

On Having Complex Representations of Things: Preschoolers Use Multiple Words for Objects and People

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Applying several names to an entity (*polynomy*) reflects the ability to categorize entities in different ways. Two experiments demonstrate preschoolers' abilities to apply multiple labels to representational objects and to people. In Experiment 1, 3- and 4-year-olds labeled representational objects and verified labels for story characters. In both tasks children reliably produced or accepted several words per entity and accepted a high percentage of both class-inclusive and overlapping word pairs. These results were replicated in Experiment 2; 3- to 5-year-olds also completed appearance-reality and receptive vocabulary tests. The mean number of words produced in the labeling task was significantly related to receptive vocabulary, but not to appearance-reality performance. The results indicate that preschoolers represent an entity as belonging to multiple categories (e.g., *dinosaur* and *crayon*). Implications for cognitive and language development, particularly the appearance-reality distinction and the mutual exclusivity bias, are discussed.

The objects and organisms that inhabit our environment are complex and multifaceted, with many aspects and attributes. Any entity belongs to many different categories defined by particular aspects and attributes. Adults can conceptualize these categories and represent them by using a variety of words (i.e., category labels). For example, an organism may be labeled *kitten*, *cat*, *feline*, *carnivore*, *mammal*, *animal*, and *pet*. Some words highlight specific attributes; for example, *kitten* specifies an age-restricted category. Many words differ in inclusiveness; for example, *cat* is subordinate to *animal*. Such words form class-inclusion hierarchies. Other words form a cross-classification matrix in which the denoted categories overlap but are not inclusive (e.g., *cat* and *pet*). The ability to produce multiple words for an entity, denoting multiple categories with various semantic relations (i.e., inclusion; overlap), is referred to as *polynomy*.¹

Polynomy implies the potential to select a term relevant to a particular context (see Olson, 1970). For example, we may say "cat" to distinguish an entity from dogs and rabbits or call it "Persian" to distinguish it from other cats. This example underscores the pragmatic relevance of polynomy. More central to current purposes, however, is the relevance of polynomy to questions about representational flexibility. Polynomy indicates the ability to represent entities in several ways.²

Background

One of the most persistent and prevalent claims made about young children is that they lack various kinds of cognitive and representational flexibility (e.g., Flavell, 1985; Karmiloff-Smith, 1992). They do not readily look at the same object or situation in different ways simultaneously. Sometimes young children process only one aspect of an event or situation (e.g., Piaget, 1941/1965), sometimes they see only one aspect of an object (e.g., Elkind, 1978; Flavell, Flavell, Green, 1983; Flavell, Green, & Flavell, 1986; Inhelder & Piaget, 1964; Taylor & Hort, 1990; Winer, 1980; Zelazo & Frye, 1996), and sometimes they are predisposed to apply only one category label to an item (e.g., Liittschwager & Markman, 1994; Markman & Wachtel, 1988; Merriman & Bowman, 1989; Merriman, Marazita, & Jarvis, 1995). Children's performance in several paradigms (conservation, appearance reality, class inclusion, word learning,

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¹ Polynomy applies to count nouns as well as to other form classes (e.g., proper names, mass nouns, and noun phrases in general). For example, an item can be labeled not only with the count nouns *Persian*, *cat*, and *animal* but also with *Fluffy* and *fur ball*.

² To demonstrate multiple concurrent representations, participants should agree that two (or more) words apply simultaneously. If two labels for an entity are produced independently, at different times, the participant might have forgotten the former name or changed his or her mind, or different contexts might have evoked different words with only a simple representation in each context.

etc.) has been explained in terms of an active preference for, or restriction to, simple one-to-one relations between representations and entities. Consistent with this is the finding that young children generally retain fewer items in working memory or have less processing capacity (e.g., Case, 1978) than older children.³

It is unclear, however, whether young children's apparent representational inflexibility is a matter of degree or whether children are categorically, profoundly inflexible. Children might behave inflexibly on tasks that impose excessive information-processing requirements or violate children's pragmatic expectations and compel them to focus on one aspect of a situation (see Winer, Rasnake, & Smith, 1987, for evidence that adults can pragmatically be compelled to fail class-inclusion questions; see also Siegal, 1991).

In fact, there is evidence that preschoolers are sometimes capable of representational flexibility. For example, Waxman and Hatch (1992) showed that children can call an item both "dog" and "animal," traversing levels of a taxonomic hierarchy (see also Au & Glusman, 1990). This shows representational flexibility within a taxonomic hierarchy.

There is another kind of representational flexibility that might be absent in young children. This is, in our opinion, a more dramatic form of the ability to maintain multiple representations for a single entity. As background, consider that it is natural to assume that a given object falls into different categories within a single taxonomy. For example, dogs, cats, and animals fall within a biological taxonomy; cars, computers, and microwaves fall within a machine taxonomy; and so on. In fact, however, many entities can be classified in more than one taxonomy. For example, dogs can be classified within a *biological* taxonomy, and they can also be classified within a *domestication* taxonomy, depending on whether they are pets. Pet does not fall into a strictly biological taxonomy because any domesticated species (of plant or animal) can be wild as well. It is the social use of living things that induces the alternate, overlapping domestication taxonomy, including subcategories such as house plant, pet, and farm animal.

