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# Optimal Contrast: Competition Between Two Referents Improves Word Learning

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Does making an inference lead to better learning than being instructed directly? Two experiments evaluated preschoolers' ability to learn new words, comparing their memory for words learned via inference or instruction. On Inference trials, one familiar and one novel object was presented and children were asked to "Point at the [object name (i.e., pizer)]." These trials required the child to infer that the novel label referred to the novel object and not to the familiar object. On Instruction trials, a novel object label directly referred to a novel object (e.g., "This is a glark") and no familiar distracter object was shown. We found that although children looked longer at the novel target on Instruction trials, they showed poorer retention of the newly learned label compared to words learned on Inference trials. Hence, we found that inferential learning was superior to instruction. Relevance for optimal learning contexts and education are discussed.

There is intuitive appeal to the notion that we can learn better by removing distractions. The negative impact of distractions has been demonstrated in the classroom (Felmlee, Eder, & Tsui, 1985; Maccoby & Hagen, 1965) and at home (Dixon, Salley, & Clements, 2006; McCartney, 1984; Pool, Koolstra, & Van Der, 2003), where distractions are sometimes irrelevant to the to-be-learned material (e.g., a hyperactive classmate nearby while other students are learning vocabulary). However, what about when the distracters are related to the material being learned (e.g., multiple new vocabulary words presented during a single learning session)? Here too, studies across a wide range of topics suggest that too many competing items can disrupt learning (e.g., in word-learning [Horst, Scott, & Pollard, 2010]; science learning in museum settings [Allen & Gutwill, 2004], target identification in rapid presentations [Shapiro, Raymond, & Arnell, 1997], working memory [Carroll et al., 2010], and long-term memory [Axmacher, Haupt, Cohen, Elgar, & Fell, 2009]). On the other hand, the presence of multiple exemplars has also been shown to aid infants and children in forming categories (Graham, Namy, Gentner, & Meagher, 2010; Quinn & Tanaka, 2007; Waxman, Chambers, Yntema, & Gelman, 1989), remembering hidden objects (Oakes, Kovack-Lesh, & Horst, 2009), and in learning "deeper" relational information (Gentner & Namy, 1999). Thus, the role of competing options in helping or hindering learning remains an open question. Here, we explored the possibility that children might learn new words better when a single distracter is present than under conditions of direct instruction, which remove all items except the target.

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Learning new words is an important challenge for young children. Individual children differ greatly in the size of their early vocabularies. These differences have been associated with the socioeconomic status of the parents or caretakers (Hart & Risley, 1995), which in turn is highly correlated with differences in maternal speech characteristics (i.e., speech complexity; Hoff, 2003; Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002). These differences have long-term implications. First grade vocabulary size is a key predictor of reading skills through 3rd grade for low-income children (Hemphill & Tivnan, 2008). Vocabulary size at age 2 is more predicative of grammatical ability than chronological age among precocious 2-year-olds (McGregor & Sheng, 2005), and predicts language and literacy skills up to the 5th grade (Lee, 2011) and possibly beyond (Cunningham and Stanovich, 1997). Despite the importance of early vocabulary for later cognitive development, there are few guidelines for early educators regarding vocabulary instruction (Beck, McKeown, & Kucan, 2002; Neuman & Dwyer, 2009; Neuman & Roskos, 2005), and vocabulary-based interventions have achieved only moderate success (see Dickinson, 2011 for a review), and are less successful for children who are most at-risk (Marulis & Neuman, 2010).

Children's vocabulary is small relative to that of the adult speakers around them, and it is likely that children often hear words that they do not know. The challenge of figuring out what these new words might refer to is compounded by the fact that, because the surrounding world is filled with many different objects and events, which object is being referred to by a new word may not always be obvious. Researchers have explored the many factors that help guide children's word learning in such ambiguous word-learning situations. This work has revealed that children likely engage domain general perceptual and attentional biases (Hollich, Hirsh-Pasek, & Golinkoff, 1998; Horst et al., 2010; Nelson, 1988; Plunkett, 1997; Samuelson & Smith, 1998; Smith, 1995; Smith, Jones, & Landau, 1996), expectations from long-term memory and pragmatics (Clark, 1990; Diesendruck & Markson, 2001; Landau, Smith, & Jones, 1988; Mervis, Golinkoff, & Bertrand, 1994; Savage & Au, 1996; Tomasello & Barton, 1994), cognitive principles (Bloom, 2000; Markson & Bloom, 1997; Markson, Diesendruck, & Bloom, 2008) and language-specific knowledge (Markman, 1989, 1990; Markman & Hutchinson, 1984; Naigles, 1990) and bring all of these to bear on the problem of learning new words (Golinkoff & Hirsh-Pasek, 2007).

