

NOTE

**By any other name: when will preschoolers produce
several labels for a referent?***

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ABSTRACT

Two experiments investigated why preschool children sometimes produce multiple words for a referent (i.e. POLYNOMY), but other times seem to allow only one word. In Experiment 1, 40 three- and four-year-olds completed a modification of Deák & Maratsos' (1998) naming task. Although social demands to produce multiple words were reduced, children produced, on average, more than two words per object. Number of words produced was predicted by receptive vocabulary. Lexical insight (i.e. knowing that a word refers to function or appearance) and metalexical beliefs (i.e. that a hypothetical referent has one label, or more than one) were not preconditions of polynomy. Polynomy was independent of bias to map novel words to unfamiliar referents. In Experiment 2, 40 three- and four-year-olds learned new words for nameable objects. Children showed a correction effect, yet produced more than two words per object. Children do not have a generalized one-word-per-object bias, even during word learning. Other explanations (e.g. contextual restriction of lexical access) are discussed.

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INTRODUCTION

Several studies suggest that preschoolers prefer to assign only one label to an entity (Markman & Wachtel, 1988). They tend to map a novel word onto an unfamiliar object rather than a familiar one (i.e. DISAMBIGUATION EFFECT; Merriman & Bowman, 1989). They also may replace an existing label with the novel one (i.e. CORRECTION EFFECT). These effects often are taken as evidence for a ‘one-word-per-object’ or MUTUAL EXCLUSIVITY bias (Markman, 1989). The bias ostensibly helps children assign new words to objects, because adults frequently assign one dominant label to an object category (Wales, Colman & Pattison, 1983).

Recent findings, however (e.g. Waxman & Hatch, 1992), show that preschoolers can assign multiple labels to an entity. Deák & Maratsos (1998) dubbed this capacity POLYNOMY. They showed three- to five-year-olds representational objects (e.g. dinosaur-shaped crayon) and questioned children to elicit multiple names for the items. Children produced a mean of almost 2.5 appropriate words per object. The words denoted more- and less-inclusive categories from different taxonomies (e.g. *dinosaur*; *crayon*; *animal*). This capacity, in contrast with mutual exclusivity, seems to reflect veridical knowledge of word-world relations – specifically, an entity can be named for all categories to which it belongs.

If preschoolers’ polynomy is replicable and robust, how can it co-exist with a tendency to restrict multiple words for an entity? Does mutual exclusivity limit preschoolers’ ability to apply multiple labels to an entity?

Deák & Maratsos (1998) concluded that polynomy is limited primarily by a child’s lexicon. The number of words in a child’s productive vocabulary predicts how many labels they can produce for a referent. There are other possible limitations, though. For example, some task demands might compel preschoolers to produce several words for an entity, even if they would not assign every label to the object in every situation. Preschoolers might normally assign one word per object, but occasionally produce multiple labels in response to social task demands. A related possibility is that polynomy is limited to certain tasks. It has been shown mostly in naming paradigms, whereas mutual exclusivity effects have been reported mostly in word learning tasks. Perhaps learning a new word inhibits polynomy. A third possibility is that polynomy is limited by lexical and metalexical knowledge: as children gain ability to reflect on word-referent relations, they learn that it is appropriate to produce different words for different aspects of a referent.

Possible limits on polynomy

Preschoolers' ability to produce several words per object might be restricted to tasks with strong demand characteristics. For example, Deák & Maratsos' (1998) methods might have compelled children to produce many words. After a child produced a word, the experimenter probed for other words by asking, 'What else is it?' This implies that there are more labels. To please the experimenter, children might have produced labels about which they were uncertain. For example, they might have named categories associated with, or metaphorically related to, the 'primary' label. Task demands might have impacted children's judgments of pairs of words they had previously produced (e.g. 'Is this a dinosaur AND a crayon?'). They accepted most pairs, but also tended to accept 'foil' pairs (e.g. 'Is this a dinosaur and a paintbrush?'). Thus, social task demands might relax children's criteria for accepting multiple labels.

To control for this possibility, Deák & Maratsos' (1998) labeling task was replicated in Experiment 1 (below), with modifications to reduce social demands for multiple words. The experimenter said nothing to specifically suggest that there are additional labels (i.e. the probe 'What else is it?' was eliminated). In addition, children's confidence about each label was assessed (e.g. 'Are you sure this is a ___?'). This poses a pragmatic challenge to each label, shifting the demand characteristics to discourage production of multiple labels. It also gives children an opportunity to reconsider and reject some labels.

Polynomy might be suspended during word learning. Perhaps mutual exclusivity effects (Merriman & Bowman, 1989) are elicited when children hear a novel word for a nameable object. If children adopt the new word, they might stop producing all other appropriate labels (i.e. FULL correction), or only some words (i.e. PARTIAL correction). Full effect would suggest a one-word-per-object bias; a tendency to accept one label as a default. A partial effect, on the other hand, would suggest temporary dampening of lexical access during word learning. This might reflect the processing demands of word learning (see Liittschwager & Markman, 1994). Alternately, it might reflect selective replacement of labels that seem to overlap in meaning with the new word. The latter would be consistent with a contrast bias (i.e. an assumption that words have distinct meanings; Clark, 1987). Experiment 2 assesses whether children show full or partial correction, and attempts to distinguish between some possible explanations for the effect.

