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RESEARCH ARTICLE

Two sides to every story: Children learn words better from one storybook page at a time

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Abstract

Two experiments tested how the number of illustrations in storybooks influences 3.5-year-old children's word learning from shared reading. In Experiment 1, children encountered stories with two regular-sized A4 illustrations, one regular-sized A4 illustration, or one large-sized A3 illustration (in the control group) per spread. Children learned significantly fewer words when they had to find the referent within two illustrations presented at the same time. In Experiment 2, a gesture was added to guide children's attention to the correct page in the 2-illustration condition. Children who saw two illustrations with a guiding gesture learned words as well as children who had seen only one illustration per spread. Results are discussed in terms of the cognitive load of word learning from storybooks.

Highlights:

- This study demonstrates that the number of illustrations in storybooks influences rate of word learning.
- Children who see only 1 illustration at a time learn more words from storybooks. Children who see 2 illustrations at a time do not learn words from storybooks. When a supporting gesture is added, children can learn words in the presence of 2 illustrations.
- Extraneous information hinders word learning from storybooks.

KEYWORDS

cognitive load, extraneous information, illustrations, storybooks, word learning

1 | INTRODUCTION

Sharing illustrated storybooks is a common activity for parents and young children (e.g., Rideout, Vanderwater, & Wartella, 2003) and provides a richer source of vocabulary than everyday conversation (Montag, Jones, & Smith, 2015). Several studies demonstrate that the styles of illustrations influence how well children learn from books

(Ganea, Canfield, Simons-Ghafari, & Chou, 2014; Ganea, Pickard, & DeLoache, 2008; Tare, Chion, Ganea, & DeLoache, 2010; Waxman, Hermann, & Woodring, 2014). However, little is known about how the number of illustrations influences learning. The current experiments investigate how well children learn new words from storybooks when they view one or two illustrated scenes at a time.

Preliterate children rely on illustrations to help them make sense of the story content (for a review, see Wagner, 2013). Specifically, in an eye-tracking study, Justice, Skibbe, Canning, and Lankford (2005) found that 4-year-old preschool children looked longer at the illustrations than the print that accompanied complicated texts, indicating that even with some emerging print awareness, children look primarily at illustrations. In another eye-tracking study, Evans and Saint-Aubin (2005) found that even with a range of illustration styles, preschool children spent the majority of their time looking at illustrations and only 6% of their time looking at the printed text (for similar findings, see, e.g., Roy-Charland, Perron, Boulard, Chamberland, & Hoffman, 2015; Roy-Charland, Saint-Aubin, & Evans, 2007).

Preliterate children have a growing awareness of reading conventions, such as print conveys meaning and is read from left to right and top to bottom (for a review, see International Reading Association & The National Association for the Education of Young Children, 1998; Snow, Burns, & Griffin, 1998). However, because they cannot yet read, young children are unlikely to know when the reader has moved from the left-hand page to the right-hand page. That is, children may be unable to determine which illustrated scene represents which part of the story. Thus, multiple illustrated scenes displayed simultaneously may make it more challenging to associate new words with their illustrated representations.

When learning from picture books, that is, books that include isolated images of one or very few objects or people presented as line drawings or photographs (e.g., Ganea, Preissler, Butler, Carey, & DeLoache, 2009; Ganea et al., 2008), children may be able to use mutual exclusivity to determine which object to attend to. That is, presenting multiple illustrations per spread may not be overly challenging because children may understand that if the left image is a toy telephone, then the word *blicket* must refer to the right image, that is, the chrome wire egg holder (Ganea et al., 2008). Most studies in which children can determine the referent of a novel word using mutual exclusivity do not teach words from storybooks but rather use highly structured experimental designs with novel objects in a referent selection task (e.g., Markman, Wasow, & Hansen, 2003) or images of novel objects in a preferential looking task (e.g., Halberda, 2006). In such cases, 3-year-old children learn words best when another object is present and struggle with only one image at a time (Zosh, Brinster, & Halberda, 2013). A potential explanation for this effect is that word learning involves remembering both what something is and what it is not (e.g., Axelsson, Churchley & Horst, 2012; McMurray, Horst & Samuelson, 2012). However, commercially available storybooks like *The Gruffalo* by Julia Donaldson or *Goodnight Moon* by Margaret Wise Brown (Wise Brown, 1947) often include rich illustrated scenes containing multiple items. How such illustrated scenes influence word learning has been neglected in the word learning from shared storybook reading literature.