To focus on the situation of interest in the current paper, imagine a case where a child hears a new word and must infer which object is being referred to. For example, consider the case where a preschool teacher gestures to her object-strewn desk and announces to her class, "Children, we got an iPad!" Children who do not already know the meaning of this word might use the teacher's gesture to limit their search to the objects on the desk. However, even with this and other cues in place children may be left with two or more competitors for the referent of "iPad" (e.g., the new electronic tablet, or the new coffee cup that is sitting on the teacher's desk). In the laboratory, researchers have constructed this type of ambiguous naming situation for young word learners by presenting children with a familiar object (e.g., a cup) and a novel object (e.g., an electronic phototube), and asking children, e.g., "Can you give me the dax?" In these situations, children consider and then reject the familiar object as the referent of the novel word "dax," and prefer to map the novel word "dax" to the novel object *phototube* (Carey & Bartlett, 1978; Halberda, 2003; Horst & Samuelson, 2008; Horst et al., 2010; Jaswal & Markman, 2001; Markman & Wachtel, 1988; Merriman & Bowman, 1989; Mervis & Bertrand, 1994; Speigel & Halberda, 2011; *for review see* Halberda, 2006).

What, then, is the role of the other possible referents (e.g., in the aforementioned situation, the cup)? Recently, researchers have explored how the number of competing items present during a learning trial affects performance during the learning and the later retention of a newly learned word. In a recent demonstration, the number of competitors present during the learning trial did not appear to impact children's ability to select the correct referent, as all children tended to choose the novel object in response to hearing the novel word (Horst et al., 2010). However, having three or four familiar competitors present during the learning trial (as opposed to just two) *did* negatively affect children's ability to *retain* this new mapping between the novel word and the novel object. Children were introduced to four novel words over the course a study by Horst and colleagues (2010). After a 5-minute delay during which children played, their memory for the mappings between the novel words and the novel objects was assessed. Children who saw novel words introduced on learning trials that included only two competitors (e.g., rubber pom-pom, car, and duck) successfully remembered which words went with which objects after the 5-minute delay, whereas children who saw novel words introduced on learning trials that included three or four competitors (e.g., rubber pom-pom, car, duck, brush, and block) failed to demonstrate successful memory for the novel word mappings (Horst et al., 2010). The authors concluded that children remember novel words better when those words are introduced with minimal competitors to disrupt their learning. Recent work suggests that highlighting the target object and/or reducing the salience of the distractor objects can help promote retention as well (Axelsson, Churchley, & Horst, 2012). One possible implication of these findings is that children might remember new words even better if there were zero competitor items present during learning. This raises an important open question: does learning via direct instruction (e.g., the child sees a single novel object and hears, “This object is a dax”) result in better retention of novel word meanings than learning via inference (e.g., the child sees a novel object and a known object, and hears, “Can you point at the dax”)? Such a result would be consistent with the expectation that learning is better when ambiguity and distractions are minimized or eliminated.

In a pair of studies, we directly compared these two types of word learning contexts. Using both between-subjects and within-subjects designs, children's reference selection and retention of novel labels was assessed. Our goals were to replicate the success of one-trial *indirect* word learning in which children had to infer the meaning of the new word (e.g., Spiegel & Halberda, 2011), and to compare this to one-trial *direct* word learning in which children were explicitly told the meaning of the new word.


FIGURE 1 Methods for Experiments 1 & 2. In Experiment 1, children were presented with novel target trials in either Inference or Instruction. In Experiment 2, novel target trials alternated between Inference (e.g., Trials 5, 11, and 17) and Instruction (e.g., Trials 8, 14, and 20) (color figure available online).