Polynomy might be limited by preschoolers' knowledge about the relations between words and referents. If children access labels without knowing why each label applies, they might produce labels inconsistently. For example they might idiosyncratically replace or disregard appropriate labels in some situations (e.g. word learning). What kind of word knowledge is important?

Calling an entity *dinosaur* in one situation and *crayon* in another might entail knowledge that each word refers to a different aspect (i.e. *dinosaur* refers to the referent's appearance; *crayon* to its function). Alternately, each label might be evoked by association, without conscious reflection or ability to judge that each is simultaneously a persistent, appropriate designator of (some aspect of) the referent. Related questions arise about metalinguistic aspects of polynomy. Preschoolers might limit polynomy because they believe every entity has one label. Preschoolers' beliefs about word-object relations (see Rosenblum & Pinker, 1983; Bialystok, 1986) change and become accessible between three and six years (Gombert, 1992; Karmiloff-Smith, 1992). Polynomy might develop with beliefs about word-referent relations. On the other hand, children's beliefs might be independent of naming. Markman (1976) found that five- to seven-year-olds hold odd beliefs about word-referent relations (e.g. they attribute words' properties to their referents), yet preschoolers use the same words appropriately. Children might produce appropriate words for a referent without insight about the power and flexibility of communication conferred by polynomy.

To address these issues, in a naming task (Experiment 1) we ask children whether each label they produced names the referent's function or appearance. This is similar to the APPEARANCE–REALITY TASK (Flavell, Green & Flavell, 1986) in which children are asked what a deceptive object (e.g. apple-shaped candle) 'looks like' and 'is really [and truly].' Preschoolers, especially three-year-olds, tend to perseverate by answering both questions with the same word (e.g. *candle*). Three-year-olds seem unable to judge whether a word denotes function or appearance. If this impedes polynomy, we would expect three-year-olds to produce fewer words per object than four-year-olds. Note that Deák & Maratsos (1998) found continuous increase with age in the number of words per object produced by three- to five year-olds. Age differences were small, however. Thus, conscious knowledge of what aspect of a referent justifies a particular label might be independent of the ability to produce multiple labels for that referent. To address the second issue, children in Experiment 1 were asked whether a hidden, hypothetical object has one name or more than one name. If children have a default one-word-per-object belief, they should answer 'one name'. We assess whether this predicts children's polynomy.

Disambiguation and polynomy. A related question is how to interpret the disambiguation effect, given preschoolers' capacity for polynomy. Why do children tend to infer that a novel word refers to an unnamed object rather than a nameable one? Although disambiguation is typically attributed to mutual exclusivity, several authors have offered other explanations (Golinkoff, Mervis & Hirsh-Pasek, 1994; Merriman, Marazita & Jarvis, 1995; Deák, 2000). These include, for example, a tendency to associate novel words with novel objects, motivation to fill lexical gaps, and learned

expectations about adults' referential acts. To assess whether the disambiguation bias predicts children's production of multiple object labels, children in Experiment 1 complete a standard disambiguation test.

EXPERIMENT 1

What are the limits of preschool children's ability to conceptualize an entity as a member of multiple categories? Producing multiple object labels might result from automatic processes of lexical access, so every label activated above some threshold is produced. Nevertheless, children might not represent the referent's persistent membership in each labeled category. When three-year-olds call the dinosaur crayon *crayon*, are they confident of the label, of its persistence, and of its co-existence with other labels (e.g. *dinosaur*)? Does he or she know what properties legitimize each label? To answer this, we assessed children's confidence in each label, and asked whether it denotes what the object looks like, and/or how it is used.

Children completed additional tasks. One tested their default beliefs about the number of words for an unseen referent. Children were told that there was something inside a box, and asked whether it has only one name, or several names. Another tested the disambiguation bias (Merriman & Bowman, 1989). Finally, the Peabody Picture Vocabulary Test (PPVT-R) was administered to confirm the relation between polynomy and vocabulary. Deák & Maratsos (1998, Experiment 2) found a significant correlation, but also had sampling bias: the mean PPVT score ($M = 112$, $S.D. = 15.6$) was significantly above test norms. The verbal precocity of the sample might have contributed to their productivity in the naming task. We replicated the task in a more normal sample by recruiting from economically diverse day care centres.

METHOD

Participants

Twenty three-year-olds (11 girls, 9 boys; M age = 3;7, range = 3;0 to 3;11) and 20 four-year-olds (10 girls, 10 boys; M age = 4;6, range = 4;1 to 4;10) participated. All were normally developing monolingual English-speakers. Most were Caucasian. Children were recruited from daycare centres in Nashville, TN, USA. Two children were replaced because their receptive vocabulary was in the 1st percentile (> 2 s.d.s below their age mean). Six additional children (three three-year-olds) were replaced for failure to complete the tasks. Seventeen children (42%) were recruited from preschools in an upper-middle class neighbourhood in Nashville; the others (57%) were recruited from preschools in a lower-middle class neighbourhood.

