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Research Article

Preschoolers' Word-Learning During Storybook Reading Interactions: Comparing Repeated and Elaborated Input

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Purpose: Previous research shows that shared storybook reading interactions can function as effective speech and language interventions for young children, helping to improve a variety of skills—including word-learning. This study sought to investigate the potential benefits of elaboration of new words during a single storybook reading with preschoolers.
Method: Thirty-three typically developing children ages 35–37 months listened to a storybook containing novel words that were either repeated with a definition, repeated with no additional information, or only said once. Their receptive word-learning for these novel words was then evaluated via a preferential looking task. We analyzed children's correct looks to target pictures and compared looking behavior across the three levels of presentation.
Results: Results showed that preschoolers demonstrated successful receptive word-learning after a single storybook reading interaction with an adult when target words were repeated, either with or without elaboration. Within this context, elaboration was not required for preschoolers' receptive word-learning.
Conclusions: These results support the use of storybook reading with young children as a way to foster early receptive word-learning and highlight the importance of repeated exposure to novel material either with or without additional semantic information.

In recent years, public health initiatives and campaigns (such as Reach Out and Read, "Got 15 Minutes? Read with a Child," and ParentChild+) have encouraged parents of young children to engage in shared reading experiences to boost early language development. Survey data show that 83% of children between the ages 3 and 5 years old were read to by a family member at least three times a week (Federal Interagency Forum on Child and Family Statistics, 2013), a promising statistic given that early exposure to print has been found to be a strong predictor for later reading skills (Cunningham & Stanovich, 1997). There is also evidence that regular exposure to books from an early age may be important for children's reading and language development as well as academic achievement (Mol & Bus, 2011). Given the evidence that early exposure to books is important, further investigation is warranted regarding the mechanisms that make reading interactions beneficial for young children.

Reading provides a rich context for language learning because children's storybooks tend to include new words that are often emphasized in the text and paired with eye-catching pictures. During shared storybook reading interactions with adults, children receive the benefit of joint attention, which helps lay the foundation for later language and social skills (Tomasello, 2000). Speech-language pathologists have reported using books during therapy to target a wide range of skills including vocabulary, literacy, reading and writing, and articulation (Ukrainetz & Trujillo, 1999). Such interventions have been shown to impact a wide range of language skills (Bradshaw et al., 1998; Crain-Thoreson & Dale, 1999; Yoder et al., 1995) and measures of early literacy (Ezell et al., 2000; Justice & Ezell, 2000). There is also evidence that young children with specific language impairment are able to learn new words from a shared book reading–based intervention (Storkel, Voelmle, et al., 2017). A recent clinical study attempted to help clinicians

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implement effective book-reading interventions for young children by developing benchmarks and providing suggestions for therapy to maximize gains in word-learning (Storkel, Komesidou, et al., 2017). This study is focused on receptive word-learning, in particular the acquisition of new vocabulary from storybook reading.

There is evidence that shared reading activities can increase receptive and expressive vocabulary in preschool-age children who are typically developing (Sénéchal, 1997) and can also lead to gains in expressive vocabulary for preschoolers who are at risk for communication disorders (Justice et al., 2010). Shared reading interventions seem to help early vocabulary development, and there have been many reports about why this may be. There has been support for using an interactive reading style that involves the child (Wasik et al., 2016), inserting pauses before novel words to allow children to make predictions (Read et al., 2019), using questions that place lower demands on children (Blewitt et al., 2009; Walsh & Rose, 2013), and avoiding introduction of new vocabulary items while reading so as to avoid overloading young children's cognitive load (Jimenez & Saylor, 2017).

At times, there appears to be conflicting evidence for how best to improve vocabulary while reading, particularly with regard to the presentation of novel words. Some studies suggest that accompanying novel words with definitions encourages word-learning (Beck & McKeown, 2007; Biemiller & Boote, 2006; Houston-Price et al., 2014). However, other studies have found that simple repeated exposure to material without any extra information added promotes word-learning (Horst et al., 2011; McLeod & McDade, 2011; Penno et al., 2002). One treatment study that investigated the potential benefit of definitional information for word-learning examined the role of elaboration of novel words (Justice et al., 2005). The researchers were interested in whether kindergartners who were at risk for language disorders would be able to acquire new vocabulary from a storybook intervention, how much of this was due to vocabulary ability at study onset, and how elaboration may support expressive word-learning. Children participated in a 10-week-long intervention that featured multiple exposures to texts with target words. Half of all target words were elaborated through an "elaboration sequence" (Justice et al., 2005, p. 23) that involved reading the text in which the word appeared, providing a definition of the word, and then using the word in a sentence. So, the elaboration sequence contained three potentially helpful mechanisms for word-learning: repeated exposure, a definition, and use of the word in an additional context. Children's knowledge of target words was assessed at the end of the intervention.

Results from this study showed that children who received the storybook intervention had greater expressive knowledge of target words than children in a control group. There also appeared to be a strong benefit of elaboration: There were only differences in pre- and postintervention scores for words that were elaborated. Moreover, while children with high vocabularies benefited from elaborated words, children who had been identified as having low vocabularies made the largest gains with elaborated words. Thus, in this case, elaboration may have been particularly important for participants with low vocabularies.

