *what a day*); and many of them can partake of more than one grammatical role (e.g., *10 toes, the power of 10*). Several studies of parental speech provide evidence that parental speech includes such varied uses for terms from these lexical domains (Bloom & Wynn, 1997; Tare, Shatz, & Gilbertson, 2008).

Compared with the quantity of research on the learning of more concrete words (e.g., Bloom, 2000; Clark, 1993; Markman, 1992), there is little on the acquisition of abstract terms. Several researchers have offered anecdotal evidence of how children err when they start to use abstract terms (Ames, 1946; Bartlett, 1978; Shatz, 1994). In particular, children at first use them in domain-appropriate but incorrect ways, answering, for example, with an incorrect number term ("four") in response to a *how many* question about the number of feet a child has (Shatz, 1994). This behavior is in marked contrast to the behaviors that have been reported for learning new words (most often concrete nouns) in the context of known ones and that provide support for theoretical constructs such as mutual exclusivity (Markman & Wachtel, 1988) and fast mapping (Carey, 1978). The anecdotal accounts raise the following question: If, when faced with abstract terms, children do not employ the sorts of strategies proposed for learning more concrete terms, what sort of strategy might they use instead?

Aside from Gleitman et al. (2005), there have been few theoretical proposals offered to address the acquisition of any abstract terms. Shatz (1993; 2005) offered a theory of how children might begin to learn such terms and why their first uses might be domain-appropriate but not correct. She argued that children's early word-learning capacities include more than the ability to map words onto referents. Additionally, children are able to create what she called word-word mappings (e.g., *color: red; color: blue*) which help children organize abstract words into lexical domains (e.g., *color: red, blue, green*) even before they know what either the domain labels or the individual domain terms refer to. Proceeding from the evidence that even 1-year-olds attempt contingent responding to questions (Shatz & McCloskey, 1984), she proposed that early lexical organization depends on two factors: One is the availability in the discourse environment of discourse regularities, such as repeated color or number questions, and of commonalities, such as the same privileges of grammatical or conversational occurrence (e.g., answers to the same question). The other is the child's ability to create categorical groupings based on the experience in discourse of those regularities and commonalities. For example, caregivers who repeatedly ask "what color is this" and who answer those color questions with a variety of color terms give children the data on which to create a domain of color terms and their appropriate use as answers to the color question, even before they know what the specific terms refer to or even what dimension "color" refers to. In a series of studies, Shatz and her colleagues reported that children aged 1 year, 7 months to 2 years (1;7–2;0) indeed give evidence of such domain-appropriate but not correct responding to questions about color, number, and letter terms (e.g., Backscheider & Shatz, 1993; Shatz & Backscheider, 2001).

The question we investigate here is whether the observed pattern of lexical organization prior to individual term meaning can be documented in children beyond the very early word-learning stage. Acquiring abstract words clearly continues beyond the toddler years. If older children, beyond toddlerhood, give evidence of a pattern of lexical organization prior to individual term meaning, then that strategy can more readily be deemed a general one for abstract-term learning. With her report on time-word usage, Ames (1946) offers only informal evidence to support this claim of generality.

In this article, we report two studies investigating experimentally whether older children, specifically preschoolers, like toddlers, give evidence of domain-appropriate but not correct knowledge of abstract words. Here we use time-duration terms to assess preschoolers' knowledge of the lexical domain *time* not only because previous research indicates that preschoolers' knowledge of time terms is incomplete (e.g., Harner, 1981) but because of anecdotal reports of the way preschoolers respond to time questions (Ames, 1946; Shatz, personal communication, 1989. In the first study, we asked children to tell us how much time common activities would take and assessed whether they gave correct or only domain-appropriate responses. In the second study, we further tested their understanding of particular time terms with an easier forced-choice task requiring the children only to point to pictures illustrating specific time durations. Taken together, the studies offer evidence of the kinds of knowledge preschoolers have about the lexical time terms they hear used by their caregivers in varied ways (Tare et al., 2008).

The developing understanding of time has been closely allied with the development of time language. Piaget's view was that the child moved from a personal, action-based sense of time to a more conventional, objective one grounded in language use (Piaget, 1969). Several researchers have since argued that knowledge of the time lexicon occurs gradually with experience in time-related discourse (Friedman, 2002; Nelson, 1996; Weist, 2002). Particularly relevant to this study of time-duration language is work by Friedman (1990) showing (in the training phase of Experiment 3) that by age 4, children are quite good at judging relative durations of common everyday activities such as "drinking milk" and "sleeping at night." However, no conventional time terms were studied in that work.

There is evidence that parental talk with conventional time markers is more frequent with preschoolers than toddlers (Hudson, 2002) and that it is varied with regard to function (Tare et al., 2008). Thus, though discourse about time is available to children, it is neither simple in the sense of unitary function nor high in frequency to toddlers. It is not surprising, then, that Harner (1981) found that kindergartners still showed considerable confusion about time.