Although children struggle to learn object names when only one object is present (Zosh et al., 2013), they also struggle when too many objects are present (Horst, Scott, & Pollard, 2010). Thus, optimal word learning tasks must be not too hard, but not too easy. Indeed, evidence suggests that word learning is particularly challenging for children when increasing amounts of perceptual information are presented. For example, children struggle to learn object names when target object categories are highly variable (Twomey, Ranson, & Horst, 2014), when target objects are presented in less predictable locations (Benitez & Smith, 2012), and with multiple combinations of extraneous objects, rather than the same combinations repeated (Axelsson & Horst, 2014). Such findings are consistent with cognitive load theory (Sweller, 1988, 1989, or see Paas, Renkl, & Sweller, 2003, for a review), which explains how working memory capacity is inherently limited and is especially problematic in situations with extraneous information. Thus, reducing extraneous perceptual information helps children focus on the target information, which then improves learning. For example, Son, Smith, and Goldstone (2008) reduced cognitive load by providing simplified depictions of novel objects and found that this promoted better generalization of novel objects than more complex examples. Whether decreasing the number of illustrated scenes presented simultaneously in a storybook also decreases the cognitive load of word learning from shared storybook reading remains unknown.

In the current experiments, we investigate whether decreasing the number of storybook illustrations presented simultaneously increases preschool children's ability to learn words incidentally from shared storybook reading. All children were presented with three storybooks that included illustrated scenes of a family's activities. The same two novel objects were included across the scenes and were named on the pages on which they were depicted (four pages for each object). Critically, all children heard the same three stories and saw the same 10 illustrations per story; however, the number of illustrations presented simultaneously and guidance varied across conditions. In Experiment 1, children saw either two illustrations (one scene on each page of the open book) or one illustration (only on the right-hand page with the other side blank). Children in a control condition saw a large storybook (cf. Big Book reading, Tse & Nicholson, 2014) with one illustrated scene the same size as the two illustrations combined. If decreasing the number of illustrations also decreases the cognitive load of word learning from storybooks, then children should learn more words when they see only one illustration at a time. In contrast, if the number of illustrations does not affect cognitive load, then children should learn words equally from one- or two-illustration books. In Experiment 2, we investigate whether guiding children's attention to the correct page with a simple gesture helps children focus on the correct page and improves word learning—even with two illustrations.

2 | EXPERIMENT 1

2.1 | Method

2.1.1 | Participants

Thirty-six 3.5-year-old children ($M = 41.99$ months, $SD = 1.76$ months, range = 38.87–45.14 months) participated. Children were monolingual, British-English speakers from predominantly middle-class families. All children were typically developing with no reported speech or language difficulties. Twelve children each were randomly assigned to one of three conditions: one illustration ($M = 41.87$, $SD = 0.65$, six girls), two illustrations ($M = 42.85$, $SD = 0.43$, six girls), or one large illustration (control condition, $M = 41.92$, $SD = 0.45$, six girls). Maternal education accounts for variability in children's vocabulary (e.g., Richels, Johnson, Walden, & Conture, 2013). Because vocabulary scores were not available for children in the current study, we compared maternal education. There was no difference in maternal education levels between conditions (Fisher's exact test = 3.71, $p = .98$). Two mothers each in the one- and two-illustration conditions and three mothers in the control condition had completed high school (General Certificates of Secondary Education and/or A levels) and/or completed a vocational diploma or access course. Eight mothers each in the one- and two-illustration conditions and six in the one large illustration condition had an undergraduate degree and/or an undergraduate degree with a postgraduate certificate (e.g., Postgraduate Certificate in Education, an additional teaching qualification). One mother each in the one-illustration and control conditions had a master's degree, and one mother in each condition had a doctoral degree. One mother in the two-illustration condition and one mother in the control condition declined to answer this question. Parents were reimbursed for travel costs, and children chose a small gift as a thank you for participating (e.g., a colouring book).