However, there are several methodological components of the Justice et al. (2005) study that bear closer examination. To measure expressive word-learning, the experimenters asked children to provide definitions of target words. This means of assessment may have been biased toward elaborated words; children who received the storybook reading intervention received exposure to formal definitions with each reading, which may have provided an advantage over children in the control group on the basis of definitional skill alone. Providing a definition can be a challenging task for young children, one that requires not only understanding of the word itself but also sufficient language proficiency to explain one word using other words (Benelli et al., 2006). There is also evidence that children's ability to provide correct definitions improves with exposure to definitions and instruction in their creation (Benelli et al., 2006; Kurland & Snow, 1997; Nippold, 1995). Thus, having been given definitions explicitly with the storybooks may have resulted in better ability to generate a definition at test. Children who were presented with the words without the assistance of a formal definition might still understand the meaning of the words, but be less able to verbalize their knowledge.

The two conditions in the Justice et al. (2005) study differed not only in the presence of elaboration but also in the presence of repetition. That is, the elaborated condition included not only more information but also additional exposures to the word itself than the nonelaborated condition. Repetition of words has previously been shown to be helpful in other word-learning situations for preschoolers (Blaiser et al., 2015; Schwab & Lew-Williams, 2016) and younger learners (e.g., Newman et al., 2016). It is possible that the repetition of words, even without the presence of elaboration itself, could explain the benefit.

In this study, we are interested in examining how elaboration and repeated exposure to words impact word-learning with a younger population. While the kindergarten-aged children in the Justice et al. (2005) study benefited from elaboration, it is possible that younger children might not see these same benefits. Elaboration provides additional information that can result in a richer semantic representation (Beck & McKeown, 2007; Biemiller & Boote, 2006), but it also may require additional memory and processing resources that may be less available for younger learners. Linking a novel word to a novel meaning is already a difficult task for young children (see, for example, Deak & Wagner, 2003; Fennell, 2012; Swingley, 2010), and adding additional information could potentially overload their representational capacity. Thus, it is worthwhile to examine whether elaboration is beneficial for this age group.

The current study addresses the methodological components mentioned above by using a developmentally appropriate task that does not rely on expressive language skills to measure receptive word-learning. We also directly compare the effect of semantic elaboration with the effect of word repetition to determine which is having a greater impact on word-learning. Finally, we examine receptive word-learning within a typically developing preschool-aged (35- to 37-month-old) population to see whether elaboration is equally beneficial in a less mature population. We chose to test typically developing children to learn more about the role of elaboration in word-learning during typical language acquisition.

In the context of a storybook reading interaction, children were presented with novel words in one of three contexts: mentioned once (i.e., the "once" condition), repeated a single time (i.e., the "simple repetition" condition), or elaborated with a definition (i.e., the "elaborated repetition" condition). We chose to use informal definitions with simplified language because the typical format of dictionary definitions may be challenging for young children to understand (McKeown, 1993). Children only heard extra semantic information about the word in the elaborated repetition condition, but all target words were presented with a picture of the object.

Children's learning of these words was assessed using a preferential looking paradigm. This paradigm uses children's visual fixation on one of two objects presented on a screen as a way to infer word knowledge—children are told to look for a given object, and if they look appropriately, this is taken as an indication that they have learned the word-to-object mapping. Previous research has found that measurements of children's word knowledge using this paradigm are correlated with those obtained via parent report (Golinkoff et al., 2013). The preferential looking paradigm has been used to assess word-learning in preschool-aged children (Chan et al., 2010; Goldfield et al., 2016) and has several advantages. First, it allows for an assessment of word knowledge without requiring the participant to produce that knowledge explicitly (Golinkoff et al., 2013). As such, it eliminates the possibility that children will give incorrect or incomplete answers due to inadequate expressive language skills. Furthermore, successful performance with this method does not require that children have prior experience with the mode of assessment, as with creating formal definitions. Also, because test images are presented on a screen in front of the child while the examiner is not in the room, this method eliminates the potential for the examiner to inadvertently influence a child's performance on the task. We also take advantage of the temporal information available with this method to investigate how recognition of the newly learned words unfolds over time using cluster-based permutation analysis (Delle Luche et al., 2015; Von Holzen & Mani, 2012; see also Maris & Oostenveld, 2007). While this paradigm assesses whether children have learned the label–object mapping, it does not assess the richness of the semantic representation more generally. Thus, this method of assessment captures initial receptive word-learning but not depth of semantic knowledge.

Given the prior findings from kindergartners, we predicted that preschoolers would show the most robust receptive word-learning when words were elaborated (i.e., as in the elaborated repetition condition), as compared to words that were simply repeated or only mentioned once. Also, the elaborated repetition condition was the only condition that provided additional information about the function, appearance, or location of the object, and previous research has shown that providing children with semantic information helps their word-learning (Blachowicz et al., 2006). However, as noted above, it is also possible that providing additional information could be overwhelming, and thus could overload children's memory skills (resulting in poorer memory), particularly for young children (Jimenez & Saylor, 2017). If so, we would expect enhanced performance for words in the simple repetition condition rather than those in the elaborated repetition condition. We did not have a specific hypothesis regarding temporal differences in children's correct looks to target objects across conditions, but faster looking is generally taken as indicative of stronger knowledge. Moreover, these analyses provide a more sensitive measure than those that collapse across the entire time course of the assessment (e.g., Von Holzen & Mani, 2012).

Although the storybook reading interaction and word-learning assessment in this study occur within a controlled experimental setting and are likely different from children's typical reading interactions, we predict that word-learning patterns will generalize to other settings. Notable differences between the experimental reading interaction and a typical reading interaction may include the lack of background noise and other distractors. Previous research indicates that children's immediate receptive word-learning is not impacted by background noise (Dombroski & Newman, 2014; Riley & McGregor, 2012) or environmental distractions (Dixon & Salley, 2006). Thus, it seems appropriate to suggest that the results of this study could be extended to more typical reading interactions children may experience.