Materials

Several nameable objects and pictures were used in a warm-up task. Five representational objects were used in the naming task. Representational objects are intended to look like, or represent, one thing and to function like another. We will refer to the former as an object's REPRESENTATIONAL ASPECT and the latter as its FUNCTIONAL ASPECT. The objects included a dinosaur-shaped crayon, a goose sticker, a pirate troll doll, a magnet that looks like a cracker, and a pen that looks like an ear of corn.

Twelve objects (six familiar; six unfamiliar) were used in the disambiguation task. Familiar objects included a fork, drum, belt, toy cat, toy hammer, and scissors. Unfamiliar objects included a melon-ball scoop, maraca, suspenders, toy armadillo, C-clamp, and compass. A black box and a white box, tied with distinctive ribbons, were used in the default belief task.

Session 1 procedure

Children were tested in a quiet room in their preschool. The session began with a brief warm-up. The child played with several objects and pictures. The experimenter informally asked the child to name them in order to orient her or him to the naming task. Children then completed the naming and disambiguation tasks (order was counterbalanced). The default belief question was asked twice (for reliability), before and after one of the other tasks (counterbalanced).

Naming task. The child was shown five objects in random order. The child was asked 'What is this called?' After producing a label the child heard probes to elicit other labels. The probes offered inappropriate words that contrast semantically with an appropriate superordinate (e.g. 'What kind of thing is a dinosaur? Is it a plant?'), or subordinate (e.g. 'What kind of dinosaur is it? Is it a spike-tail?'), label. Note that probe questions combine a contrasting 'foil' with a formulaic semantic cue (e.g. '... kind of thing ...'). To elicit functional aspect labels the experimenter demonstrated the object's function (e.g. wrote with the crayon). If the child did not then produce the function label the experimenter asked 'What do you call something that does this?' For every word the child produced, the experimenter asked 'Are you sure this is a(n) [WORD]?' The experimenter also asked 'Is it called [WORD] because that's what it looks like?' and 'Is it called [WORD] because that's how you use it?' For clarity, these queries were repeated with different wording (e.g. 'Is it called 'crayon' because you draw with it?').

After eliciting individual words the experimenter asked the child to judge the simultaneous applicability of word pairs. For every possible pairing of words the child produced, the experimenter asked 'Is this a(n) [WORD1] and a(n) [WORD2]?' Equal numbers of inappropriate pairs were probed to test for response bias. For example, if the child called an object *cracker* and *magnet*,

the experimenter would ask 'Is this a cracker and a magnet?' (appropriate pair) and 'Is this a cracker and tape?' (foil pair). The number of words a child produced determined the number of pairs judged by the child.

Disambiguation task. Children were shown six object pairs in random order. Children first examined both objects to reduce any novelty bias. The experimenter asked the child to name each object. If the child named the novel object or failed to name the familiar object, the set was replaced. The experimenter then asked, 'Can you show me the [NOVEL WORD]?' If the child did not respond, the experimenter asked the question as a forced choice.

Default word-object belief task. Children were shown a closed, opaque box and told 'I have something in this box, but I'm not going to show it to you. You don't know what's inside the box, right? Do you think there is one word for the thing in this box, or more than one word? I mean, do you think there's only one name for the thing in the box, or does it have a few names?' Order of options (i.e. 'one' vs. 'more than one') was counterbalanced. The content was always referred to with singular syntax, so children would not infer that several items were in the box.

Session 2 procedure

The PPVT-R was given using standard procedures (Dunn & Dunn, 1981).

RESULTS AND DISCUSSION

Naming task

Four-year-olds produced a mean of 2.2 words per object (s.d. = 0.5); three-year-olds produced a mean of 1.7 (s.d. = 0.5). The age difference was significant, $t(38) = 3.2$, $p < 0.01$. Apparently polynomy persists when leading probes are eliminated (e.g. 'What else is it?') and each label is challenged (i.e. 'Are you sure ...?'). Thus, polynomy is not an artifact of social task demands. A 2 (gender) \times 2 (task order) ANCOVA, with age covaried, revealed a non-significant gender effect, $F(1, 39) = 1.8$. The order effect approached significance, $F(1, 39) = 3.7$, $p < 0.07$, but was small ($M = 2.1$ vs. 1.8 words per object; more when the naming task was first). These variables are therefore collapsed in subsequent analysis.

Children were confident of their labels: three- and four-year-olds were 'sure' about $M = 90\%$ (s.d. = 10%) and $M = 89\%$ (s.d. = 14%), respectively, $t(38) < 1$, *ns*. Both ages also accepted most, but not all, word pairs. Three- and four-year-olds accepted $M = 85\%$ and 68% appropriate pairs, respectively; a non-significant age difference ($t(36) = 1.7$). (By comparison, they accepted $M = 34\%$ and 12% of foil pairs.) That preschoolers do not accept all pairs of words they just produced is curious: adults would probably maintain that each label remains appropriate, even if it is not preferred in a given context. Not accepting all pairs might indicate a weak,

context-specific one-word-per-object preference, or a tendency to produce appropriate labels without explicit knowledge of WHY the referent takes each label. Alternately, children might find it odd to be asked, of words they just produced, whether the referent ‘... is a [WORD 1] and a [WORD 2]’. They might respond inconsistently because the question violates conversational conventions.