2.1.2 | Storybooks

Stimuli included three 10-page storybooks slightly modified from Horst, Parsons, and Bryan (2011): *The Very Naughty Puppy*, *Nosy Rosie at the Restaurant*, and *Rosie's Bad Baking Day*. Each storybook depicted and named the same two novel objects 4 times. There were no other novel words in the storybooks. We only included two targets because preschool children's word learning abilities are limited (Bion, Borovsky, & Fernald, 2013). Each object had a function: The orange inverted slingshot functioned like a hand mixer (*tannin*), and the metal kinetic wheel was used like a rolling pin (*sprock*). Throughout each story, objects were named incidentally and were not the focus of the story. The objects appeared twice on their own pages and twice together. We used real photographs edited with the poster edges

feature in Photoshop to make them look like drawings typical of a commercially available children's book. Across storybooks, there was no difference in the number of words per page, $M = 45$, $SD = 9.34$, $F(2, 24) = 0.98$, $p = .39$.

All children heard the same stories and saw all of the illustrations for each story. The only difference between conditions was the way the storybooks were printed (see Figure 1): Children either heard stories with two A4 illustrated scenes per open spread, one A4 illustrated scene per spread (i.e., the left-hand page was always blank), or one A3 illustrated scene per spread. In the ISO A-series paper system (i.e., European standard), A3 pages (29.70×42.00 cm) are twice the size of A4 pages (21.00×29.70 cm); thus, the A3 condition served as a control condition where the storybooks included only one illustration per spread (as in the one-A4-illustration condition) but included the same overall illustrated area (as the two-A4-illustration condition). Because the one-illustration condition differed from the two-illustration condition in both surface area and amount of items or details, we wanted to include a control condition to disentangle which of these was driving any effects we might obtain. Equating the number of items or details would have precluded presenting all children with the same illustrations; therefore, we chose to test surface area as the control condition. Data from all three conditions were collected at the same time.

When two illustrated scenes were displayed simultaneously (i.e., in the two-illustration condition), these scenes reflected different aspects of the plot so were sometimes set in different rooms or with different characters (see Figure 1). For example, in *Rosie's Bad Baking Day*, page 4 displays the kitchen tools and ingredients Rosie puts on the counter, including the *sprock* and *tannin* among several items, and page 5 depicts Rosie holding the salt instead of the sugar as she is about to stir her dough with the *tannin*.

2.1.3 | Enjoyment ratings

Three emoticons were printed in a row on a single laminated card, and each paired with the responses "liked a lot," "liked a little," and "didn't like" (see also Williams & Horst, 2014).

2.1.4 | Test stimuli

An A4 test booklet with images of four novel objects per right-hand page was used on the test trials (the left-hand pages were blank). On each page, four objects were presented on a plain white background without any other contextual information (see Horst, Parsons & Bryan, 2011). Across test trials, the targets (*tannin* and *sprock*) were presented with four additional novel objects that the children had not previously seen, so that each trial would present children with a different combination and it would not appear that a question was being repeated. Novel objects and their locations varied across trials. Finally, a practice trial page included images of four known objects: a dog, a plane, a duck, and a chair.