## EXPERIMENT 1

Children played a simple game in which they were asked to look at and point to objects on computer screens. Over the course of this game, six novel words were presented: either in an indirect Inferential context (e.g., “Point at the dax,” when presented with a phototube and a cup) or a direct Instructional context (e.g., “This is a dax”). Children's looking behavior was measured during these Learning trials. Afterward, we measured children's retention of the new words by presenting them with four of these recently named novel objects and asking, for example, “Out of these objects, can you remember which one was called a ‘dax’?” Children's choices were measured during these Memory trials (Figure 1).

### Method

#### Participants

Participants were 48 full-term children (24 male) from the greater Baltimore area, from families reporting English as the primary language used within the home (i.e., greater than 80% of all utterances). Children ranged in age from 36–42 months (mean = 38 months, 21 days). Sixteen additional children were tested but not included in the final sample (seven for refusing to participate in either the Learning or Memory trials, three for displaying a side bias toward one of the two screens [e.g., only pointing to one of the two screens throughout Learning trials], two for technical issues [e.g., computer froze during Learning trials], two for experimenter error [e.g., not properly placing objects on Memory trial], and two for parental interference [e.g., parent repeated the novel names and/or verbally reinforced the correct object selection during Learning trials]).

#### Stimuli and Procedure

Children sat at a small table, centered between two computer monitors approximately 3 feet away. A curtain surrounded the two screens, and a small opening between the two monitors allowed for a video camera to record children's behavior throughout the experiment. First, children received four practice trials (Figure 1). During these trials, a familiar object was displayed on each screen and a recorded voice asked children to point to one of the two familiar objects. The experimenter and parent reinforced and encouraged children's looking and pointing behaviors during these practice trials only. After the practice trials parents moved to a chair approximately 3 feet behind their children and were asked to remain silent for the remainder of the experiment so that they did not influence children's behavior. The experimenter went behind the curtain, saying that they needed to “start the game” and remained hidden for the duration of the Learning trials.

Visual stimuli consisted of 38 pictures of familiar objects (e.g., cup) and 12 pictures of novel objects (e.g., cotter pin, wooden citrus reamer) (Figure 1). Each object appeared only once during Learning (i.e., Referent-Selection). Novel objects appeared sometimes as labeled targets and sometimes as distractor items (Figure 1). A native English speaker recorded a single token carrier phrase for each object used in the Instruction context (e.g., "This is a [dax]") and one for each object used in the Inference context (e.g., "Point at the [dax]"). Using a between-subjects design, children learned novel words in either an Inference or an Instruction context (Figure 1).

For each Learning trial, one or two objects (depending on trial type) appeared on the screen(s) for 2 seconds, after which the child heard a carrier phrase (e.g., Instruction trials: "This is a ___."; Inference trials: "Point at the ___."), followed by the label for the target object. On Instruction trials, only the target object appeared on either the left or right screen, counterbalanced across trials. After label onset, objects remained on the screen for four seconds. Children's comprehension of the spoken label was measured by their looking and pointing to the target object after label onset.

Trial type varied pseudo-randomly. The particular novel object that was paired with a particular novel label was counterbalanced across children. Trials progressed one after the other with approximately 1.5 seconds between each trial. The total duration of the Learning trials was approximately 3.5 minutes.

After the Learning trials, the experimenter emerged from behind the curtain to administer the Memory trial (i.e., Referent-Retention). The experimenter presented children with real 3-D versions of four of the six novel target objects that had been labeled during the Learning trials, placing them on the table. Only four novel objects were presented on the Memory trial because pilot testing suggested that the presentation of all six novel objects that had been labeled was overwhelming for some children (e.g., some pilot children simply began playing with the objects rather than answering the Memory question). The same four novel objects were presented to all children (drain, hair clip, copper tube, and bottle opener). The novel label had appeared with one of these four objects during the Learning trials. The positions (i.e., which Learning trial the Memory target had appeared on), labels (i.e., which novel word was the Memory word), and objects (i.e., which novel object appeared as the Memory target) were counterbalanced across children. After placing the four novel objects on the table, the experimenter asked the child, "Out of these objects, can you remember which one was called a ["dax"/"blicket"/"pizer"/"lorp"/"tanzer" or "glark"]?" Children were allowed to choose an object either by pointing or by picking up one of the objects. The experimenter would reply, "OK, thank you" and then the experiment was over.