To assess whether polymony requires explicit awareness of why each label applies to an object, we asked whether each word refers to function or appearance. We must first consider what counts as a correct response. Objects were not completely deceptive (e.g. the crayon does not look exactly like a dinosaur), so it is not wrong to say that an object looks like a member of the function category (e.g. *crayon*). Regardless, children should state that it looks like the representational category (e.g. *dinosaur*). In contrast, the only words children should identify as naming ‘how an object works’ are functional aspect labels. For example, if the child produces *magnet* and *cracker*, the correct responses are that *magnet* names what the object does, and *cracker* (or both *magnet* and *cracker*) names how it looks. To be credited with a correct response for an object, the child had to correctly classify each word for it.

We considered the relation between number of labels produced per object and accuracy of appearance/function judgments. The correlation was $r = 0.29$ ($p = 0.08$), with age and receptive vocabulary partialled out. Comparing age groups, three-year-olds did not exceed the percentage of correct appearance/function answers expected by chance ($M = 52\%$, S.D. = 28%), but four-year-olds did ($M = 67\%$ correct, S.D. = 21%), $t(19) = 3.7$, $p < 0.005$. The age difference was not significant, though; $t(38) = 1.9$, $p < 0.08$. This implies that knowing why a referent takes a label is an aspect of lexical knowledge that continues to develop into kindergarten. The data also suggest that polymony does not depend on this ability. That is, three-year-olds can appropriately and confidently label an item *dinosaur*, *animal*, and *crayon* in response to specific probes, yet fail to correctly judge what aspects of the referent warrant each label.

Disambiguation task

Children showed a strong tendency to map novel words onto unnamed objects: three-year-olds chose $M = 4.8$ out of six unfamiliar objects (S.D. = 1.1); four-year-olds chose $M = 5.3$ out of 6 (S.D. = 1.2). There were no significant effects of age, sex or task order.

Default belief task

Three-year-olds asserted that an unseen object has only one name $M = 64\%$ of the time (not above chance; $t(17) = 1.8$, $p < 0.10$). Four-year-olds did so $M = 52\%$ of the time. These means were not significantly different, $t(36) =$

11. Five children (two three-year-olds) inferred that both unseen objects had more than one name; 11 children (seven three-year-olds) inferred that both had only one name. These results, though tenuous, suggest that individual preschoolers hold a range of default beliefs about the permissibility of multiple labels for an entity.

PPVT-R. Children's standardized scores were $M = 103.4$ (s.d. = 14.8), similar to the national norm ($M = 100$, s.d. = 15; Dunn & Dunn, 1981). Age-standardized scores of three- and four-year-olds did not differ ($M = 104.4$ and 102.5 , respectively).

Inter-task relations. Several theoretical questions concern performance across tasks, especially with respect to a child's productivity in the naming task. Correlations between number of labels per object, number of novel objects chosen in the disambiguation task, number of one-word answers in the default belief task, and receptive vocabulary (PPVT-R) were calculated, with age partialled out. Coefficients are shown in Table 1. Most notably,

TABLE 1. *Correlations between number of words produced (naming task), number of unfamiliar objects chosen (disambiguation task), number of 'one name' answers (default belief task), and PPVT-R scores, with age in months partialled out*

	Unfamiliar objects	'One name' answers	PPVT
No. words produced	0.29†	-0.35*	0.57**
No. unfamiliar objects		0.13	0.44*
No. 'one name' answers			-0.34*

$df = 35$; † $p < 0.10$; * $p < 0.05$; ** $p < 0.005$.

almost one-third of the variance in polynomy is predicted by vocabulary ($R^2 = 0.32$). The number of labels produced per object depends on the child's lexicon. Note, though, that even children with low-average vocabularies ($n = 17$; PPVT $M = 90$, s.d. = 7) produced $M = 1.8$ (s.d. = 0.6) words per object.

Children who produced more words per object showed a non-significant tendency to guess that unseen objects have more than one name, $r = -0.21$ with age and vocabulary partialled out. Apparently, a default belief that things have multiple labels is unnecessary for polynomy. Children who consistently answered 'more than one word' produced more labels than children who consistently answered 'one word' ($t(14) = 2.6$, $p = 0.02$), yet the latter still produced $M = 1.7$ (s.d. = 0.5) words per object, and were confident about $M = 95\%$ of these.