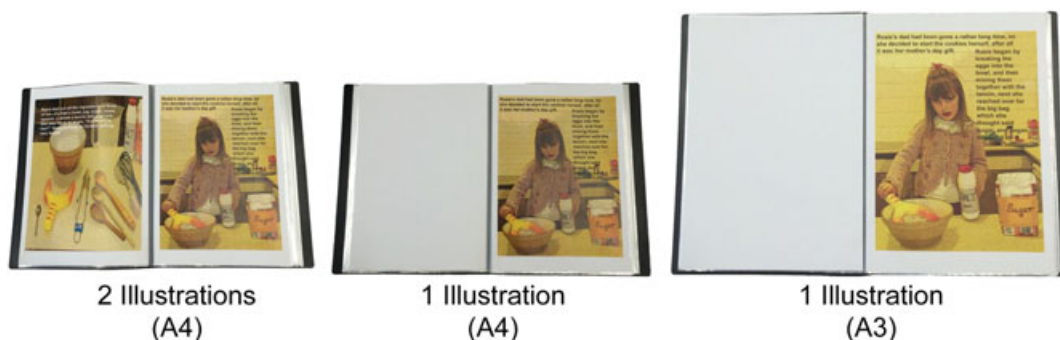


FIGURE 1 Page 5 in *Rosie's Bad Baking Day* as seen by the children in the two-illustration, one-illustration, and one-large-illustration conditions. Note that in the two-illustration condition, page 4 is viewed at the same time as page 5

2.1.5 | Procedure

Each child was tested individually in a children's laboratory at the university. During the reading phase, the experimenter sat opposite the child and held the storybook upright, to her side, with the pages facing the child, like a teacher would when reading to a group of children. The parent sat on a seat in a different corner of the room. All children were read each of the three stories. For each child, all three stories were presented in the same format (e.g., two illustrations per spread). No dialogic techniques, such as giving definitions for novel words or pointing, were used during the readings. Story order was counterbalanced across children.

After each story, the experimenter showed children the enjoyment rating cards and asked children whether they "liked the story a lot," "liked the story a little," or "didn't like the story at all," while simultaneously pointing to the corresponding emoticon. We included this measure to ensure differences in word learning could not be attributed to differences in enjoyment across conditions. Children indicated their choices by pointing to the emoticon, often with verbal confirmation. For half of the children the order enjoyment ratings were presented from "liked the story a lot" to "didn't like the story at all", and for half the children the order was reversed.

After reading the final story, the experimenter tested word learning using the test booklet, which did not include illustrated scenes, rather isolated images of objects. The test phase began with four warm-up trials to get the child used to pointing to pictures in the test booklet and to ensure the child understood the task. Warm-up pages included images of only highly familiar objects. The experimenter opened the test booklet to one of the warm-up trial pages and asked the child to point to one of the familiar objects (e.g., "can you point to the plane?"). Across the four counterbalanced warm-up trials, children were asked to point to an object in each quadrant of the page. Test pages included images of only novel objects; thus, children could not solve these trials by using the process of elimination. On each trial, the experimenter turned to a different test page and asked the child to point to one of the novel objects. In total, children were asked to point to each target novel object twice (see also Werchan & Gómez, 2014). On half of the trials only one target was present (e.g., the *sprock* with three other novel objects), and on half of the trials both targets were present (e.g., the *sprock* and *tannin* with two other novel objects). Trial order, page, and quadrant were counterbalanced across participants.

2.2 | Results

Individual story reading durations ranged from 105 s to 230 s ($M = 146.48$ s, $SD = 2.11$ s). Preliminary analyses indicated no effect of illustration format on children's average reading durations between conditions, $F(2, 33) = 0.23$, $p = .79$, $\eta_p^2 = .01$.

2.2.1 | Enjoyment ratings

Overall, children generally reported that they liked the stories (37%) and liked them a lot (45%). There was no difference between conditions in the total numbers of "a lot," "liked," and "not at all" in children's enjoyment ratings, (Fisher's exact test, $p = .40$). There was also no difference between stories, (Fisher's exact test, $p = .25$).