In order to maintain strict control over the acoustic properties of the book presentation, we used a recorded storyteller rather than having the experimenter read the book aloud. This ensures that the experimenter did not provide hints to the child that could influence learning (by reading one type of word more slowly, etc.), but it also may make the learning situation less natural than typical book reading. On the other hand, many children do listen to books with audio recordings embedded in them on a regular basis (Rideout, 2014) and may do so as part of an interactive book-reading situation. There are even companies that advertise books that a nonlocal family member or friend can record themselves reading for their young relative (Hallmark, 2020). As such, this situation of "reading" a book with one person, while a recorded voice tells the story, may not be that unnatural to some children.

Method

Participants

Thirty-three children, aged 35.1–37.2 months, participated in this study. We recruited children from the 35- to 37-month-old range to maintain low variability in age and proximity to the 3-year-old mark. All participants were recruited from the University of Maryland's Infant and Child Studies database. Children were offered a small toy for participation in the study. All participants were English monolinguals, as judged by parental report of current exposure to at least 80% English (range: 90%–100%). See Table 1 for participants' demographic information.

Exclusionary criteria for participant selection included language or hearing impairment and exposure to language(s) other than English 20% or more of the time. One child's data were excluded from the final analysis due to a later reported hearing impairment that had been present at the time of testing, and another child's data were excluded due to a later diagnosed speech and cognition delay that had been present at the time of testing. Participation in this experiment required the participant to remain seated on a parent's lap for a period of 5–10 min. All parents/caregivers were told at the beginning of the experiment that if they wished to stop at any time, they could do so by raising or waving a hand. Children who did not complete the experiment were still offered a small toy for their participation. Potential reasons to stop the experiment included a child becoming restless or upset. One participant demonstrated restless behavior, and the child's parent chose to end the experiment early; this child's data were not included in the final analyses. In total, data from 30 participants (13 boys, 17 girls) ranging in age from 35.1 to 37.1 months (M = 36 months, SD = 0.602) were included in the final analysis.

All parents and/or caregivers of participants were asked to complete the MacArthur–Bates Communicative Development Inventory III (Fenson et al., 2006) and the Ages and Stages 36 Month Questionnaire (Squires et al., 2009). Of the 30 participants whose data were included in the final analysis, six did not return the provided measures. Thus, we collected scores on both measures for 24 participants. Scores on the MacArthur–Bates Communicative Development Inventory III ranged from 15 to 95 (the maximum possible score is 100), with an average score of 57.68 (SD = 21.86); the participants had a range of vocabulary levels. For the Ages and Stages 36 Month Questionnaire, all participants scored within the "typical" range on the Communication and Personal-Social skill domains, as determined by receiving scores above the designated cutoff of 38.7 for both domains. As per parental report, no participants had been diagnosed with receptive or expressive language delays.

Table 1. Demographic information for participants included in final analysis.

Characteristic	Number	%
Gender		
Male	13	43
Female	17	57
Ethnicity		
White	17	57
African American	5	17
Other/biracial	7	23
Declined response	1	3
Maternal level of education		
2-year college	1	3
4-year college	10	33
Master's degree	14	47
Doctoral degree	5	17

Materials

Six color storybooks were created, containing both pictures (real-life photographs) and text. The book was about a child working in a garden for the day and was 16 pages long. The objects chosen to represent the target words were real items; prior to the experiment, we verified with parents that their children did not know the names for the objects. All of the real items chosen to appear in the storybooks were inanimate and were chosen to be equally interesting to children, such that they would not elicit different looking behaviors. The items also were specifically chosen because of the low likelihood that children would recognize the items and therefore know their names. Four of the objects were unusual gardening tools, and two of the objects were unusual fruits/vegetable (for a picture of each object, refer to Appendix A). Therefore, all of the items that were used in the word-learning task were from two semantic categories with which children were unlikely to be familiar. Had the words been chosen from a semantic category with which children are very familiar, for example, animals or toys, it would have been difficult to ensure that the objects were unfamiliar to all participants.

Six nonwords (*needoke, koopa, snirk, zoop, yosh,* and *tydo*) were selected to serve as noun labels in the story. This number of novel words was chosen because it allows for multiple instances of each type of elaboration without being too large, which can be overwhelming for young learners (Christ & Wang, 2012). Three different types of contexts were built to present the nonword, such that the nonword was (a) repeated a single time and elaborated with a definition that included category, function, and/or attribute information (elaborated repetition); (b) repeated a single time without any specific definitional information (simple repetition); and (c) only said once, without any specific definitional information (once). There were six different sentence frames used for the elaborated repetition condition, five different sentence frames used for the simple repetition condition, and four different frames used for the once condition. See Appendix B for all sentence frames used in the storybooks.

We analyzed length (in words) for the sentence frames containing target words; frames in the once condition had a mean length of 20.83 words (SD = 2.66), frames in the simple repetition condition had a mean length of 21.83 words (SD = 2.37), and frames in the elaborated repetition condition had a mean length of 22.67 words (SD = 1.78). An analysis of variance comparing the number of words used to present target words in each condition (as measured by word count) revealed a significant effect of condition, $F(2, 10)$ = 5.48, p = .02, but follow-up t tests revealed no difference in the number of words per condition; elaborated versus simple repetition: $t(20.40) = 0.98$, $p = .341$, Cohen's $d = -0.398$; elaborated versus once: $t(19.19) = 1.99$, $p = .061$, Cohen's $d = 0.812$; simple repetition versus once: $t(21.71) = 0.97$, $p = .341$, Cohen's $d = -0.397$. Regarding syntactic complexity for the sentence frames, all six of the sentence frames for elaborated sentences included complex sentences, one of the five sentence frames for the simple repetition condition included complex sentences, and none of the sentence frames for the once condition included complex sentences.