To ensure that the experimenter was blind to the condition, position, and target object, a different lab member chose the condition for each child and the experimenter wore headphones behind the screen during the Learning trials so that they could not hear the labels nor see the images. In this way, the experimenter was completely blind concerning the correct answer on the Memory trial and did not know whether the child had participated in an Inference or Instruction condition.

As in previous studies (e.g., Spiegel & Halberda, 2011), we only queried a single novel object during the Memory trial. Although we would have liked to have tested children's retention for multiple novel labels across multiple Memory trials, pilot work suggested that performance declined with repeated testing. As an alternative approach to testing children in multiple Memory trials, we varied the trial position of the Memory target during the Learning trials (i.e., the Memory target for each child had appeared on either the 5th, 8th, 11th, 14th, 17th, or 20th Learning trial; see Figure 1). Four children were tested at each position for each condition (i.e., Inference or Instruction). Because children were not aware that their memory would be tested, if the group of children succeed at multiple positions it suggests that children correctly remembered more than just one of the novel labels from the Learning trials.

After the experiment, a coder who was blind measured children's looking time to the two screens and final object choice. Coders were extensively trained and intercoder-reliability was required to be above 90% prior to the coding of the experiment.

## Results

Children's correct versus incorrect pointing or reaching response on the Memory trial was compared to the chance level of 25% (because 4 objects were presented) for both the Instruction and the Inference groups. Children who had been presented with new words in an Inference context chose the correct object significantly more often than chance (54% of children chose correctly), one-tailed binomial $p < .01$. In contrast, children who had been presented with new words in an Instruction context performed at chance levels on the Memory test (29% of children chose correctly), one-tailed binomial $p = .39$ (see Figure 2).

One possible interpretation of these results is that the Instruction context, in which only the target object was presented, was not engaging enough for children. Perhaps children did not even look at the target object for very long on these trials. We therefore examined children's looking behavior during the Learning trials to assess how much time children spent attending to the novel target during learning. Total time spent looking at the particular novel target object that was later tested in

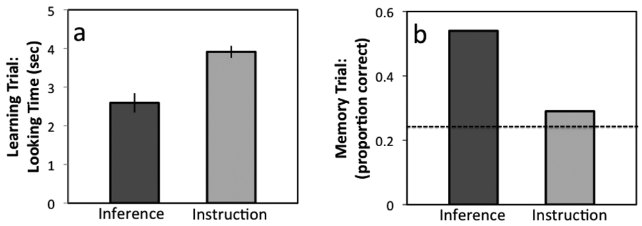


FIGURE 2 Results of Experiment 1: a) Average looking time to the critical novel target object during the Learning trial. Error bars depict standard error and b) Proportion of children who later chose this novel target object correctly on the Memory trial (chance = .25).

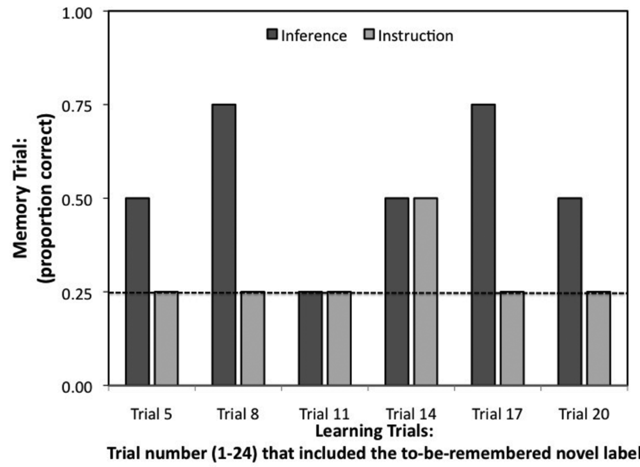


FIGURE 3 Experiment 1: Memory trial performance as a function of the trial in which the novel target had been experienced during the Learning trials ($n = 4$ within each bar).