2.2.2 | Word learning

Children in the one-illustration condition, $M = 0.75$, $SD = 0.34$, $t(11) = 5.14$, $p < .001$, $d = 1.48$, and in the control (one large) condition, $M = 0.75$, $SD = 0.30$, $t(11) = 5.75$, $p < .001$, $d = 1.66$, chose the target objects more than expected by chance (.25) (see Figure 2, left panel). However, with Bonferroni's correction to correct for Type I error ($p = .017$), children in the two-illustration condition did not choose the target objects more than expected by chance, $M = 0.44$, $SD = 0.28$, $t(11) = 2.28$, $p = .04$, $d = 0.66$. Additional analysis confirmed that there was no effect of novel object (*sprock* and *tannin*) on children's responses, $F(1, 33) = 0.34$, $p = .56$, $\eta_p^2 = .01$.

To test for differences between illustration formats, children's proportions of correct choices were entered into an analysis of variance with illustration format (two, one, and one large) as between-subjects factor. The analysis of variance yielded a main effect of illustration format, $F(2, 33) = 4.10$, $p = .03$, $\eta_p^2 = .20$. Planned contrasts showed that

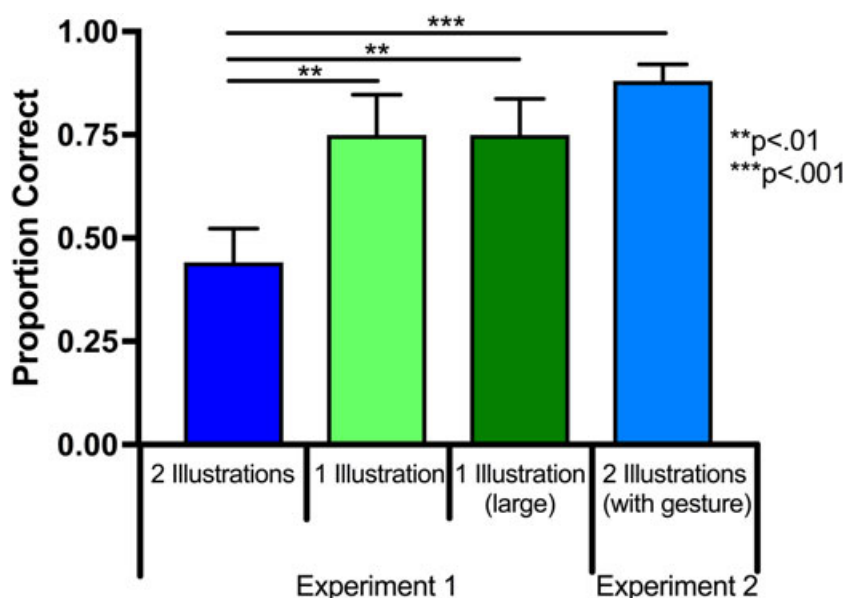


FIGURE 2 Proportion of correct word learning trials for Experiment 1 (left) and Experiment 2 (right). Error bars represent ± 1 SEM

children who saw two illustrations learned words less well than children who saw one illustration per spread, $t(33) = 2.87$, $p = .007$, $\eta_p^2 = .20$. There was no difference in word learning between one illustration in A4 or one illustration in A3 $t(22) = 0.00$, not significant. Thus, illustration size did not affect word learning, but the number of illustrations did.

2.3 | Discussion

Many illustrated storybooks are printed with two illustrations per spread (e.g., *In the Night Kitchen* by Maurice Sendak (Sendak, 1971) or *Dinosaur Roar!* by Paul and Henrietta Stickland (Stickland & Stickland, 1994))—if not more (e.g., *The Incredible Book Eating Boy* by Oliver Jeffers contains six illustrations on pages 7–8 (Jeffers, 2007)). Further, some books include a combination of one or more illustrations per spread (e.g., *The Smartest Giant in Town* by Julia Donaldson (Donaldson, 2002)). Our goal is not to suggest that all of these books be reprinted. However, because young children do not necessarily know when the text is referring to the left- or right-hand page, they may benefit from a nonverbal gesture to look to the correct page. Specifically, a nonverbal signal may help children to focus on the correct illustration at the correct time, thus improving their chances of learning new words from the storybook (cf. Booth, McGregor, & Rohlfing, 2008).