We created six different storybooks for the study so that each target word could be assigned to different conditions across participants. In all books, the visual objects that represented target words were presented in the same sequence; this was done because the specific visual objects were part of the narrative of the storybook. The pairing of nonword labels (e.g., *koopa, needoke, tydo, zoop, snirk, yosh*) with objects was counterbalanced using a modified Latin squares design. The order of elaboration types in the storybooks was counterbalanced within each order using ABCCBA counterbalancing, and which elaboration type occurred first (the "A" in the ABCCBA counterbalancing) was fully balanced across storybooks. This method of balancing ensured that each visual object and each target word appeared in each condition across the set of participants. To eliminate primacy or recency effects, each storybook contained at least three pages of narrative (that included neither the pictures of objects nor the nonwords used to label them) at both the beginning and end of the story.

We created recordings of the text for each storybook used in the experiment. The recordings were created by a female native speaker of English, using child-directed speech to maintain participants' interest and attention to the story (Fernald, 1985). We used a Shure SM81 microphone to create the recordings and then edited them to ensure a uniform intensity across all individual recordings. For sentences that were the same across all orders (i.e., pages at the beginning and end of the storybook that did not include any target words), we used the same recording across orders. For sentences that contained target words and therefore were not the same across all orders due to counterbalancing, we recorded full sentences (i.e., target words included in sentence frames) separately. We then spliced sentence recordings together to correspond to the sequence of pages in each storybook. The recordings contained tones that signaled when a page should be turned to ensure that all participants were exposed to each page, and therefore to all pictures and printed words, for an equal amount of time. Recorded readings of the storybooks were presented to children via two portable speakers that were placed in the testing room, with an average sound level of presentation between 65 and 70 dB SPL.

Procedure

The researcher began the session by positioning the book in front of the participant, as would be done during a typical joint-reading interaction. She then began playing a recorded reading of the story via loudspeaker from a laptop computer that was set at a predetermined volume level. While the recorded reading was playing, the researcher flipped pages of the book to match the pace of the tones that were included between pages. When target words (nonwords) were highlighted, the researcher pointed to the corresponding picture in the book so that participants could associate the word with its referent. We chose to pair the recorded reading with a live presentation of the book, rather than use an entirely video-recorded presentation, to allow for experimental control while still maintaining some elements of what would be expected in a typical book-reading interaction. Also, there is evidence to suggest that young children may learn differently when the material is presented via screen media as compared to printed materials (Anderson & Pempek, 2005), hence our choice to use a live presentation of the book.

Storybook presentation was followed by a preferential looking task. This task has been used previously to assess word-learning following a training or familiarization phase in preschool-aged children (Chan et al., 2010; Goldfield et al., 2016). Participants were seated in front of a 58-in. TV and saw pairs of images previously labeled in the storybook presented via E-Prime software. At the same time, they heard a pair of sentences (recorded in child-directed speech by the same speaker that recorded the storybook) instructing them to look at one of the two objects on the screen ("Where's the…? Look at the…?"). In between all trials, a short video was played to maintain children's visual attention to the screen and to discourage visual fixation to either side. The study began with two initial practice trials to familiarize participants with the format of the task. During practice trials, participants heard a voice that directed them to look at one of two familiar objects, a cookie or a dog, that was on either the left or right side of the television screen. The practice trials were the same length as test trials (6 s long, with the target word occurring 1.85 s from trial onset); participants did not receive any feedback. After these trials were completed, test trials began, using the target words and images from the story. There were three test trials for each of the six target words, resulting in a total of 18 test trials, presented in random order. Images were paired according to the type of elaboration that they received; for example, items from the elaborated repetition condition were always paired together (e.g., yellow fruit and clippers, claw tool and hose, green vegetable and knee rest), and these pairings were constant across children. Since all of the objects were included in the storybook, looking appropriately required not only recognition of the word or object but also successful object–label mapping. The side of the screen on which the correct image appeared was pseudorandomized such that the correct item did not appear on the same side for more than three trials in a row. Participants' eye gaze during practice and test trials was recorded via a video camera above the television monitor. Participants' parents listened to masking music through supra-aural headphones to avoid bias, both during the story and the preferential looking task. The examiner was not in the room while the child was completing the test trials, such that she was not able to influence the child's looking behavior.

Coding

Participant videos were coded frame by frame by the researcher to record looking times during test trials. The computer program SuperCoder Universal (Hollich, 2008) was used to calculate looking times. If a participant blinked while looking at an object, this was still counted as a look toward the object provided there was no overt head movement away from that side. Test trials in which participants did not look to either the target or distractor object were counted as no-look trials and were excluded from final analysis; this impacted data from 11 participants. For these 11 participants, the average number of no-look trials was less than two (M = 1.45, SD = 0.69) out of 18 total test trials. There were no participants who had more than a single no-look trial within the three test trials per target word. Prior to analysis, there was a plan to exclude data from participants who had no-look trials for all three test trials of a given word; this did not impact data from any of the 30 participants whose data were used in the analysis.

The first author coded all videos; because the coder could only see the child's face and could not see the pictures or hear the words, coding was blind to condition, although the coder was not blind to the hypotheses of the study. A second coder recoded to assess reliability, and any trials on which the two disagreed were juried by a third coder; final data were highly reliable, with correlations across the coders for each participant consistently above .985 (a single exception was r = .969). From these data, proportion of time spent looking to the correct (target) or incorrect (distractor) item in each trial after target word onset was calculated by dividing the number of correct or incorrect looks by the total number of looks to either object. These were then averaged across words of the same type. These analyses were conducted across the entire time window, from target word onset (1,850 ms from the start) to the end of the trial (6,000 ms).