Learning duration terms is challenging because some of the usual strategies described for acquiring other terms are not appropriate for that task. Not only are there no referents to point to, but "fast mapping," the strategy of applying the unknown word to a recognized gap in one's lexicon, is not applicable. Recognizing gaps would require knowing that there is a conventional partitioning of the time continuum as well as meanings of some of the duration terms. Instead, children may start by recognizing that certain words fall into a specific discourse domain and thereafter develop specific meaning understandings only as they experience both more talk about time and activities of varying durations. Then, their knowledge and use of time language might indeed first be domain appropriate and only gradually become more accurate. The work here addresses the kinds of knowledge children have about time words and how best to describe their understandings. In particular, we hypothesize that children will be able to respond appropriately to questions about time durations—that is, with one or another (but not correct) time-duration term—before they give evidence that they understand the meanings of those terms.

STUDY 1

In their studies of letter and number terms, Shatz and Backscheider (2001) showed examples of letters, numbers, or Chinese symbols to toddlers and asked them either, "What letter is this?" "What number is this?" or "What is this?" Responses were coded for whether children gave number or letter responses and then as appropriate if they gave a letter name when a seeing a letter or a number name when seeing a number. Appropriate responses were then coded correct or not. Children provided very few correct responses compared with appropriate ones, and they gave more domain-appropriate terms when they were given lexical category-label cues (... "letter," ... " number") than when they heard only "What is this?" Moreover, they increased name responding when hearing the labels *letter* or *number* even when they saw Chinese symbols. These findings led us to address with preschoolers not only the question of whether they would give more domain-appropriate than correct answers to time-duration questions but whether the word *time* itself in the questions would facilitate duration-term responding. To address whether the word *time* would be a facilitator, we asked two different questions to cue the children's answers: "How much time does it take to ... ?" and "How long does it take to ... ?" *How much time* includes an explicit superordinate lexical category term, *time*, similar to *letter* and *number*, whereas the phrase *how long*, although linked to time understanding in previous research (Friedman, 2002), can also cue a question about distance. Hence, the question with the *how long* phrase is potentially confusing and provides a more ambiguous cue to the time-duration lexical category.

Method

Participants

Twenty-four children were divided equally into two age groups: The younger group (seven females) ranged from 3;9 to 4;4 years ($M = 4;0$); the older group (six females) ranged from 4;8 to 5;4 years ($M = 4;11$). All children were monolingual English speakers according to parent report and attended a university preschool in the Midwest. Three additional preschoolers (one younger, two older) were excluded from analyses due to noncompliance (two) and unintelligibility (one).

Design

We used a $2 \times 2 \times 4$ design, with age group as a between-subjects variable and question type (*how much time ..., how long ...*) and time duration (minutes, hours, days, and years) as within-subject variables. Each time duration was represented on four trials by pictures of activities typically taking that amount of time. Half of the trials for each duration were accompanied by one question, half with the other. Each participant received all 16 picture-question pairs plus 2 control pairs.

Picture Stimuli

We selected simple color illustrations (roughly 4×6 inches) of varied activities taking different time durations from children's books, Web archives, and magazines. To assure similarity of the activities asked with each question type, we paired pictures of two similar activities (for a total of eight stimulus pairs). Thus, children were not asked about the exact same activity twice but instead about very similar activities taking similar amounts of time, such as eating lunch and eating breakfast. The pairs of pictures were divided into two blocks of eight each, and each block was administered with one of the two question types for a total of four different block-question combinations. Each block also included a picture with a control question. The control questions (“How did you come here today?” and “How much does a lollipop cost?”) called for non-time-word responses and were included to ensure that children were regularly responding with time words because of the cues in the time questions and not because of a time response bias induced by a series of time questions. The order of the blocks and the first question type asked were counterbalanced. The order of the nine questions within each block was randomized. Table 1 lists the paired stimulus activities by time duration and block.

TABLE 1
Stimuli for Study 1

	Block A	*Block B*
Minutes	Eating lunch	Eating breakfast
	Driving to the gas station	Driving to the supermarket
Hours	Going to a movie	Going to a birthday party
	Making a sand castle	Making a turkey for Thanksgiving
Days	Learning to ride a bike	Learning to ice skate
	Getting over a cold	A cut getting better
Years	An acorn growing into an oak	Growing to be tall like dad
	Learning to be a baseball player	Learning to be a dancer
Control Question	“How much does a lollipop cost?”	“How did you come here today?”

Procedure

Each child was seen once individually in a separate room in the preschool. Children were told that they would see some pictures and answer questions about them. An experimenter showed the child one color picture at a time, gave a brief (two- or three-sentence) description of the activity, and asked for a response to a time question (e.g., “Look at Tommy. He is eating breakfast. How long/How much time does it take to eat breakfast?”) The child’s answers were written down and tape recorded. The entire procedure took about 10 minutes.