Thus, in Experiment 2, we again read children storybooks with two illustrations per spread but included a quick sweeping hand gesture to indicate which page we were reading from to help focus children's attention to the correct illustration. We chose a sweeping gesture over the other possible techniques to keep the manipulation visual without additional auditory information. We did not use a pointing gesture because it would limit the gesture to a specific area or object on the page, and our aim was to draw children's attention to the general area, or whole page, lest the word learning not be incidental. We also wanted to perform the same gesture on every page, and some pages did not include a novel object, whereas others included both novel objects. Thus, by not pointing directly at the novel objects, this sweeping gesture allowed us to maintain an incidental word learning task (Rice, 1990) as opposed to providing ostensive reference. If storybooks with one illustrated scene per spread are more helpful than storybooks with two illustrated scenes because children do not know which page to look at, then guiding them towards the correct page should improve word learning to similar levels as those from single-illustration displays.

3 | EXPERIMENT 2

3.1 | Method

3.1.1 | Participants

An additional 12 3.5-year-old children ($M = 40.45$ months, $SD = 1.30$ months, range = 38.45–45.03 months, six girls) participated. Children were monolingual, British-English speakers with no reported speech or language difficulties. Two mothers had completed high school (General Certificate of Secondary Education and/or A levels), and seven had an undergraduate degree or an undergraduate degree with a postgraduate certificate. One mother had completed a master's degree, one a doctoral degree, and one declined to provide this information. Parents were reimbursed for travel costs, and children chose a small gift as a thank you for participating (e.g., a colouring book).

3.1.2 | Stimuli

The same stimuli were used as in the two-illustration condition in Experiment 1.

3.1.3 | Procedure

All children were read the two-illustration storybooks. The procedure was the same as in Experiment 1 except that before reading each page, the experimenter smoothly swept her open hand from the top of the page to the bottom, thereby drawing children's attention to the correct page.

3.2 | Results

Individual story reading durations ranged from 131 s to 298 s ($M = 158.86$ s, $SD = 30.45$ s). There was no significant difference in average reading durations between children in this experiment and children in the two-illustration condition of Experiment 1, $M = 148.81$ s, $SD = 20.34$ s, $t(22) = 1.26$, $p = .22$, $d = 0.43$. Thus, adding a simple sweeping gesture only added on average 1 s per page to the time needed to read a story.

3.2.1 | Enjoyment ratings

Overall, children generally reported that they liked the stories (61%) and liked them a lot (19%). Again, there was no difference between stories (Fisher's exact test, $p = .50$).

3.2.2 | Word learning

Children learned the words from the story (see Figure 2, right panel). Specifically, children chose the target object more than expected by chance, $M = 0.88$, $SD = 0.17$, $t(11) = 12.84$, $p < .001$, $d = 3.71$. Again, there was no effect of novel object (sprock and tannin) on children's responses, $t(11) = 0.69$, $p = .50$, $d = 0.20$.

Our goal was to determine whether adding a simple gesture would be sufficient to improve children's word learning from storybooks with two illustrations per spread. Thus, we compared the word learning performance of children in the current study to that of children in the two-illustration condition of Experiment 1. Children who had the additional support to guide their attention to the correct page learned words significantly better than children who did not have that support, $t(22) = 4.58$, $p < .001$, $d = 8.78$.

3.3 | Discussion

In Experiment 2, we investigated whether orienting children's attention to the correct storybook page with a simple gesture while reading could diminish the effects of cognitive load from multiple illustrated scenes found in Experiment 1. Adding the gesture did not significantly increase the amount of time needed to read the story but did significantly improve children's word learning compared to reading without a guiding gesture.