Number of unfamiliar objects chosen in the disambiguation task is not significantly related to number of words produced in the naming task ($r =$

0.04) when age and vocabulary are partialled out. Correlations with the disambiguation performance must be interpreted cautiously because scores are not normally distributed. Most children ($n = 29$, 72%) showed a strong disambiguation bias (i.e. chose five or six out of six unfamiliar objects), and most ($n = 32$, 80%) produced two or more words for at least four objects in the naming task. Thus, the two tasks are not statistically independent: most children show the same patterns of performance on both tasks. Preschoolers produce several words for an object, and tend to map novel words to novel objects. Consistency of novel object selection increases with vocabulary ($r = 0.44$, $p < 0.05$, with age partialled out). Perhaps children with larger, better-consolidated lexicons can consistently retrieve a familiar object's conventional labels, recognize that none of these matches the novel label, and therefore assign the latter to another (hard-to-name) object. This does not necessarily entail a GENERALIZED belief that every referent has but one label (note that mapping novel words to unfamiliar objects is independent of the belief that an unseen referent has one name). Nevertheless, polynomy might co-exist with a PREFERENCE to assign one preferred label to each referent, or an expectation that adults will use the most common appropriate label for a referent.

The data also suggest that polynomy is not elicited by very specific task demands. This complements evidence of polynomy in a range of tasks using different stimuli (e.g. story characters), words (e.g. social categories), and prompts (see Clark & Svaib, 1997; Deák & Maratsos, 1998). On a practical level, polynomy should facilitate communication. Circumstances that render one word (e.g. *crayon*) ambiguous (e.g. referring to one object in a large box of crayons) leave another word (e.g. *dinosaur*) unambiguous. Polynomy allows speakers to select or highlight different aspects of an entity. Vocabulary, and knowing whether a word refers to function or appearance, jointly account for about 40% of the variance in productivity (i.e. $R^2 = 0.32$ plus partial $R^2 = 0.08$, respectively). These aspects of lexical knowledge predict a child's ability to select labels that highlight distinct aspects of objects.

The data also show that polynomy does not require sophisticated beliefs about word-referent relations. An intriguing question is whether children's explicit beliefs change as they notice that people sometimes use different labels for a referent, or as increasing vocabulary and the demands of expanding communication jointly support increasingly flexible naming behaviours.

The results show that polynomy is related to lexical knowledge, but independent of (some) metalexical knowledge. This does not resolve the apparent discrepancy between children's polynomy and mutual exclusivity. The coexistence of polynomy and the disambiguation bias also fails to resolve the discrepancy, in part because the tasks differ in stimuli and responses, and

in part because disambiguation is itself ambiguous. An outstanding question, then, is whether polynomy is restricted in word learning situations.

EXPERIMENT 2

Preschoolers have no general one-word-per-object bias, but they might adopt a temporary one-to-one preference when they hear a novel word. In this situation, children might choose categorically between a new word and a known word for a referent (i.e. full correction).

A less extreme possibility is that novel words reduce the probability that a child will access any given label (i.e. partial correction). This could reduce the cognitive demands of word learning (e.g. memory load, resolution of indeterminacy, attention switching, etc.). Consistent with this hypothesis, Liittschwager & Markman (1994) found an increased correction effect in one-year-olds under increased inductive demands (i.e. learning two words vs. one).

This possibility suggests that polynomy rests on normal processes of lexical access, which are moderated by certain contextual factors. Under some conditions, children might behave as if they have a one-word-per-object bias. The first step in understanding the correction effect is to find whether it is partial or full. The naming task provides an ideal test: if correction is partial, children taught new words for test objects should reduce the number of known labels produced, but still produce more than one word per object. If children produce approximately one word per object after learning new labels, it will suggest a full one-word-per-object bias.

Children were taught novel words for three of the six naming task objects. We chose objects for which children produce a mean of approximately two familiar labels, so partial correction could be detected. After learning a new word, children were prompted to produce novel and familiar labels. By comparing the number of known words produced for objects for which children learned a new word (hereafter, *NEW-WORD OBJECTS*) to the number produced for objects *not* given a new word (hereafter, *CONTROL OBJECTS*), we can evaluate the extent of the correction effect.

An ancillary question is how input about a new word affects whether children correct known words or reject the new word. Does quality of input help children integrate a new word with existing words? When children are taught a new word by ostension (i.e. pointing and saying, 'This is a ___') with no explicit information about meaning, they might reject the new word or haphazardly replace known words. In contrast, if children are told a definition that specifies the new word's semantic differences from known words, they might integrate the new word with known words (Banigan & Mervis, 1988; Waxman, Shipley & Shepperson, 1991).

METHOD

Participants

Twenty three-year-olds (11 girls, 9 boys; M age = 3;7; range = 3;3 to 3;11) and 20 four-year-olds (14 girls, 6 boys; M age = 4;5; range = 4;0 to 5;1) participated. Participants were normally developing monolingual English-speakers recruited as in Experiment 1. Two children were replaced for failure to complete the tasks.

Materials

Six representational objects from Deák & Maratsos (1998) were used: the dinosaur-shaped crayon, the car-shaped book, the corn-shaped pen, the metal toyshop box, the goose sticker, and the Dalmatian hand puppet. Objects were arbitrarily divided into two sets of three objects. Novel words and definitions were created for each object (see Appendix). Definitions for set A (book, crayon, and pen) specified representational categories. Definitions for set B (box, puppet, and sticker) specified functional categories. This allowed us to assess whether correction is specific to a new word's meaning. Infrequent English words and English-like neologisms were used to increase the words' plausibility.¹

Procedure

Children were tested individually during two sessions up to three days apart. The first session lasted about 10 minutes and the second lasted about 25 minutes.