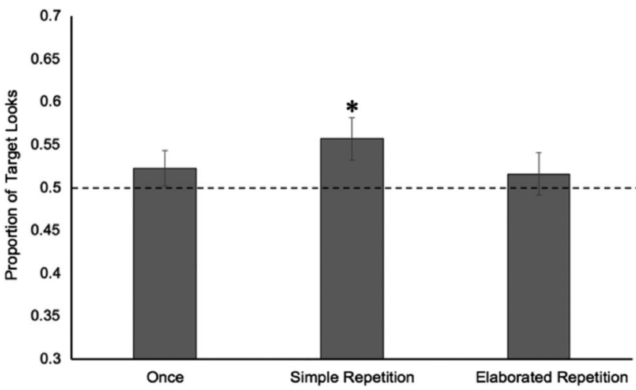
In addition to analyses collapsing across the time window, we also analyzed the time course of children's correct looks to the target object. This approach allows for a more sensitive test of word recognition with greater temporal resolution and can capture smaller differences than an analysis collapsed across the full time course. We used the eyetrackingR package (Dink & Ferguson, 2015) to examine children's looks to the target across the whole time course. For each child, the average proportion of target looks was calculated for bins of 100 ms. This resulted in 60 time bins. We used nonparametric permutation analysis to determine whether children recognized target words, indicating that they learned the label–object mappings, as well as whether there were differences in target looks between conditions. The permutation analysis can be used to identify clusters of time points where two conditions differ from one another across the time course while accounting for multiple comparisons (Delle Luche et al., 2015; Von Holzen & Mani, 2012; see also Maris & Oostenveld, 2007). To investigate whether children recognized words labeled once, twice, or with elaboration, we compared target looks between baseline (0–1,850 ms) and postnaming (1,850–3,700 ms) at each of the matched time bins. A one-sample t test against a chance *mu* value violates the randomization of the data carried out during the permutations. To avoid this issue but still evaluate recognition, we use the novel approach of comparing target looks at baseline (0–1,850 ms) with target looks postnaming (1,850–3,700 ms) and a paired t-test design. This is a time-sensitive analogy to the typical comparison of prenaming versus postnaming target fixation comparisons. We also compared target looks between conditions across the full time course (0–6,000 ms). For each time point, a t statistic is calculated between two conditions of interest, identifying time-adjacent clusters of significant t tests (α = .05). The data set is then randomized 1,000 times, and the sums of significant clusters of t statistics are computed at each randomization. Significant clusters from the actual and randomized data are used to compute a Monte Carlo p value for each time window where a difference is identified. Significance was assessed using a corrected p value threshold of .0083 (Bonferroni correction for six comparisons). In the current study, we use the nonparametric permutation analysis to determine whether children recognized the tested target words and to compare the time course of recognition between conditions.

Results

We first collapsed across the entire time window from word onset (1,850 ms after trial onset) to trial end, and for each condition, we calculated the proportion of total looks (looks to either the target or distractor) in which participants were looking at the target object. We then used one-sample t tests to compare the proportion of total looks to the target object to chance-level looking behavior (i.e., 50% of total looks to either of the two objects). This analysis showed above-chance looking only for words in the simple repetition condition (once: $t(29) = 1.08$, p = .29; simple repetition: $t(29) = 2.31$, p = .028; elaborated repetition: $t(29) = 0.65$, p = .53). Within the simple repetition condition, the difference between correct looks to target (M = .56, SD = .14) and chance-level looking was .06, with a 95% confidence interval of [.006, .108] and a small to medium effect size (Cohen's d = 0.42). Figure 1 shows the proportion of target looks across the three conditions, with chance-level looking marked with a dashed line.

For each condition, we next examined the time course of target looks using the cluster-based permutation analysis. The purpose of these analyses was to provide a more time-sensitive comparison of children's target looks between conditions. Looks to the target object during the baseline (0–1,850 ms) and postnaming (1,850–3,700 ms) windows were compared to evaluate whether children learned and subsequently recognized the target word–object association. We also compared target looks in the postnaming phase between conditions. The time course of target looks for both

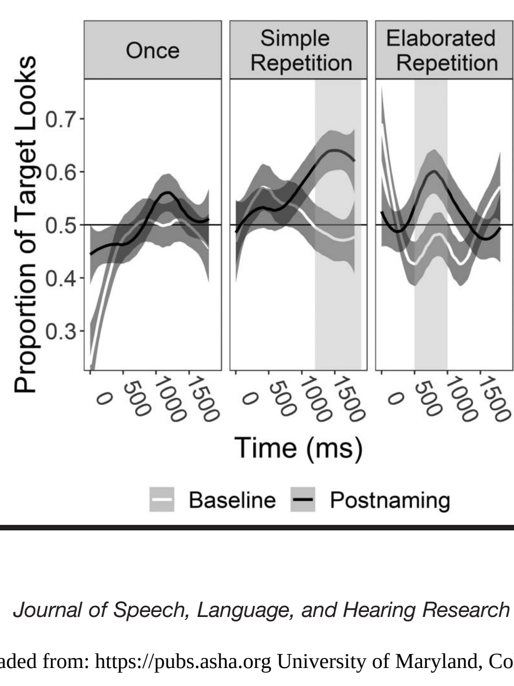
Figure 1. Proportion of correct looks to target image, collapsed across the entire test trial postnaming, is displayed for each condition. A chance-level rate of looking behavior is represented with the dashed line at 0.5. Error bars represent standard error.



baseline (0–1,850 ms) and postnaming (1,850–3,700 ms) for all three conditions are shown in Figure 2. Time window clusters, as identified by the permutation clusters analysis, are indicated by shaded rectangles and summarized in Table 2.