the Memory trial was coded from the videotapes of each testing session. A planned independent $t$-test found that children looked longer to the novel target object when it was presented in an Instruction context (M = 3.91 sec, $SD = .72$) than in an Inference context (M = 2.59, $SD = 1.15$) (see Figure 2), $t(41) = 4.52$, $p < .001$ (video was unavailable for six children – three children tested in the Inference context and three children tested in the Instruction context). It therefore appears that the observed performance difference on the Memory trial cannot be attributed to a lack of attention during the Learning trials.

Although we only tested children's retention of a single object, all children were presented with six novel labels and novel objects during the Learning trials. One way of assessing how many novel labels children remembered is to examine differences in performance on the Memory trial as a function of item position. Although Horst and colleagues have found better memory for words presented earlier during the Learning trials (Horst & Samuelson, 2008; Horst et al., 2010), this type of primacy effect is not always observed (Spiegel & Halberda, 2011). In the present experiment, we found that children in the Inference context appeared to remember multiple novel labels, as evidenced by their above chance performance across the multiple positions assessed on the Memory trial (Figure 3). In contrast, children in the Instruction context did not show any noteworthy success at any of the trial positions (Figure 3), suggesting that they may have remembered none of the novel labels that were presented during the Learning trials.

## Discussion

Despite previous work suggesting that competition from distracter items may make the retention of newly learned object-label pairings harder for children (Horst & Samuelson, 2008; Horst et al., 2010), the results of Experiment 1 suggest that the presence of a single distracter item may be beneficial for early word learners. Children who experienced a new object label in the context of a competing familiar distracter later remembered the name of the novel object at above chance levels, while children who experienced this label in an Instructional context (e.g., "this is a dax") with no competitors failed to demonstrate memory for these novel labels.

# EXPERIMENT 2

To test the specificity of our results, we attempted to replicate the findings of Experiment 1 using a within-subjects design. In Experiment 2 all children experienced some novel labels in an Inference context and also experienced some novel labels in an Instruction context over the course of the Learning trials. If the effect of the learning context is specific to the individual labels experienced in that context, children should again be above chance for remembering a novel label that had been learned in an Inference context, but should perform at chance in remembering a novel label that had been learned in an Instruction context. In contrast, if hearing words presented in an Inference context is simply more stimulating throughout the Learning task, then all children in Experiment 2 should perform equivalently.

## Method

The method of Experiment 2 was identical to that of Experiment 1, except that now all children heard novel labels in both Inference and Instruction contexts.

### Participants

Participants were 24 full-term children (11 male) from the greater Baltimore area, from families reporting

English as the primary language used within the home (i.e., greater than 80% of all utterances). Children ranged in age from 36–42 months with a mean age of 38 months, 27 days. Six additional children were tested but not included in the final sample (three children had to be excluded for parental interference, two for technical issues [e.g., computer froze during Learning trials], and one for being familiar with one of the novel objects).

### Stimuli and Procedure

The same stimuli and procedure as in Experiment 1 were used with the following exceptions. During the Learning trials, each child saw three novel targets appear in an Instruction context (e.g., "This is a pizer") and three other novel targets appear in an Inference context (e.g., "Point at the dax"). This change was accomplished by using the trial order depicted in Figure 1 and alternating novel label trials between an Inference and Instruction context (Figure 1). We also presented three rather than four novel objects on the Memory trial in an attempt to increase the number of children who could succeed on the Memory trial by reducing the number of distractor items.

Because no item position effect was found in Experiment 1, all children were asked to retrieve the "pizer" on the Memory trial. This object was always the wooden citrus reamer and always appeared as the 5th novel target presented (i.e., the 17th Learning trial). This ensured that the only difference between the two conditions was whether this item had appeared in an Inference or an Instruction context. The experimenter wore headphones behind the screen during the Learning trials and was blind to whether the child had experienced the novel word (i.e., "pizer") in an Instruction or Inference context.