In session 1 the experimenter taught the child novel words for each of three objects (either set A or set B). Children were randomly assigned to learn words for set A or B objects, hereafter called the NEW-WORD OBJECT set. The remaining set served as control objects. Half of the children (randomly assigned) were taught by ostension: the experimenter held up the object and said the new word in several count-noun frames (e.g. 'This is a __. Can you say __?'). The label was given at least six times. The other half was taught definitions for the words. Each definition was repeated three times; the label was repeated at least six times while giving the definition.

In session 2 the experimenter reviewed the novel words. Children were prompted to produce labels (both new and known) for objects in both sets, using prompts like in Experiment 1. New-word objects were always tested

[1] Although this introduces possible contamination by lexical knowledge, the low-frequency English words – *niblet*, *roadster*, and *tin* – were never produced by any of the 94 three- and four-year-olds in Deák and Maratsos (1998) or Experiment 1 (above). This was despite efforts to elicit all appropriate words for the objects. Apparently these words are novel to preschoolers.

first, to minimize the delay between learning and production and thereby maximize recall. Object order within each set (new-word and control) was randomized.

RESULTS

The mean numbers of new and known words produced per new-word object are shown in Table 2 (control set totals are given, for comparison, in the

TABLE 2. *Mean (and s.d.) number of new and known words, and totals, produced per new-word object in Experiment 2, by condition (between subjects). Mean total words per control set object are shown for purposes of comparison*

Condition	New words	Known words	Total	Control set total
Ostension				
New words for set A	0.4 (0.3)	2.1 (0.7)	2.4 (0.8)	2.4 (0.8)
New words for set B	0.7 (0.2)	2.0 (0.5)	2.3 (0.9)	2.2 (0.4)
Definition				
New words for set A	0.5 (0.2)	2.3 (0.6)	2.5 (0.7)	2.5 (0.6)
New words for set B	0.5 (0.3)	1.6 (0.5)	1.7 (0.7)	2.1 (0.5)

Totals for control sets indicate mean known words produced per object. Each group's control set included the same objects as the comparison group's new-word set (e.g. children who learned new words for set A named objects in set B as the control set).

right-hand column). An input (2) × new-word set (2) ANCOVA compared number of new words, with age covaried ($M = 1.5$ and 1.8 for three- and four-year-olds, respectively, a non-significant difference). All effects were non-significant. Because the input effect was non-significant, we further compared the ostension and definition groups on several measures (e.g. number of known words per new-word object; number per control object; total words per object). All differences were non-significant and small, so subsequent analyses combine input groups to increase statistical power.

The number of known words produced per new-word object was examined in a (2) age × new-word (2) set ANCOVA, with input covaried. The age effect was significant, $F(1, 35) = 8.9, p < 0.005$, as was the set effect, $F(1, 35) = 7.0, p < 0.02$. Four-year-olds produced more words ($M = 2.0$, s.d. = 0.6) than three-year-olds ($M = 1.4$, s.d. = 0.8). Children who learned set A words produced more ($M = 2.0$, s.d. = 0.7) than children who learned set B words ($M = 1.4$, s.d. = 0.8). The interaction was non-significant. For comparison, number of known words per control object was examined in a (2) age × (2) new-word set ANCOVA. The age effect was significant, $F(1, 35) = 5.9, p < 0.03$, (M s = 2.1 and 2.6). The set effect was marginally significant, $F(1, 35) = 4.0, p < 0.06$.

To test the central question, we compared the within-subjects difference between mean known words for new-word objects ($M = 1.7$) and for control

objects ($M = 2.3$). The difference was significantly greater than zero, $t(39) = 5.9$, $p < 0.001$, indicating a correction effect. Follow-up t -tests showed that the difference was significant in every experimental condition (except one, in which it was marginal) and age groups. Although the correction effect was consistent, it was not absolute. As Table 2 shows, every group but one produced a mean of more than two words per new-word object. Thus, learning a new word reduced the number of known words, but not the total number of words produced. This is supported by a non-significant within-subjects comparison of total words for new-word objects and control objects, $t(39) < 1.0$.

The correction effect was analyzed to determine if children corrected known words from the same taxonomic aspect (representational or functional) as the new word, perhaps to avoid confusion or maintain semantic contrast. To test this, known words were coded as functional (e.g. *puppet*, *box*) or representational (e.g. *dog*, *store*). A difference score, which controls individual differences in productivity, was calculated for each child in the definition condition. For children who learned new representational words (i.e. set A), this was the number of known representational words for control objects minus the number for new-word objects. For children who learned new function words (set B), it was the number of known function words for control objects minus the number for new-word objects. Overall, difference scores ($M = 0.5$, s.d. = 0.5) exceeded zero, $t(19) = 4.9$, $p < 0.001$. This might show selective correction of words from the same taxonomic frame as the new word, but only if the scores are higher than 'dummy' difference scores of children in the ostensive input condition. Because this group did not hear definitions, it would have no basis for selective correction. The definition group's mean difference scores did not differ from the ostension group's dummy scores ($M = 0.4$), $t(38) < 1$, *ns*.