Coding

Children's responses were coded for time content; examples from the data are included here. Responses were first judged to be *time related* or not. A *time-related* response included at least one quantitative word or time word. Distance term responses (e.g., "miles"), "I don't know," irrelevant or non-time responses (e.g., "You just gotta eat your vegetables" in answer to "How long does it take to grow to be tall like dad?") were judged as *non-time related*.

Both quantitative and time words in the time-related responses were then further coded before designations of appropriateness or correctness were assigned. *Quantitative words* were coded as either *non-specific* (e.g., *a lot* or *a few*) or as a *numeral* term (e.g., *8* or *15*). *Time words* were coded as *durational* (e.g., *minutes* or *hours*), *non-specific durational* (e.g., *tomorrow* or *yesterday*), or *closed class*,[1] (e.g., *until* or *when*).

Responses were coded *inappropriate, appropriate*, or *correct*. Appropriate responses to the duration questions that were asked of the pictured activities included a quantitative word and a time-duration word. For example, the response of *weeks* to the question, "How much time does it take to drive to the supermarket?," would be inappropriate because it does not contain a quantitative term as well as a duration term, whereas *a lot of days* or *10 hours*, having both, would be appropriate but not correct. Responses were coded as correct if overall they were reasonable answers to the specific stimulus question provided in the appropriate form (e.g., "10 minutes" or "half an hour" answering the question above). Of course, all correct responses are also appropriate.

We also devised a criterion for children's *correct overall use of a time word* by counting the number of times they used the word in its expected context and the number of times they used the word in an unexpected context. Specifically, use of a time word such as *minutes* was judged *correct overall* if a child used it to answer at least three of the four questions related to a pictured activity taking minutes and to respond at most once to other duration picture-questions.

To determine coding reliability, two coders independently coded the responses of four participants, two from each age group. Intercoder agreement for the different codes ranged from 98.4% to 100%. Differences were discussed and resolved.

Results

There was no significant effect of the four block-question combinations on the data.

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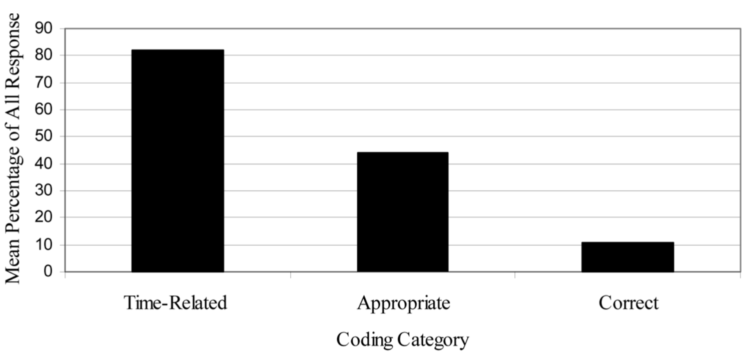
[1]Closed-class words generally serve a grammatical or functional role in a sentence (Hoff, 2009).

Non-Time-Related Responses

Both groups of children provided mostly time-related responses, but there was a tendency for a larger percentage of all the older children's responses ($M = 89\%$, $SD = 13\%$) to be time related compared with the younger children's responses ($M = 76\%$, $SD = 19\%$, $F(1,22) = 3.85$, partial $\eta^2 = .15$, $p = .06$). Of the 48 control questions (two per child) that asked about amount and instrument rather than time, only 1 was answered by a younger child with a time word. Distance words were provided only once by each of three children (two in the older group). They were equally distributed over question types, and all were given to one pair of stimuli: driving to the gas station and driving to the supermarket. Taken together, these results show that both groups of children were generally up to the task of producing time-related responses.

Appropriateness and Correctness

For both age groups, children provided many more appropriate than correct responses ($t = -6.9$, $p < .01$). Figure 1 shows that overall, the mean percentage of all responses that were appropriate was 44% ($SD = 32\%$), and the mean percentage that were correct responses was 12% ($SD = 13\%$). Older children had mean percentages of 47% ($SD = 34\%$) for appropriate responses and 15% ($SD = 14\%$) for correct responses. Younger children had mean percentages of 40% ($SD = 31\%$) for appropriate responses and 7% ($SD = 12\%$) for correct responses. Results of one-way analyses of variance (ANOVA) for age revealed no significant differences between age groups for percentage of appropriate or correct responses.



Note. Time-related includes both appropriate and correct; appropriate includes correct.

FIGURE 1 Time-related, appropriate, and correct responses.

Question-Type Influences

We had hypothesized that the question with the word *time* might increase appropriate responding over a non-time-word question. However, for both age groups, a multivariate analysis of variance (MANOVA) on appropriateness revealed that the factor of question type (*how long* versus *how much time*) was non-significant. In fact, there was a non-significant trend in the opposite direction, $F(1, 22) = 3.45$, partial $\eta^2 = .14$, $p = .07$. Half of the responses to *how long* questions were appropriate ($SD = 37\%$), whereas only 38% ($SD = 34\%$) of responses to *how much time* questions were appropriate. There was no interaction of question type and age; however, there was a three-way interaction for the effects of age, order of question-type blocks, and question type, $F(1,16) = 5.52$, partial $\eta^2 = .26$, $p < .05$. Further analysis did not reveal a clear reason for the interaction.