The rates of word learning observed in Experiment 2 are similar to those of other studies using dialogic reading techniques, such as pointing or asking questions (e.g., Elley, 1989; Sénéchal, Thomas, & Monker, 1995; Walsh & Blewitt, 2006). For example, Ard and Beverly (2004) read storybooks to 3- and 4-year-old children either verbatim or with one of three dialogic techniques: added questions, added comments, or both questions and comments. Children learned approximately 75% of the new vocabulary with the dialogic reading techniques included but only 53% with verbatim readings. Although the efficacy of the use of dialogic techniques to improve children's word learning from storybooks is not in doubt, multiple dialogic techniques are often employed in combination, making it harder to compare effects across the literature for individual techniques (see Wasik, Hindman, & Snell, 2016, for a recent review). It is therefore particularly exciting to see that such a simple, imprecise gesture could have such powerful effects on children's learning.

4 | GENERAL DISCUSSION

Across two experiments, we investigated whether decreasing the number of storybook illustrations presented simultaneously increases preschool children's ability to learn words from shared storybook reading. In Experiment 1, we read children 10-page stories with either one, two, or one large illustration per spread. Children learned the new words better when presented with only one illustration per spread, regardless of the image size, even though all children saw the same number of illustrations overall. In Experiment 2, we read children the same stories with two illustrations per spread but added a small sweeping gesture to narrow their field of attention and indicate which page we were reading, thus providing a solution for overcoming the cognitive load burden of multiple illustrations. Although children in this condition were presented with multiple illustrations at once, they were able to focus their attention to learn more words than expected by chance and more words than children who were presented with the same number of illustrations but no guidance on which page to attend to. Taken together, these findings suggest that children's word learning is improved by helping children focus on the relevant information by either reducing the number of illustrations presented simultaneously (Experiment 1) or directing their attention to the correct illustration (Experiment 2). Previous studies have demonstrated that children's word learning is also improved by reading the same short story repeatedly compared to reading one longer story (McLeod & McDade, 2011) or reading different stories (Horst et al., 2011; Williams & Horst, 2014). However, in those studies, the number of illustrations presented to children over the course of the reading sessions differed between conditions (although the number of target word exposures was the same). This study is the first to maintain both the number of target word exposures and the number of illustrations across conditions.

These findings are consistent with cognitive load theory (Paas et al., 2003; Sweller, 1988, 1989), which suggests that extraneous information can prevent optimal learning. The more information children need to think about, the more challenging the task. Consequently, removing extraneous perceptual information may improve learning (see, e.g., Son et al., 2008). For example, kindergarten children are better able to learn information from science lessons when the extraneous information of a highly decorated classroom is removed (Fisher, Godwin, & Seltman, 2014). Similarly, reducing the amount of extraneous information in graphs improves children's mathematics skills (Kaminski & Sloutsky, 2013), and removing extraneous information in ABC books improves alphabet learning (Chiong & DeLoache, 2012). However, children do struggle when the learning situation is overly simplified, for example, when no extraneous information is present (e.g., Zosh et al., 2013). In this study, in the two-illustration format, children are faced with processing additional materials—which in some cases may even provide conflicting information—slowing down the process of word learning. Children do not know when the story moves from one illustration to the other. In contrast, in the one-illustration format, the child is provided with only the relevant scene, which corresponds with the text they are currently hearing, thereby reducing the cognitive load associated with understanding the story and the new words. Similarly, in Experiment 2, children are directed towards the relevant scene, thereby reducing cognitive load.

In the real world, children's literature includes both picture books of decontextualized pictures and stories with rich illustrated scenes. Thus, a single page can have any number of items on it, which adds to the challenge of identifying and determining the referent for a new word. We know the number of items visually presented to children influences learning about both words and objects (e.g., Horst et al., 2010; Oakes & Ribar, 2005; Thom & Sandhofer, 2009; Zosh et al., 2013). In this study, we read children storybooks with illustrated scenes containing multiple items to examine how the amount of extraneous visual information affects incidental word learning. Because the illustrations were rich and complex, there was always at least some distractor item present (cf. Zosh et al., 2013), and children could use the cross-situational regularities across pages to learn the name–object associations via gradual associative learning (see Smith & Yu, 2008; McMurray et al., 2012). Several studies have presented books consisting of simplified drawings (e.g., Ganea et al., 2008) that might have a different effect on word learning (see related findings with simplified objects, Smith, 2003). Thus, future research is needed to further explore the roles of attention and perception in children's word learning from both storybooks with illustrated scenes and picture books with simplified drawings. Furthermore, these findings might differ for older children who have more extensive vocabularies or in children from other socio-economic status or linguistic backgrounds. Future research should also explore how prior vocabulary knowledge interacts with attention in word learning from storybooks.

