



Testing a word is not a test of word learning



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ABSTRACT

Although vocabulary acquisition requires children learn names for multiple things, many investigations of word learning mechanisms teach children the name for only one of the objects presented. This is problematic because it is unclear whether children's performance reflects recall of the correct name–object association or simply selection of the only object that was singled out by being the only object named. Children introduced to one novel name may perform at ceiling as they are not required to discriminate on the basis of the name per se, and appear to rapidly learn words following minimal exposure to a single word. We introduced children to four novel objects. For half the children, only one of the objects was named and for the other children, all four objects were named. Only children introduced to one word reliably selected the target object at test. This demonstration highlights the over-simplicity of one-word learning paradigms and the need for a shift in word learning paradigms where more than one word is taught to ensure children disambiguate objects on the basis of their names rather than their degree of salience.

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1. Introduction

Building a vocabulary is a critical and impressive early childhood accomplishment, considered both “remarkable” (Waxman & Booth, 2000) and “amazing” (Graham, Poulin-Dubois & Baker, 1998). For example, during toddlerhood children's productive vocabularies increase from roughly three words at 12 months of age and up to 570 words at 30 months of age (Fenson et al., 1994). Based on the sheer rate of vocabulary acquisition such as that seen during the “vocabulary explosion” (Fenson et al., 1994; Hamilton, Plunkett, & Schafer, 2000), children must learn the meanings of *multiple* words in parallel (McMurray, 2007). Nevertheless, attempts to uncover the mechanisms that support children's exponential word learning typically present children with multiple objects but teach children only a *single* novel word.

When children are introduced to only one name in the context of multiple novel objects, they appear to learn that name well. For example, in an influential paper on domain-general learning mechanisms, Markson and Bloom (1997) introduced 3- and 4-year-old children to multiple objects, but only named one of them, and found that children successfully selected the target up to one month after the original naming episode. Comparable comprehension accuracy has been observed after 30-month-old children were directly addressed or listened in on a conversation (Akhtar, Jipson, & Callanan, 2001) and after they received distributed and massed exposures to the

new word (Childers & Tomasello, 2002). These studies suggest that young children are adept at retaining a single new word across a variety of learning situations (see Horst & Samuelson, 2008, for a review).

However, when only one of multiple objects is named and children proceed to select the correct target at test, it is unclear whether children have really learned the correct name–object association and are not simply selecting the target object because it was singled-out by being the only object named during training. Naming increases children's attention to novel objects (e.g., Baldwin & Markman, 1989; Martínez-Sussman, Akhtar, Diesendruck, & Markson, 2011; Mather & Plunkett, 2009). Consequently, a target object may be chosen simply because it appeared more salient and memorable because it was the only object named. Therefore, what should be a test of word learning may become a test of recalling which object was given special treatment. This kind of test is simpler than a test of word learning and may lead children to perform at ceiling. This may explain some of the conflicting findings in the child word learning literature, such as outstanding retention after one week or even one month when tested on a single target (e.g., Childers & Tomasello, 2002; Markson & Bloom, 1997; Waxman & Booth, 2000), but poor retention after shorter intervals such as 5 min when tested on multiple targets (Gurteen, Horne, & Erjavec, 2011; Horst & Samuelson, 2008; Wilkinson, Ross, & Diamond, 2003).

To ensure that children are not choosing the correct object for the wrong reason, rigorous tests of word learning must treat all of the test objects equivalently; each should serve as both a target and a competitor. Naming each test alternative helps ensure children are selecting a target object in response to the phonetic content of its name and not its salience during training or because it was the object most recently presented

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with a name (Axelsson, Churchley, & Horst, 2012; Dollaghan, 1985; Schafer & Plunkett, 1998; Wilkinson et al., 2003). Such tests of word learning in which more than one of the objects are named have typically failed to produce evidence of significant word learning unless they provide highly salient ostensive naming with 2-year-old children (Horst & Samuelson, 2008; Horst, Scott, & Pollard, 2010), memory supports such as increased saliency and repetition with 3-year-old children (Vlach & Sandhofer, 2012), or as many as 12 repetitions with 13- to 17-month-old toddlers (Gurteen et al., 2011; Schafer & Plunkett, 1998).