Duration-Term Influences

Two MANOVAs, one on appropriateness and one on correctness, did not reveal any significant effects of the factor of the anticipated time durations (minutes, hours, days, and years) of the activities we asked about. Children did, however, use the words with varying frequency. See Figure 2. A series of *t* tests revealed only two differences between word-use frequencies that reached significance. The 18 children who produced the time-duration words (*minutes, hours, days*, or *years*) said "minutes" significantly more often than "hours" ($t = 2.7$, $p < .05$) or "years" ($t = 2.5$, $p < .05$). However, higher frequency did not result in more discriminating use. Analysis of children's correct overall time-word use showed that only 4 children (3 from the older group) met the criterion of correct use, each with a single term: 1 with minutes, 1 with years, and 2 with days.

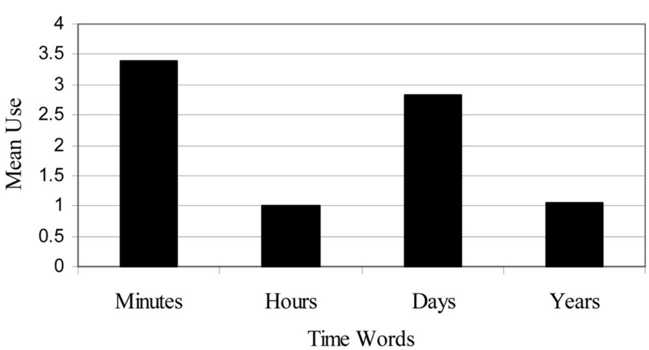


FIGURE 2 Mean frequency of children's use of time words.

Numeral-Term Use

Older children produced significantly more responses with numeral terms ($M = 67\%$, $SD = 29\%$) than younger children ($M = 34\%$, $SD = 36\%$, $F(1,22) = 6.13$, partial $\eta^2 = .22$, $p < .05$). More older children (seven) than younger children (three) gave at least one inappropriate response of a numeral term only (e.g., saying "14" in response to "How much time does it take to eat breakfast?" However, two children in each group used numerals only on 75% of their trials.

Discussion

More than 80% of the responses to time questions by preschoolers in this study were time related, showing that the children recognized the relevance of time words to the questions. Moreover, more than 40% of all responses included both a quantitative term and a duration term, revealing some understanding of the form of an appropriate response to a time question. And children virtually never used time terms for control questions or distance terms for time-related questions. Yet, they demonstrated little understanding of particular time terms: Only 12% of responses were correct. Thus, the theory that children learn abstract terms by first recognizing a lexical domain for them in a question-answer format received some support.

Two findings offer further insights into the course of learning time words. First, while older children tended to give somewhat more time-related responses, even the younger group readily gave such responses, and there were no group differences on appropriateness or correctness. It is possible that larger samples would have revealed an age effect, but the findings on numeral-term use suggest that even when the older children knew that quantities were needed in a response, they did not always produce a well-formed one. While they gave more numerical responses than did younger children, more of them occasionally gave numeral terms without a duration term (resulting in inappropriate responses) than did younger children. Thus, although by the age of 4, children recognize time-related discourse, their progress in the following year toward better time-duration responding seems slow.

Second, the lack of an advantage in appropriate responding for questions using the word *time* suggests that what may be important for learning about the time lexicon is the frequency of any particular time-related question-answering sequence in discourse and not necessarily the use of the specific superordinate term *time* in the question. Our findings on the time domain contrast with those on the lexical domains of color, number, and letter, where conventional ways of asking about those domains include superordinate terms and where explicit superordinate terms facilitate appropriate responding (Shatz, 2005). The time-question equivalence may be attributed to the fact that children may hear the *how long does it take* question at least as often as the *how much time* question. Certainly, the children's excellent performance on control questions, as well as the rarity of distance responses to both time questions, supports the claim that they are able to identify both kinds of time questions as the sort requiring time-relevant answers.

This study adds to the work on the acquisition of abstract words by showing that preschoolers, like toddlers, organize their lexicon so that they can respond appropriately though not yet correctly to questions about an abstract lexical domain. The use of the strategy in answering time-related questions provides strong evidence for its use as a general strategy in word learning and lexical organization. Nonetheless, some issues remain. For one, using a task that required children to respond verbally may underestimate their knowledge of time-duration terms. The relatively few age-group differences are another; indeed, more age differences might be found with a different task and more subjects. Finally, we judged what would be reasonable time-duration responses without pretesting the stimuli for conventional adult responses. Study 2 addresses these issues.