### Results

Children's correct versus incorrect responses on the Memory trial were compared to a chance level of 33% (because 3 objects were presented). Children asked about a novel target that had been presented in an Inference context chose the correct object significantly more often than chance (67% of children), one-tailed binomial $p = .018$. In contrast, children asked about a novel target that had been presented in an Instruction context did not chose the correct object significantly more often than chance (42% of children), one-tailed binomial $p = .359$ (Figure 4).

We again examined looking behavior as a measure of attention to the novel target object during the Learning trial. A planned independent $t$-test found that children looked longer to the novel target (i.e., pizer) when it had been presented in an Instruction context ($M = 4.07$,

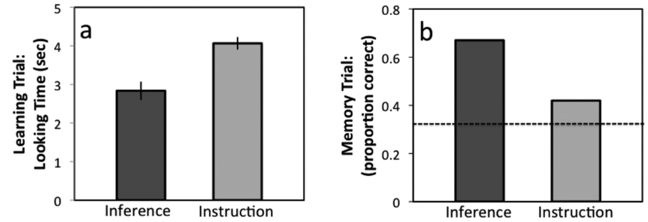


FIGURE 4 Results of Experiment 2: a) Average looking time to the critical novel target object during the Learning trial. Error bars depict standard error and b) Proportion of children who later chose this novel target object correctly on the Memory trial (chance = 0.33).

$SD = .048$) than in an Inference context ($M = 2.84$, $SD = 0.79$; Figure 4), $t(18) = 4.11$, $p < .01$ (video was unavailable for five children: two children whose critical trial was given in an Inference context and three children whose critical trial was given in an Instruction context). The findings from Experiment 2 suggest that children's improved memory for novel object names is restricted to those objects that appeared in an Inference context during the Learning trials.

## GENERAL DISCUSSION

The present experiments demonstrate that word learning by inference can yield better memory for a new word than word learning via direct instruction, in the absence of competing objects. These results do not imply that children cannot learn from direct instruction. Indeed, children can and do learn from both direct instruction and inferential learning and the kinds of information children learn in these settings may differ—with instruction being superior for certain types of learning and inference for others. The present experiments aimed to provide a direct comparison of these two learning contexts within child and in a single setting that closely matched stimuli and the information being learned (i.e., novel object names). We found that children retained novel object names learned via inference but failed to retain those learned via direct instruction. It is important to consider these results in a developmental context.

A number of studies have demonstrated that children below five years of age engage in robust word learning in ambiguous naming situations, where the object being referred to is not made entirely clear (Akhtar, Jipson, & Callanan, 2001; Carey & Bartlett, 1978; Floor & Akhtar, 2006; Halberda, 2003, 2006; Horst et al., 2010; Jaswal & Markman, 2001; Jaswal & Markman, 2003; Rice, 1990). By the age of 36 months, typically developing children have already developed a rich vocabulary base (Bloom, Lifter, & Broughton, 1985) that could empower them to confidently reject competing familiar distracters in order to motivate a mapping from a novel label to a novel target object. However, while children as young as 17-months-old may also succeed at looking longer to novel objects in response to hearing novel labels (Halberda, 2003), children may not rely on the same strategy across development (Hirsh-Pasek & Gollinkoff, 2008; Hollich, Hirsh-Pasek, & Golinkoff, 2000). Consistent with the possibility of strategy change across development, children with smaller vocabularies and children younger than those tested in the current experiments do not appear to make use of inferential reasoning in ambiguous naming situations (Halberda, in revision). Whereas 3- to 4-year-old children often rely on inferential strategies (Halberda, 2006 & present experiments), younger children appear to make use of an associative strategy known as N3C (Novel Name, Nameless Category) in order to motivate a mapping from a novel label to a novel object (Halberda, in revision; Hollich et al., 2000). That is, these younger children appear to simply match novelty with novelty (here, novel words with novel objects). This suggests the possibility that younger children, or children with smaller vocabularies, may lack the vocabulary knowledge and expertise necessary to learn via inference in the ambiguous word learning context tested here. Younger children, who may rely on N3C, might in fact remember novel words better when those words are encountered in an instruction context rather than in an inference context—the opposite pattern to that found here for 3- to 4-year-olds. If verified, this pattern would suggest a developmental shift in the contexts that support robust word learning: a pattern that would recapitulate what has already been observed for learning in formal settings for older learners. It has been suggested that a trade-off between guided and unguided learning interacts with the learners' expertise and with their knowledge surrounding the particular challenge at hand (Sweller, 2006). It may be that, as with the guidance-fading effect in active problem solving (Sweller, 2006) where students benefit from worked examples and direct instruction more as novices than as later expert learners, the children in our experiment may have benefited from direct instruction early in development that enabled them to benefit from active problem solving in our inference context (i.e., active problem solving may not be the most effective context for the earliest word learning [cf. Sweller & Cooper, 1985; Cooper & Sweller, 1987]). The present results suggest that although the presence of too many competitors may hinder children's retention of a newly learned word (Horst et al., 2010), the presence of just one competitor may be beneficial for young word learners.