The time course data demonstrate significant evidence of learning in both the simple repetition and the elaborated repetition conditions, but not when the word is said once. Words that had been named twice in the simple repetition condition showed a later increase in looking starting approximately 1,000 ms after word onset; this differed from baseline target looks from 1,200–1,900 ms after word onset

Figure 2. For each condition, the looks to the target image during baseline (0–1,850 ms) and postnaming (1,850–3,700 ms) are plotted. The *x*-axis represents time since start of the trial for baseline and time since target word onset for postnaming target looks. Time windows where target looks in postnaming differed from baseline according to the cluster permutation analysis are indicated by shaded rectangles.



(cluster t statistic = 21.81, Monte Carlo p = .001). Words in the elaborated repetition condition showed an early period of appropriate looking, which differed from baseline 500 to 1,000 ms after word onset (cluster t statistic = 14.75, Monte Carlo p = .005). Although this analysis did identify a cluster showing a difference in target looks from 3,200 to 3,900 ms between the simple and elaborated repetition conditions (cluster t statistic = −18.37, Monte Carlo p = .045), this was not significant after Bonferroni corrections were applied (corrected p value threshold of .0083). Since the two analyses showed significant correct target looks for the simple and elaborated repetition conditions, these results suggest that children learned the label–object mappings for words in both conditions. Although this analysis found no significant difference in target looks for the simple versus elaborated repetition conditions, the effect was earlier for the elaborated repetition in comparison to the simple repetition condition.

Discussion

In this study, children were taught six novel words in the context of a storybook narrative. Novel words were either elaborated with a definition (i.e., the elaborated repetition condition), repeated a single time (i.e., the simple repetition condition), or only said once—such that there were three different ways in which novel words were presented. After listening to the storybook, children's receptive knowledge of these words was assessed with a preferential looking task. When children's looking times for each condition were examined, there was evidence of receptive word-learning for both the words that were simply repeated or repeated with elaboration, but not for words that were only said once.

In essence, the results suggest that children were reliably able to map novel words to objects when they were repeated, regardless of whether additional information was provided or not. Within the context of a preferential looking task, elaboration is thus not necessary for word-learning; simple repetition is sufficient. These results are slightly different from those of Justice et al. (2005), who found that older children (aged 5 years) who were at risk for language disorders showed more successful expressive word-learning when words were both elaborated with a definition and repeated compared to words that were not elaborated and only said once. They interpreted this result as an indication that elaboration aids word-learning. We examined elaboration and repetition separately, and found that typically developing children aged 35.1–37.2 months were able to successfully map newly learned labels to objects in both cases. This suggests that the elaborative information, per se, was not aiding learning for preschool-aged children during a receptive picture identification task. Hearing the word twice, whether with elaboration or not, led to learning within this context. To understand these findings and their implications more fully, it is important to consider differences in word-learning assessments and how repeated

Table 2. Summary of the time clusters identified by the nonparametric permutation clusters analysis.

Condition 1	Condition 2	Cluster time (ms) Start	Cluster time (ms) End	Summed *t* statistic	Monte Carlo *p* value
Once	Baseline	0	200	5.66	.103
Simple rep.	Baseline	1,200	1,900	21.81	.001
Elaborated rep.	Baseline	100	200	−2.05	.399
Elaborated rep.	Baseline	500	1,000	14.75	.005
Elaborated rep.	Baseline	1,200	1,300	2.14	.350
Elaborated rep.	Once	0	300	7.83	.224
Elaborated rep.	Once	2,500	2,700	4.57	.446
Once	Simple rep.	300	500	−6.68	.315
Once	Simple rep.	3,300	3,700	−10.12	.175
Elaborated rep.	Simple rep.	300	700	−11.97	.149
Elaborated rep.	Simple rep.	3,200	3,900	−18.37	.045
Elaborated rep.	Simple rep.	5,900	6,000	−2.37	.611

Note. Start and end times are given in milliseconds after the onset of the trial. rep. = repetition.

exposure and elaboration may impact children's receptive word-learning.

Variations in Measurement of Word-Learning

In addition to differences in participant age, language skill, and risk status, there were two notable methodological differences between the word-learning measurement used in this study and that used by Justice et al. in 2005. These include differences in *how* and *when* word-learning was measured and may explain the different findings regarding the utility of elaboration in word-learning. In this study, word-learning was measured directly after exposure through a low-demand preferential looking paradigm and was judged to be successful if a child could identify the target word from a field of two pictures. In the study conducted by Justice et al. (2005), word-learning was measured a week after exposure through an oral language task and was judged to be successful if a child could form a definition for a target word. Furthermore, the current study involved one reading of the book, whereas the intervention used by Justice et al. 2005) provided children with multiple exposures across time. Given these differences, it would be reasonable to posit that this study assessed a more shallow level of word-learning compared to Justice et al., who assessed a deeper level of word-learning.

The results of this study show that elaboration of novel words is not necessary for children's identification of target words during a preferential looking task; simple repetition is adequate. This finding is consistent with those of other studies using immediate object recognition tasks as a word-learning assessment, which have also found that simple repetition of target words results in successful label–object mapping (Horst et al., 2011; McLeod & McDade, 2011; Penno et al., 2002). Taken together, it appears that when a shallow level of word-learning is assessed, which was not the case for the treatment study conducted by Justice et al. (2005), simple repetition is sufficient. There is also some evidence to suggest that initial fast mapping of target words, as in this study, may lead to later retention of that target word for preschool-aged children (Golinkoff et al., 1992; Wilkinson & Mazzitelli, 2003). Therefore, simple repetition may be beneficial for initial stages of receptive word-learning with young children.