DISCUSSION

After children learned a new word for an object, they produced fewer known labels. On average, however, children produced more than two words per object. Thus, the correction effect (Merriman & Bowman, 1989) is partial. Children do not adopt a one-word-per-object bias when they hear a novel word: polynomy extends to word learning situations. Why, if children produce multiple words even when learning a new word, do they correct known words at all? One possibility is that children selectively replace words with meanings similar to the new word. They might maintain known words with distinct meanings, but choose only one of several words (either known or new) with similar or confusable meanings. Although the magnitude of meaning-specific correction was not significant, we cannot rule it out. Nor can we reject the possibility that children allow only one label per taxonomic frame during word learning.

A viable and more parsimonious hypothesis is that learning a new word inhibits access of all plausibly appropriate labels. Thus, the child would not produce labels that were only weakly activated by the referent. If hearing a novel word raises the threshold of access of known words, we might see transitory correction. That is, upon re-testing sometime after word learning, the child might produce additional words not produced during word learning. This is a testable hypothesis.

A complication in these data is the set effect. Children who learned new words for the book, crayon, and pen produced more words than children who learned words for the other objects. This might be due to item effects (i.e. preschoolers tend to know more words, on average, for set B objects). This is suggested by a marginal set difference in number of words per object, when assigned as control objects. This does not support the alternative hypothesis that set B words were easier to learn, or their definitions more memorable (this was possible because words and definitions differed between sets). Regardless, because the correction effect obtained across conditions and ages, the set effect does not compromise our interpretation.

An unexpected result was the non-significant effect of input (i.e. ostension vs. definition). Although this is difficult to interpret without a more powerful replication, it fails to support the finding that children learn words more readily from definitions (Banigan & Mervis, 1988). Perhaps our definitions were confusing, or beyond children's memory capacity (note that children learned three novel and definitions). Alternately, preschoolers might have ignored definitions in favor of intuitive inferences about word meanings. Finally, definitions might have facilitated aspects of word learning not measured by our tests. These possibilities require further research.

GENERAL DISCUSSION

What is the nature of polynomy in preschool children? Why do children sometimes produce multiple, appropriate category labels for an entity, and other times restrict the number of labels? One possibility is that polynomy does not reflect preschoolers' everyday naming skills, but is a procedural artifact. Despite concerns about sampling error and demand characteristics in Deák & Maratsos (1998), Experiment 1 replicated the findings with a verbally average sample and less leading probe questions. This is the second replication of the naming task, each using different experimenters, recruitment methods, populations, and probe questions. We have now substantiated findings that, taken with other findings (e.g. Clark & Svaib, 1997), show polynomy is not tightly tied to high verbal samples, particular stimuli or words, or specific methods or probes. A tentative working hypothesis is that all normally developing children, by three years and probably younger, can produce multiple category labels for an entity. This hypothesis demands

testing in a variety of language communities and settings. The finding that the raw number of labels a child can produce is predicted by vocabulary also raises questions. For example, is the capacity to assign an entity to multiple categories available before children have a large enough lexicon to include many words that overlap in reference?

Exactly what conceptual and lexical knowledge is required for polynomy? If a preschooler calls an entity *dog*, *animal*, and *pet*, we might infer conceptual representation of hierarchical and overlapping category relations. This cannot be assumed, though. Children might produce one label for an entity in one context and another label in another context, without explicitly representing the semantic or taxonomic relations, or even believing that both words simultaneously apply. Polynomy might follow a series of automatic, unanalysed naming responses, each adapted to context-specific demands or cues. The naming task might elicit labels effectively because each probe strongly establishes a context that activates a specific label. The child might ‘hedge bets’ by shifting from one category label to another, according to the contextual cues of the moment.

The evidence does not support this minimalist hypothesis. Children in Experiment 1 accepted most label pairs, even when corrected for response bias. This, plus children’s confidence in their labels, implies that word-referent relations persist for the child. Other judgments, though, show the limits of children’s lexical insight. Three-year-olds do not reliably judge whether a label names what a referent looks like or how it is used. In addition, many preschoolers guess that an unseen referent has but one name, immediately before or after producing multiple words for objects! This suggests a dissociation of naming and beliefs about word-referent relations. In contrast, two types of lexical knowledge – vocabulary, and knowing what aspect of an entity a word refers to – predict the number of words a child will produce per object.

Polynomy is not suspended in word learning situations. This would have explained the co-occurrence of polynomy and the disambiguation effect. Experiment 2 shows, however, that children do not simply choose one novel or known label for an object. Just after learning a new label, preschoolers might temporarily limit known labels due to confusable meanings, pronouncability, typicality, or other variables. Future research should address how and why children replace known labels, reject new labels, or temporarily reduce access to known words.