For learning, both within the classroom (Steffe & Gale, 1995) and within the present experimental contexts, it remains to be determined how inferential learning results in better learning. One possibility, for the present experiments, is that once children are expert word learners they are more engaged by a learning context that they find more challenging. Similar effects have recently been found for decision making and delayed gratification in four-year-olds, i.e., that indirect goal priming is more powerful than explicit instruction for guiding children to adjust their goal settings (Kesek, Cunningham, Packer, & Zelazo, 2011). Changes in motivation are one possible route for the benefits of inferential learning that we found here.

Inferential learning may also require deeper processing on the part of the word learner. In an inference context such as ours, children do not only look at the novel object; instead, they look at a distracting familiar object, reason to eliminate it as a target, and then assign the ambiguous novel label to the novel object. In contrast, in a direct instruction context such as ours, children can simply point to the novel object because there are no other options. Thus, children may need to consider the evidence before them more deeply in our inference context than in our instruction context. The benefits of "depth of processing" on retention of new information have previously been demonstrated and it is one of the foundational results in the study of human memory (Craik & Tulving, 1975).

A third possible contribution to superior learning in inference contexts may be the availability of multiple retrieval cues during learning. The presence of the familiar object distractor during learning can serve later as a route to retrieving the novel name/object (e.g., a cartoon example of how retrieval might work: "I remember I heard "tanzer" on the trial with a book, and here is the novel object that appeared with the book"). In contrast, the routes to retrieval may be less rich when no familiar object distractor is present during learning. The benefits of multiple cues during learning and multiple routes to retrieval have previously been demonstrated (Otani, Widner, Whiteman, & St. Louis, 1999; Tulving & Osler, 1968) and these benefits may be more robust when multiple cues can be grouped into a single memory (Dosher & Rosedale, 1997; Rickard & Bajic, 2004).

We believe that engagement, depth of processing, and routes to retrieval may all play a role in supporting the more robust word learning demonstrated here for inference contexts.

Concerning how inferences may help the acquisition of new knowledge, a minimally guided environment is generally defined as a situation in which the child, or learner, is not receiving information directly but must instead discover it (Steffe & Gale, 1995). Constructivist approaches in education, which are versions of instruction with minimal guidance, have developed under the idea that in order for something to be learned, the learner must construct new knowledge (Handelsman et al., 2004). An important challenge for learners in these contexts is filtering out irrelevant information in order to focus on informative cues (Kirschner, Sweller, & Clark, 2006). In this way, much of the potential developmental shift in children's ability to learn new words in ambiguous contexts may be the result of changes in their ability to determine which are relevant cues and which are irrelevant (Golinkoff & Hirsh-Pasek, 2007).

Learning new words is one of the earliest learning challenges that children face. It begins prior to entering school and it continues throughout the whole of our lives. In the present experiments, we found that optimal contrast in a structured naming environment involving two competing objects leads to better retention of a novel label than presenting that same label in an instructional context with no competitors. The benefits for learning of having a single salient contrast may extend beyond word learning, and these benefits may be similar to the benefits seen in Problem-Based Learning and minimally guided learning in educational contexts.

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