Within this study, elaborated repetition also led to correct object–label mapping, albeit not more than simple repetition. It is possible that the extra semantic information provided in the elaborated repetition condition would have been more beneficial if children had been asked to demonstrate a deeper level of word-learning or been given a different assessment task. For example, if children were asked questions that required knowledge of an item's function or attributes (e.g., "Which one grows on a tree?" or "Which one helps us dig?"), they may have shown improved learning for objects that received elaboration, as this was the only condition that provided such information. Perhaps an assessment that measured a deeper level of word-learning would yield results closer to those of Justice et al. (2005). Thus, the apparent benefits of either simple or elaborated repetition may be dependent on the nature of an assessment task.

Differences Between Elaborated and Simple Input

When we examined children's looking behaviors across the time course of the assessment period, as depicted in Figure 2, we found evidence for receptive word-learning in both the elaborated and simple repetition conditions. This analysis captured minor timing differences in children's correct looks across the two conditions, such that children appeared to recognize the target word earlier for the elaborated compared to the simple repetition condition. Although no differences arose when the two conditions were compared with one another (when accounting for multiple comparisons), this does suggest a difference in speed of recognition.

However, upon closer examination of the time course data, it appears that the earlier period of significant target looks postnaming in the elaborated repetition condition is somewhat similar to the pattern observed at the same (non-significant) time period for words in the simple repetition condition. What does seem to be different between these two conditions was their proportion of target looks at baseline, not postnaming. Thus, the different time periods of significant word-learning may actually be due to different patterns of target looks at baseline rather than different patterns of target looks postnaming, the latter of which would suggest word-learning. Comparing baseline and postnaming looks is typical to establish recognition in intermodal preferential looking studies, and we sought to extend this using a novel approach in time course analysis. Considering the lack of a difference in postnaming looks between the elaborated and simple recognition conditions, drawing definitive conclusions from this would be unwise. A potential difference in recognition time could be the subject of future research.

The present results suggest that children's word-learning was the same across elaborated and simple repetition conditions, despite the differences in the timing of effects between these two conditions. Although there were no length differences, the elaborated repetition sentences contained more information than those in the simple repetition condition. Previous research suggests that providing young children with elaborated information within a book reading task may increase their cognitive load, such that this may not be beneficial for all children (Jimenez & Saylor, 2017). Therefore, it is interesting that we saw similar levels of receptive word-learning in these two conditions that would seem to impart different cognitive loads.

Sentences in the simple repetition condition not only contained less semantic information than sentences in the elaborated repetition condition but also included fewer content words. Many of the elaborated repetition sentences contained multiple content words that could be associated with the novel word, whereas the simple repetition sentences contained nonspecific words. While the simplified input could make word-learning itself easier (fewer other words to process at the same time), it does not provide a semantic framework of related words that could support recognition. Given these differences, the similarity in children's receptive word-learning across these two conditions is noteworthy.

Another difference between the sentence frames used in the simple repetition condition and the elaborated repetition condition concerns their levels of syntactic complexity. Preschool children have been found to struggle to understand complex sentence structures (Kidd & Bavin, 2002). The sentence frames in the elaborated repetition condition all included complex sentences, whereas only 20% of the sentence frames in the simple repetition condition included complex sentences. On the basis of syntactic complexity differences, it is also notable that children's word-learning was the same across both simple and elaborated repetition conditions.

Despite the differences between simple and elaborated repetition conditions, we find that children's recognition of target words is similar across both conditions. Within the context of this study, it appears that the elaboration neither improved children's receptive word-learning over simple repetition, nor did it overload their processing capacities. This is not to suggest that elaboration is unimportant or unnecessary. On the contrary, elaboration is a key component of scaffolded reading experiences, wherein children receive multiple, enriching exposures to concepts or vocabulary. These experiences have been used successfully with kindergartners with communication disorders (Storkel, Voelmle, et al., 2017) and with preschoolers (Justice et al., 2010) to improve language outcomes. In our study, we find that a single, brief exposure to a storybook with words that are elaborated or simply repeated leads to successful receptive word-learning.

Future Directions and Conclusions

In this study, all of the novel words were selected from categories with which children were likely to have relatively lower levels of category knowledge. Given the existing evidence on dense semantic networks and their facilitation of word-learning (Beckage et al., 2010; Borovsky et al., 2016; Steyvers & Tenenbaum, 2005), it is possible that children's relatively sparse semantic networks for gardening and produce may have contributed to the pattern of results seen in this study. Perhaps we would have found a greater advantage for elaboration had we attempted to teach words from familiar categories. Although this was not our focus, future work could investigate how different levels of elaboration facilitate children's word-learning for words from familiar or unfamiliar categories.

This study also presented a storybook within a controlled experimental setting that was likely different from a typical shared reading interaction. The experimental setting lacked background noises and other distractions that may be found in a home or school environment. Although previous research shows that low levels of these factors do not impact initial receptive word-learning (Dixon & Salley, 2006; Dombroski & Newman, 2014; Riley & McGregor, 2012), it is possible that these factors could interact with repetition or elaboration. Perhaps in environments that are particularly noisy or distracting, the extra information provided in elaborated repetition would act as an antidote to the background distraction and thus would be more beneficial than simple repetition. Future research is needed to assess how repetition, elaboration, and background distractions may contribute to children's word-learning.