If treating all of the test alternatives equivalently leads to a more robust test of word learning than singling out one particular named object, then we should expect children to perform differently in these two styles of experiments. To demonstrate this difference, we presented two groups of children with the same objects and either named only one object or named all of the objects present. We presented children with *four objects* because this is common in the literature (e.g., Akhtar & Tomasello, 1996; Akhtar et al., 1996; Diesendruck, Markson, Akhtar, & Reudor, 2004; Moore, Angelopoulos, & Bennett, 1999; Samuelson & Smith, 1998), and because we wanted to use an established method (Akhtar et al., 2001). Moreover, recent research suggests that more than four objects can be too distracting for children even up to 38 months of age (Zosh, Brinster, & Halberda, 2013). Importantly, all children received the same exposure to the four novel objects. However, half of the children were taught one name with the target being the only object named (one word condition); and half of the children were taught one name per object and all of the objects were treated equivalently (four words condition). We chose a maximum of *four words* because current estimates suggest that young children (18- to 30-month-olds) can learn up to four words each day (Bion, Borovsky, & Fernald, 2013; Mayor & Plunkett, 2011), and recent research suggests that 24-month-old children may be able to learn up to four words during an experimental session (Horst & Samuelson, 2008). We tested 2-year-old children because they can complete this task easily without becoming overly tired (e.g., Akhtar et al., 2001), and findings with children in this age group would likely generalize to older children who have even better language skills and working memory capacities. We predicted that only children who were introduced to a single word would demonstrate significant target selection, that is, would perform at above chance levels on a novel name recall test.

2. Method

2.1. Participants

Twenty-four typically-developing children between 22 and 31 months of age ($M = 26$ m, 22 d, $SD = 2$ m, 22 d; 11 girls, 13 boys) participated, and were randomly assigned to either the One Word or Four Words conditions. There was no significant difference in age across the two conditions (one word: $M = 27$ m, 10 d, $SD = 2$ m, 16 d; 23 m, 0 d – 31 m, 3 d; four words: $M = 26$ m, 3 d, $SD = 2$ m, 26 d; 22 m 1 d – 31 m, 24 d, $t(22) = 1.12$, *ns.*). Parents were reimbursed for travel expenses and children received a small gift for participating.

2.2. Stimuli

Four novel, unfamiliar toys served as stimuli: a red, plus-sign-shaped top (*blicket*), a beaded metal spaceship-shape (*chatten*), a blue, plastic rod with a weighted ball on one end (*pizer*), and an orange birdtoy with rope extending from a cone (*toma*). Name-object pairs were held constant to minimize experimenter error (Capone & McGregor, 2005). Four familiar objects also served as stimuli: a block, a cow, a cup, and a train. Four identical opaque, handle-less, yellow buckets were used to conceal the objects during the learning phase.

2.3. Learning phase

The experiment began with the learning phase. The experimenter sat opposite the child and set the four buckets in front of herself, but out of the child's reach. The experimenter first presented the familiar objects, then the novel objects using the same procedure. Each familiar object was shown once. To show an object, the experimenter removed the object from its bucket and let the child handle it while she named it using a set script "Ooh, look at the (*name*). Yeah, see the (*name*)? Wow, look at the (*name*)." (see Woodward, Markman, & Fitzsimmons, 1994). The experimenter replaced each object before continuing; thus only one object was visible at a time.

After the child had seen all four familiar objects, the experimenter removed the buckets and exchanged the familiar objects for the novel objects and replaced the buckets on the table. Then, the experimenter presented the novel objects. Each novel object was shown successively (e.g., *blicket*, *chatten*, *pizer*, *toma*) in two presentation rounds in the same order using the same procedure (Akhtar et al., 2001). In the one word condition, only one of the objects was named and "this one" was used for the other objects. In the four words condition, all four objects were named. Word order and the locations of the objects were counterbalanced across participants. In the one word condition, the one object that was named and its location was also counterbalanced across participants (Table 1). The experimenter always presented objects from left-to-right to minimize experimenter error (Akhtar et al., 2001).

2.4. Test phase

The test phase began immediately after the learning phase. To familiarize the child with the recall task, four warm-up trials were presented using the same four familiar objects from earlier, on a tray divided into four parallel compartments. On each trial, all four objects were placed on a tray and children were asked to "get the (*name*).". Each object was requested once and served as a foil on the other trials. Across trials, the same objects were presented but in different locations. Children received feedback on the warm-up trials with the familiar objects.

The novel word test trials immediately followed the warm-up trials using the same procedure except that children did not receive any feedback. In the one word condition, children received one novel name test trial; and in the four words condition, children received four novel name test trials (one for each named object). The words were presented in the same order (but not same locations) as in the learning phase to keep the timing between first encounter and test the same for all words (Mather & Plunkett, 2009). As on the warm-up trials, each object was requested once and served as a foil on the other trials, and object locations were changed on each trial.

Table 1

Number of children correct for each target word from the children tested on that word. * $p < .05$ (binomial test).

	<i>Blicket</i>		<i>Chatten</i>		<i>Pizer</i>		<i>Toma</i>	
	One word	Four words	One word	Four words	One word	Four words	One word	Four words
Number of correct children (<i>k</i>)	2	3	3*	3	3*	5	3*	4
Number of children tested on this word (<i>N</i>)	3	12	3	12	3	12	3	12
Percentage correct	67%	25%	100%	25%	100%	42%	100%	33%

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