STUDY 2

Previous research has shown that comprehension tasks can reveal some language knowledge earlier than production tasks (for discussion, see Hoff, 2009). Moreover, tasks requiring nonverbal responses rather than verbal ones can be easier for young children. Therefore, to assess whether Study 1 had underestimated preschoolers' knowledge of time-duration terms, we asked children to select from one of two which picture best exemplified a particular time duration. But first, we ascertained with adult participants the most typical durations for the phenomena to be pictured for the children. Once again, we examined the durations of minutes, hours, days, and years.

Method

Participants

Participants consisted of 54 children. Children were divided into three age groups: 24 children (12 girls) in the younger group ranged in age from 3;3 to 4;1 years ($M = 3;8$); 20 children (13 girls) in the older group ranged in age from 4;4 to 5;8 years ($M = 4;11$); and 10 children (6 girls) in the oldest age group ranged in age from 6;0 to 6;10 years ($M = 6;5$). In addition, a group of 16 adults provided ratings for the stimuli used. All participants were predominantly Euro-American, living in a middle-class community in the Southeast. Child participants attended local day cares and preschools, and adult participants were students at a local university.

Design

We used a 2×4 design with age group (younger, older) as a between-subjects variable and time duration (minutes, hours, days, years) as a within-subjects variable. The oldest age group was analyzed separately (see p. 29 for our rationale). Each time duration was represented by different pictures for three trials as the target and for three trials as the distractor, once with each of the other time durations (e.g., *minutes* as target was paired with *days* as distractor once; *minutes* as distracter was paired with *days* as target once), for a total of 12 test trials using 24 pictures. In addition, there were four warm-up trials with 8 pictures.

Picture Stimuli

To assure consensus on time durations, we provided 16 adults with a written list of 28 phenomena we thought preschoolers had some experience with and asked the adults to estimate the duration each phenomenon would have, from start to completion. Adults were asked to respond with both a number term and a time word (e.g., "10 minutes") and to try to use the time words, *minutes, hours, days*, or *years*. The participants generally followed these directions and were remarkably consistent in their responses, which were then used to refine our selection of pictures of the phenomena and the pairings of them. Twenty-four pictures of the phenomena rated most similarly by the adults with regard to duration ($M = 95\%$ agreement, $range = 63–100\%$) were selected for use in the task. Each of the 12 of the 24 that we chose to serve as "correct" choices for the children's task had received 100% agreement among the adults as to duration word. Of the 12 "distractor" pictures paired with the "correct" pictures, only one had received the correct choice's duration word as an adult's response.

Each picture (roughly 4" $\times$ 6") was situated on the upper half of an 8.5" $\times$ 11" in. paper. Eight of the 24 test pictures had been used in Study 1. The remainder had been printed from free Internet sites which also provided 8 pictures for four warm-up trials. For warm-up trials, as with test trials, we paired pictures of one activity or entity with a different activity or entity. On both warm-up and test trials, the orientations of the pictures and the location of the correct choices varied across trials. Half of the picture pairs were arranged horizontally, and half vertically. Locations of correct pictures were balanced between right and left, and above and below. See Table 2 for a complete list of both warm-up and test trial stimuli.

Procedure

Children were individually tested for approximately 10 minutes by a female researcher in their day cares or schools. The children were first introduced to a puppet named Toby and told that Toby came from far away and didn't know very much. The children were then asked to help Toby learn about the pictures that were going to be shown by pointing to the picture that would tell Toby what he wanted to know. Following the introduction of the puppet, children completed a warm-up consisting of four trials. The picture pairs used in the warm-up did not represent time durations but were used to familiarize children with the task of pointing to a picture after attending to them and listening to verbal instructions. The researcher described the pictures and then asked the children to point to the picture that would tell Toby what he wanted to know. For example, the researcher

TABLE 2
Stimuli for Study 2

	Warm-Up Trials	
Who	*Correct Picture*	*Incorrect Picture*
Has a bat	Boy hitting a ball	Man throwing a ball
Is smiling	Woman on the telephone	Girl drinking water
Is helping his dad	Boy at a barbecue	Boy riding a bike
Can fly	Bird	Cat
	Test Trials	
What takes	*Correct Picture*	*Incorrect Picture*
10 minutes	Baby taking a bath	Family visiting the zoo
7 days	Boy with a cold getting better	Lady growing old
4 years	Puppies growing up to be mommy dogs	Children cooking spaghetti
2 hours	Children watching a movie	Girl putting on her shoe
20 years	Baby growing up to be a mommy	Boy learning to ride a bike
10 minutes	Boy eating breakfast	Child learning to surf
3 hours	Girls at a birthday party	Boy growing up to be a daddy
2 days	Man and lady camping	Boy boiling water
15 years	Boy growing up to be a baseball player	Girl going to the park with mommy
2 hours	Girl trick-or-treating	Boy learning to skate
3 minutes	Girls singing a song	Girl growing up to be a ballerina
3 days	Girl with a cut getting better	Children making a snowman

said, "Here is a man who is throwing a ball. Here is a boy who is hitting a ball. Toby wants to know who has a bat. Point to the one who has a bat." If children chose the incorrect picture, they received feedback until they understood the task. Children had to respond correctly to three of four warm-up trials to go on to test trials. Every child successfully passed the warm-up, with almost all children responding correctly without feedback on every trial.