Although children in the current studies learned target words better when presented with single illustrations, there may be benefits for other types of learning from multiple illustrations. For example, story comprehension may be better supported by having more to look at, particularly as visual attention to illustrations during storybook reading predicts story comprehension (Kaefer, Pinkham, & Neuman, 2016). Therefore, future research is needed to understand how the number of illustrated scenes influences other types of learning from storybooks, beyond that of learning names for objects.

The current findings add to a growing literature on the usefulness of dialogic techniques for teaching words from storybooks. Dialogic techniques include providing definitions (Coyne, Simmons, Kame'enui, & Stoolmiller, 2004), asking children questions (Walsh & Blewitt, 2006), and asking children to point to items on the page (Sénéchal et al., 1995). During shared storybook reading, adult pointing helps children attend to specific items (Roy-Charland et al., 2015) and facilitates vocabulary growth (Sénéchal, 1997). Here, we demonstrate another nonpointing gesture also facilitates word learning from storybooks. Importantly, our sweeping gesture dramatically improved word learning from storybooks without significantly increasing the amount of time it took the adult to read the story. However, we only tested children's ability to learn concrete nouns, but there may be differences in the effect of gesturing on learning other word classes, which might benefit from more specific pointing.

The current findings may also be informative for research comparing e-books (i.e., storybooks presented on screens) with traditional two-illustration paper storybooks. Some studies report a deficit in learning from e-books (e.g., Segers, Takke, & Verhoeven, 2004), whereas others do not (e.g., Korat & Shamir, 2007; Segal-Drori, Korat, Shamir, & Klein, 2010). One explanation for this discrepancy is that e-books often contain added manipulative features, which influences parent–child interactions and affects learning (Parish-Morris, Mahajan, Hirsh-Pasek, Golinkoff, & Collins, 2013). For example, e-books often contain additional games (e.g., de Jong & Bus, 2002) or interactive dictionary features (e.g., Korat, 2009). Previous research indicates that added manipulative features such as pull-tabs hinder learning from paper books (Tare et al., 2010); however, some features of e-books may be helpful in the same way as dialogic techniques by highlighting key information at the right time. Another explanation is that e-books are often viewed only one illustration at a time (e.g., Verhallen & Bus, 2011), which could be an additional confounding factor when comparing between storybook media types. The current findings suggest that such single illustrations help children focus their attention on relevant information and may aid learning especially when children are exploring books without an adult.

This paper is the first to examine how the amount of illustrations (both number and surface area) influences word learning. The current experiments demonstrate that reducing the number of simultaneous illustrations to just one at a time improves children's word learning from shared storybook reading. Given that we do not wish readers to start cutting up their books so they can show children one illustration at a time, we provide a solution for overcoming the cognitive load burden of multiple illustrations—the gesture manipulation in Experiment 2. That is, when it is not possible

to alter the number of illustrations, providing a simple gesture to generally direct children's attention to the correct page provides sufficient support to enable word learning in this otherwise complicated learning situation. These findings have important implications for educational research and suggest that even seemingly minor differences in illustration format and providing scaffolding cues can result in significant differences in how well children learn. These findings should help shape future storybook research design and provide useful practical solutions, which could be used by teachers and parents alike and may inform our understanding of how to create e-books and other media that children may encounter without an adult. Furthermore, in an age of seemingly endless possibilities, they provide a stark reminder that less is sometimes more.

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