Related to the experimental setting, in this study, children listened to a prerecorded reading of the storybook. Although the recording contained child-directed speech, it was edited to have a uniform intensity across all words and sentences. While this allowed for greater experimental control, it eliminated the possibility of adult responsivity to the child's interest or behavior. While reading with children, parents often engage their children in conversation about the book (DeBaryshe, 1995; Hoff-Ginsberg, 1991) or use phrases to maintain or focus children's attention (DeBaryshe, 1995; Dickinson et al., 1992). An interactive style of book reading has also been shown to facilitate children's word-earning (Wasik & Bond, 2001). The different effects of elaboration versus simple repetition of new words within a responsive reading interaction would be a subject for future research.

Finally, although we attempted to obtain measures of participants' vocabulary ability from parents, we did not receive completed assessments for all children whose data were included in the final analysis. Thus, it is unclear if children's vocabulary impacted their word-learning. Previous research shows that children with strong vocabularies more readily acquire new words compared to children with low vocabularies (Bates et al., 1988; Hart & Risley, 2003). Future research could examine how children's vocabulary ability interacts with elaboration of novel words during storybook reading interactions.

In summary, the results from this study show that preschoolers can receptively demonstrate knowledge of novel words after a brief exposure during a single storybook reading interaction. Children were able to do this for new words that were repeated, either with or without elaboration. These results suggest that, when teaching new words to young children, it may not be necessary to provide a wealth of semantic information when presenting target words. Rather, it appears that a simple repetition will suffice for early receptive word-learning within typically developing preschoolers. Overall, this study suggests that either elaborated or simple repetition of new material promotes children's receptive word-learning during a shared book reading interaction.

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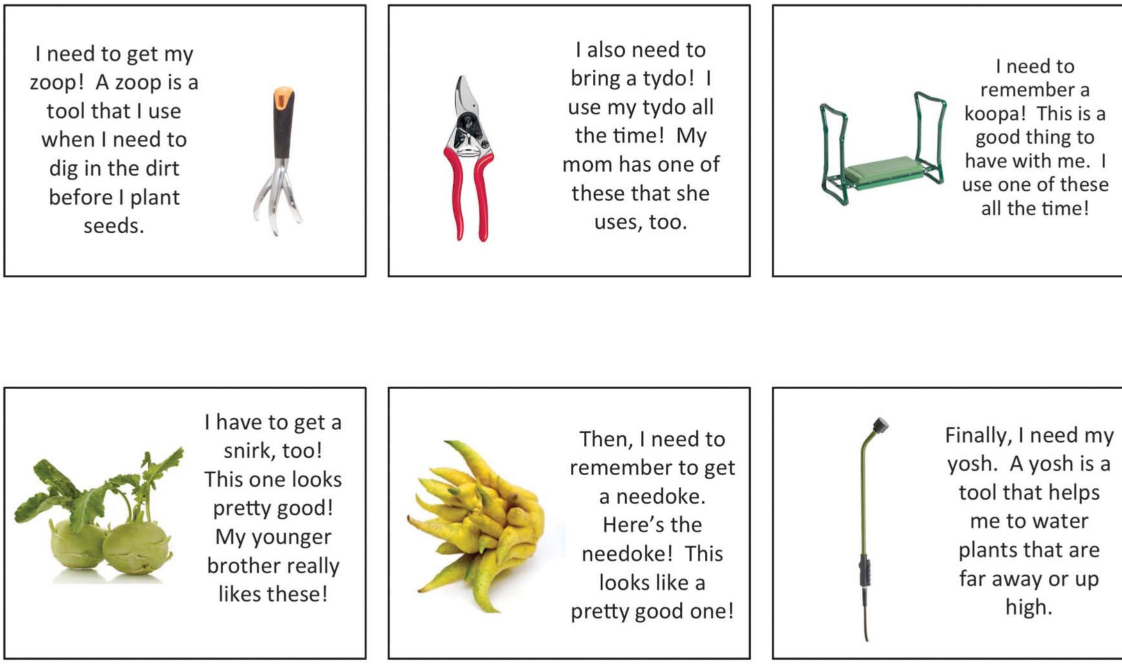
Appendix A

Sample Pages From Storybook



Appendix B

List of All Sentences Used in Storybooks, by Condition

Elaborated repetition sentence frames

- I need to get my [target word]! A [target word] is a tool that I use when I need to dig in the dirt before I plant seeds.
- Finally, I need my [target word]. A [target word] is a tool that helps me to water plants that are far away or up high.
- I can't forget to get my [target word]! I use a [target word] to cut down flowers that are still growing in the ground.
- I also need a [target word]. A [target word] is a type of fruit from Japan that grows on trees and tastes sweet.
- I can't forget my [target word]! I use a [target word] to protect my knees when I have to kneel on the ground.
- First, I need to pick the [target word]! A [target word] is a vegetable that you can cut into pieces and eat in a salad.

Simple repetition sentence frames

- Then, I need to remember to get a [target word]. Here's the [target word]! This looks like a pretty good one!
- I can't forget my [target word]! It's important to have a [target word] when I work in the garden! They're great!
- I need to pick a [target word]. This [target word] looks really nice! I can't wait to take it home with me today!
- First, I need to bring a [target word]! I use my [target word] all the time! My mom has one of these that she uses, too.
- I also need to bring a [target word]! I use my [target word] all the time! My mom has one of these that she uses, too.

Once (no repetition) sentence frames

- I need to remember a [target word]! This is a good thing to have with me. I use one of these all the time!
- I have to get a [target word], too! This one looks pretty good! My younger brother really likes these!
- I also need to get my [target word]. Sometimes my brother uses one of these. It can be very helpful!
- I need to remember a [target word]! This is a really good thing to have with me. I use one of these all the time!