Following the warm-up, children completed the 12 test trials on time durations. The researcher described the pictures and then asked the children to point to the picture that would tell Toby what he wanted to know. For example, the researcher said, "Here is a baby who is taking a bath. Here is a family who is visiting the zoo. Toby wants to know what takes 10 minutes. Point to what takes 10 minutes." No feedback was given to the children during the test trials. For quantity terms used in the task instruction, for 11 of the 12 trials, we had selected the most common quantity earlier cited by the adult participants ($M = 48\%$ agreement, *range* = 25–81%).[2]

Results

Children's responses to the 12 picture trials were scored for accuracy. A *1* was assigned to children's responses when they pointed to the correct picture, and *0* was assigned when they pointed to the incorrect picture. These numbers were then converted into percentages.

Table 3 shows the mean percentage accuracy for all three age groups. The performance of the 10 participants in the oldest group was so consistently high that we decided to analyze them separately rather than add to the number of participants in that age group and include them in an overall analysis. The results for the younger and older age groups are presented first, followed by the results for the oldest age group.

Younger Versus Older Age Group

Overall age differences. A one-way ANOVA was conducted on the children's total scores to examine age-group differences in average comprehension of duration words. The results show a clear developmental trend: The older age group was more accurate than the younger age group

[2]Despite the fairly low exact agreement percentage, the quantity-term choices of adults were usually reasonable and within relatively small ranges, with only occasional outliers; for example, within 1 to 5 days for the couple going camping or 1 to 3 hours for children watching a movie. The one exception was the trial, "puppies growing up to be mommy dogs," for which two-thirds of adults said "5" or "6" years. We elected to go with the slightly more reasonable number of 4 (only one adult having responded "1").

TABLE 3
Mean Percentage (*SD*) of Accuracy on Individual Trials by Age

	Younger	*Older*	*Oldest*
Minutes			
Bath	42 (50)	70 (47)	80 (42)
Breakfast	29 (46)	45 (51)	70 (48)
Song	33 (48)	40 (50)	80 (42)
Hours			
Movie	58 (50)	70 (47)	70 (48)
Party	67 (48)	65 (49)	80 (42)
Trick-or-treat	79 (41)	40 (50)	40 (52)
Days			
Cold	75 (44)	85 (37)	80 (42)
Camping	79 (41)	75 (44)	100 (0)
Cut	42 (50)	80 (41)	80 (42)
Years			
Dogs	42 (50)	80 (41)	100 (0)
Mommy	46 (51)	65 (49)	90 (31)
Ball Player	21 (41)	55 (51)	90 (32)

($M = 65\%$, 51%; $SD = 31\%$, 28%, respectively), $F(1, 43) = 10.39$, partial $\eta^2 = .19$, $p < .05$. Also, only the older age group had overall above-chance performance, $t(19) = 4.0$, $p < .05$. Only 3 of 24 (12%) younger children were correct on two-thirds or more of the trials, compared with 12 of 20 (60%) of the children in the older age group. These results suggest that overall, children's comprehension of duration words is developing during the preschool years.

Time period analyses. To examine possible duration-word effects, we collapsed the percentage of correct scores on the 12 trials into four summary variables (minutes, hours, days, and years). A 2 (age) $\times$ 4 (time period) ANOVA was then conducted on the data. The results revealed main effects of age (see means in prior section), $F(1, 42) = 10.39$, partial $\eta^2 = .19$, $p < .05$, and time period (*M* and [*SD*] for *minutes, hours, days*, and *years*, respectively: 45% [29%], 64% [34%], 72% [28%], 50% [35%]), $F(3, 126) = 7.00$, partial $\eta^2 = .14$, $p < .05$. These were moderated by an interaction between the two, $F(3, 126) = 3.61$, partial $\eta^2 = .07$, $p < .05$.

This interaction was examined with two sets of follow-up analyses. The first set of analyses examined each time period separately. On both the minutes and the years analyses, the older age group performed significantly better than the younger age group, $t(42) > -2.80$, $p < .05$. However, there was not a significant age difference on hours or days. See Figure 3. The second set of analyses examined each age group separately. For the analyses

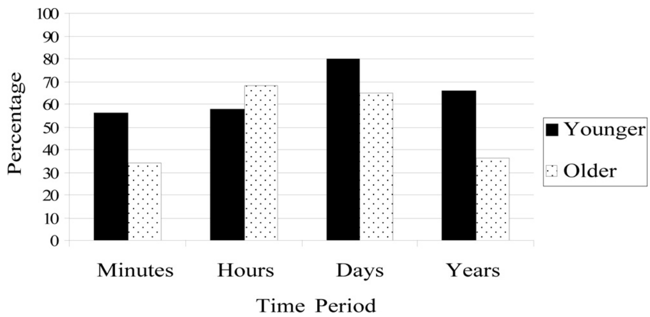


FIGURE 3 Mean percentage of accuracy on time periods by age group.

of the younger age group, children were significantly more accurate on hours than minutes, days than minutes, hours than years, and days than years, $t(23) > -4.1$, $p < .05$. For the older age group, children were significantly more accurate only on days than minutes, $t(19) = -3.19$, $p < .05$.