In sum, the current findings allow a refinement of our conceptualization of children’s ability to produce multiple words for an object, and their tendency to restrict access to known words. The former ability is behaviourally robust, albeit susceptible to reduction in a specific circumstance; namely, word learning. The ability does not require explicit awareness of word-referent relations. Preschoolers do not have a one-word-per-object bias: rather,

behaviours that have been attributed to a mutual exclusivity constraint are adopted by degrees when the child is learning novel words. The effects may be transitory, and they speak more to the cognitive load imposed by word learning than to the child's beliefs about words and reference.

REFERENCES

- Banigan, R. L. & Mervis, C. B. (1988). Role of adult input in young children's category evolution: II an experimental study. *Journal of Child Language* **15**, 493–504.
- Bialyskok, E. (1986). Children's concept of word. *Journal of Psycholinguistic Research* **15**, 13–32.
- Clark, E. V. (1987). The principle of contrast: a constraint on language acquisition. In B. MacWhinney (ed.), *Mechanisms on language acquisition*. Hillsdale, NJ: Erlbaum.
- Clark, E. V. & Svaib, T. A. (1997). Speaker perspective and reference in young children. *First Language* **17**, 57–74.
- Deák, G. (2000). Chasing the fox of word learning: why 'constraints' fail to capture it. *Developmental Review* **20**, 29–80.
- Deák, G. O. & Maratsos, M. (1998). On having complex representations of things: preschoolers use multiple words for objects and people. *Developmental Psychology* **34**, 224–40.
- Dunn, L. M. & Dunn, L. M. (1981). *Peabody Picture Vocabulary Test – Revised*. Circle Pines, MN: American Guidance Service.
- Flavell, J. H., Green, F. L. & Flavell, E. R. (1986). Development of knowledge about the Appearance–reality distinction. *Monographs of the Society for Research on Child Development* **51** (1, serial no. 212).
- Golinkoff, R. M., Mervis, C. B. & Hirsh-Pasek, K. (1994). Early object labels: the case for lexical principles. *Journal of Child Language* **21**, 125–55.
- Gombert, J. E. (1992). *Metalinguistic development*. (Trans.) Chicago: University Press.
- Karmiloff-Smith, A. (1992). *Beyond modularity*. Cambridge, MA: MIT Press.
- Liittschwager, J. C. & Markman, E. M. (1994). 16- and 24-month-olds' use of mutual exclusivity as a default assumption in second-label learning. *Developmental Psychology* **6**, 955–68.
- Markman, E. M. (1976). Children's difficulty with word-referent differentiation. *Child Development* **47**, 742–9.
- Markman, E. M. (1989). *Categorization and naming in children: problems of induction*. Cambridge, MA: Bradford/MIT Press.
- Markman, E. M. & Wachtel, G. F. (1988). Children's use of mutual exclusivity to constrain the meanings of words. *Cognitive Psychology* **20**, 121–57.
- Merriman, W. E. & Bowman, L. L. (1989). The mutual exclusivity bias in children's word learning. *Monographs of the Society for Research on Child Development* **54** (3–4, no. 220).
- Merriman, W. E., Marazita, J. & Jarvis, L. (1995). Children's disposition to map new words onto new referents. In M. Tomasello & W. E. Merriman (eds), *Beyond names for things: young children's acquisition of verbs*. Hillsdale, NJ: Erlbaum.
- Rosenblum, T. & Pinker, S. A. (1983). Word magic revisited: monolingual and bilingual children's understanding of the word-object relationship. *Child Development* **54**, 773–80.
- Wales, R., Colman, M. & Pattison, P. (1983). How a thing is called: a study of mothers' and children's naming. *Journal of Experimental Child Psychology* **36**, 1–17.
- Waxman, S. R. & Hatch, T. (1992). Beyond the basics: preschool children label objects flexibly at multiple hierarchical levels. *Journal of Child Language* **19**, 153–66.
- Waxman, S. R., Shipley, E. F. & Shepperson, B. (1991). Establishing new subcategories: the role of category labels and existing knowledge. *Child Development* **62**, 127–38.

APPENDIX

NOVEL WORDS AND DEFINITIONS

Set A (representational category definitions)

1. Car/book (novel word: *roadster*):
'This is a roadster You can put the top down in a roadster and feel the wind blow in your hair when you're driving If there's a top over the driver's head, it isn't a roadster.'
2. Dinosaur/crayon (Novel word: *standosaurus*):
'This is a standosaurus A standosaurus [is a dinosaur that] walks on two feet If it's walking on all four feet, it's not a standosaurus.'
3. Corn/pen (novel word: *niblet*)
'This is a niblet A niblet [is corn that] is all yellow, and it's still on the cob If it has other colors, it's not a niblet.'

Set B (functional category definitions)

1. House/box (novel word: *tin*):
'This is a tin It's [a box that's] metal. You can open up the top and put things like candy or toys inside of it'
2. Dog/puppet (novel word: *spuffet*):
'This is a spuffet You can put your whole hand in a spuffet If you can't fit your hand in it, it isn't a spuffet.'
3. Goose/sticker (novel word: *gumby*):
'This is a gumby You can write on a gumby ... and it's sticky on the back If it's not sticky on the back, it's not a gumby.'

Information from the definition condition only. Protocols have been edited to eliminate repetition.