Children's performance was also compared to chance (50%). The younger age group was significantly above chance on the analyses for hours and days, $t(23) > 2.60$, $p < .05$, but significantly below chance on the analyses for minutes and years, $t(23) > -3.0$, $p < .05$. The older age group was significantly above chance on days, $p < .05$, but was at chance on minutes, hours, and years. In sum, the results of the time period analyses suggest that the preschoolers had only partial understanding of duration words, with days generally being the easiest duration for the children to comprehend.

Individual trial analyses. We followed the analyses of the summary time-duration variables with two sets of tests on individual trials. The first set, comparing the performances of the younger and older age groups on each trial by Fisher exact probability tests, revealed significant differences ($p < .03$) on four trials. Specifically, the younger age group was more accurate than the older age group on one *hours* trial (girl trick-or-treating), and the older age group was more accurate than the younger age group on two *years* trials (puppies growing up to be dogs, boy growing up to be a baseball player), as well as on a *days* trial (a cut getting better).

The second set of tests separately compared younger and older children's responses on each individual trial to chance (50%) with binomial tests. The younger age group was above chance on two *days* trials (a cold that is getting better, a man and lady camping) and an *hours* trial (girl trick-or-treating), $p < .05$. The older age group was above chance on all three *days* trials and on one *years* trial (puppies growing up to be dogs), $p < .05$. Taken together, the results of the individual trial analyses suggest that which phenomena exemplify particular durations will influence children's ability to perform correctly. We return to this point in the Discussion.

Oldest Age Group

Total score analyses. The ten 6-year-olds in the oldest age group were correct 67% of the time on average, performing at an above-chance level, $t(9) = 4.63$, $p < .01$. The mean is somewhat misleading, as most children did very well: Eight of 10 children were correct on 10 of 12 trials. The other 2 children were correct on only 5 trials each.

Time period analyses. Figure 4 shows the mean percentage of accuracy by time period achieved by the oldest age group. We conducted a series of paired *t*-tests to assess possible duration-word differences. The 6-year-olds were significantly more accurate on two tests, days versus hours and years versus hours, $t(9) > -2.4$, $p < .05$. The group's performance was also compared to chance (50%). It was significantly above chance on the analyses for the durations of minutes, days, and years but not hours, $t(9) > 2.30$, $p < .05$, and on 9 of the 12 trials ($p < .05$). Column 3 of Table 3 reveals that the trick-or-treat *hours* trial was troublesome for the majority of the oldest age group, as it was for the older age group. In sum, the oldest group did very well, with most children consistently answering correctly for most questions.

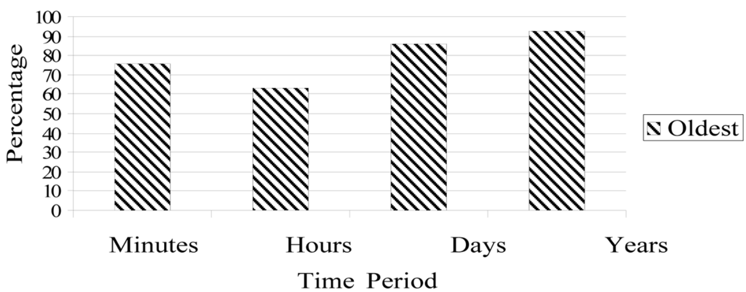


FIGURE 4 Mean percentage of accuracy on time periods for the oldest age group.

Discussion

Several findings from the comprehension study deserve comment. First, our results suggest we were successful in documenting children's limited understanding of time-duration terms. It is clear that even with an easier task requiring only forced-choice, nonverbal responding to stimuli (the duration terms for which adults had agreed on), preschoolers younger than age 6 had a relatively hard time making correct choices about time-duration words. This finding contrasts with Friedman's (1990) findings that even 3-year-olds have some awareness of the relative time durations of common everyday activities *when no specific time terms are used to differentiate them*. Thus, even though old enough to have the ability to judge duration (at least vaguely) of common events, our participants had a difficult time assigning time-duration terms accurately.

Nonetheless, the examination of choices on individual trials suggests that a variety of factors may influence children's ability to make a correct choice. For one, experience—or lack of it—with particular phenomena may influence their choices. Also, older preschoolers may be overly optimistic about the time necessary to acquire skills like surfing, skating, or bike riding. The two older groups' problems in selecting the trick-or-treat picture in response to " . . . what takes 2 hours?" may have been that it was paired with a picture of a boy learning to skate. Some of the children may have chosen the skate picture because they underestimated the difficulty of learning that skill. Moreover, those choices themselves may have been too indistinct. Even though adults typically said it would take "days" to learn such skills, a few did offer "hours" instead. The trick-or-treat and skate pair was the only one violating our restriction that no adults had given the correct choice's duration to the distractor. In addition to specific time-duration terms, our study used a wider range of phenomena for the children to judge than did Friedman's. Exploring further how differences in participants' beliefs and experiences, as well as experimental stimuli, influence time-duration judgments is a matter for future research.

Both our studies and earlier ones agree that there is considerable improvement in the preschool years on time understanding. Eight of 10 (80%) oldest children made no more than two errors, and 6 made only one error, compared with 5 of 20 (25%) children in the older group with two errors or fewer and only 1 with one error and none of the younger group with so few. However, even a few of the oldest children still struggled to make correct choices, and no child performed perfectly.

GENERAL DISCUSSION

Taken together, the studies demonstrate that preschoolers have incomplete knowledge of the meanings of time-duration words and that they organize them into a lexical domain useful for question answering. The first study showed that children use duration terms to answer questions about common phenomena, but they give more appropriate than correct answers to those questions. The second study confirmed their inadequate understanding of duration-word meanings by showing that children younger than age 6 perform poorly even on a simple duration-word comprehension task. Thus, the pattern of lexical organization before individual-term learning proposed as a means of abstract-term learning for toddlers (Shatz, 1993, 2005) holds for preschoolers as well, at least in the realm of time words.

Why might words for time durations be difficult to learn? Time durations are most readily thought of as abstract aspects or characteristics of activities or events, phenomena that extend for varying durations. Children have to learn there are words for the dimension experienced but not visually sensed as color or size are, how those words are ordered, and ultimately what those ordering relations are and how and why they differ across the dimension. Much of this last task is left to specific teaching in the early school years. Before that, children are left largely to their own devices to relate specific phenomena to the time spectrum and whatever words and formats for expressing duration they have gleaned from conversations. The variability with which parents talk about time durations may play a large role in the emergence of time-word vocabulary in children (Friedman, 2002; Hudson, 2002; Weist, 2002). Indeed, in previous work, we found weak support for the learning of specific time durations in the talk mothers directed to young children (Tare et al., 2008), thereby suggesting a reason for the relatively poor performance of the younger groups in our study. Children do hear the words *minutes, hours, days*, and *years*, but the frequency and the uses to which these terms are put vary greatly. The mothers of three children we studied varied in using time words to describe activity durations from 1 in almost 100 utterances to 1 in almost 2,000.

What then is a child to do when confronted with a group of words for which she has no clear and specific meanings? We propose the child employs a strategy of creating a lexical domain, governed largely by usage in conversation, and that such lexical domains only gradually incorporate understandings about the meanings of the individual words within them and the relations they bear to one another. Some understandings will depend on learning about the boundaries between the words, as with color terms. Others will depend on learning a simple and universal ordering relation among them, as with ordinality in numbers; and others will depend on learning more complex and varied ordering relations, as with time-duration words. Not all such relations require overt teaching, but virtually all can benefit from it (see Shatz, Behrend, Gelman, & Ebeling, 1996, on color-term acquisition). Future work should consider how and when children are cognitively ready to learn about such relations and which of them require overt teaching by the child's language community.

Like Piaget, we believe that children's early knowledge of time is very likely grounded in their personal experiences of activity and that it gradually becomes conventionalized through language. Like researchers after him, we found that preschoolers' understandings of time are still incomplete. However, our work goes beyond the earlier work on time in that it provides evidence on how conventional terms enter children's lexicons and can begin to affect their understandings. Like others before us, we grant early conversations a role in vocabulary development. But we suggest in particular that question-answer sequences about abstract dimensions can offer the information children need to engage their conceptual abilities. Importantly, our work also goes beyond the earlier discussions of the cognitive capacities and strategies used for word learning (see, e.g., Bloom, 2000.). We situate time-word learning within the larger context of a general strategy for language learners to use conversations as an entrée into building a lexicon of abstract-word domains even before they know the meanings of individual abstract words.

Our work on acquisition of the time lexicon also has relevance beyond the field of word learning. Understanding time and time language has a role to play in the development of autobiographical memory as well (Nelson & Fivush, 2004). We know that parents can be trained to carry on conversations in ways that can influence their children's memories (Boland, Haden, & Ornstein, 2003). We have offered an argument for how children use conversations to enhance their learning of the abstract language they hear. If parents can be encouraged to use time terms in ways that build on their children's efforts, children might achieve even earlier and better understanding of time-related events and their place in them. In sum, acquiring abstract vocabulary is an integral part of becoming a member of a socio-cultural environment as well as a member of a language community.

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