These alternative ways of dividing the world (e.g., domestication vs. biological taxonomies) are *taxonomic frames*: independent (and overlapping) taxonomies defined by different attributes. People can also be represented from within a biological taxonomic frame (subdivided according to gender and age; for example, *boy* and *woman*), but there are other taxonomic frames for people. One includes social and occupational roles, such as *doctor*, *plumber*, and *Democrat*. This taxonomy is not embedded within the biological taxonomy because occupation and avocation are logically independent of gender, race, and other biological criteria. Further, it is easy to think of nonhumans as police officers, candy strippers, or airheads. Science fiction readily extends humanlike occupations to nonhumans, as do children's books (e.g., books by Richard Scary; see Clark & Svaib, 1997). Another taxonomic frame for people is defined by kinship concepts. Thus, *parent* is logically independent of species and occupation (though gender and age are encoded in some kinship terms, providing biological information). Each frame is a broad and self-sufficient scheme for dividing an ontological class (e.g., people).

For current purposes we distinguish between thinking about an entity at two (or more) levels in a single taxonomic frame

(e.g., *woman-person*; *cat-animal*)—called *within-frame* representation—and thinking about an entity within two (or more) different taxonomic frames (e.g., *woman-doctor*; *fish-pet*)—called *between-frame* representation.

In this article we evaluate claims about preschool children's abilities to construct and utilize simultaneous multiple within- and between-frame representations of an entity. These abilities, which are central to questions of conceptual flexibility (see Deák, 1994, 1995), are evaluated through children's naming locutions. First, we show that preschoolers can simultaneously apply two or more different, appropriate category names to an object. Others who have investigated this ability (e.g., Au & Glusman, 1990; Clark & Svaib, 1997; Mervis, Golinkoff, & Bertrand, 1994; Waxman & Hatch, 1992; see also Hall, 1996) presented test items or words (or both) sequentially, often with a considerable delay between successive words or items so that one cannot rule out the possibility that participants changed their minds in between trials, forgot earlier words or items, or failed to recognize an item as one that was previously labeled. Second, and more important, we show that children as young as 3 years old can conceptualize an object or person in terms of categories that span different taxonomic frames, as well as more- and less-inclusive categories within a frame. In fact, children can represent the entity at what is plausibly the "basic level" (e.g., Mervis & Pani, 1980; Murphy & Smith, 1982; Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976) of different frames, indicating the ability to represent two (or more) fundamentally different aspects of an entity.

The goal of these experiments was to test whether preschoolers are capable of maintaining two representations of the same object, as measured by the use (production or acceptance) of words that denote different categories. Also in these experiments we ascertained whether preschoolers' abilities in this respect exceed existing characterizations.

Our results will have specific implications for several current hypotheses about children's cognition and language learning. Most central are the mutual exclusivity (ME) bias (e.g., Markman, 1992; Markman & Wachtel, 1988; Merriman & Bowman, 1989) and understanding of the appearance-reality distinction (e.g., Flavell et al., 1983; Flavell, Flavell, & Green, 1987; Flavell et al., 1986). Detailed treatment of these is deferred to the General Discussion section.

Experimental Rationale

The problem of how to elicit multiple labels (polynomy) for within- and between-frame categories is not straightforward, given that many paradigms, such as appearance-reality (Flavell

³ Whereas young children seem at a relative disadvantage in forming and using multiple representations, adults also fall short of ideal mental flexibility (e.g., Duncker, 1945; Gick & Holyoak, 1980). Part of the reason may be that all other things being equal, it is probably easier to maintain few representations than many (as it is easier to remember shorter lists than longer ones) and easier to deal with simple, discrete representation-to-referent relations than interrelated, overlapping ones (e.g., the fan effect; Anderson, 1974). Nevertheless, there is evidence that in many circumstances (except perhaps religious or political discussions), children are less representationally flexible than adults.

et al., 1983), class inclusion (Winer, 1980), and naming tasks (Merriman & Bowman, 1989) reveal little representational flexibility in preschoolers. The question is not only how to elicit multiple words but how to elicit multiple words from different taxonomic frames.

Semantic contrast was used to elicit multiple words from children (see Waxman & Hatch, 1992). For example, if shown a dog and asked, "Is this a cat?" children tend to correct the inappropriate label with an appropriate one: "No, it's a dog!" When asked, "Is it a plant?" children might respond, "No, it's an animal!" Children tend to respond with appropriate words at the same level of inclusion, or specificity, as the adult-provided "foil" word.

Between-frame words were elicited for certain kinds of stimuli. Many entities might elicit between-frame words, but a strong test involves entities that can be labeled with seemingly incongruous words (e.g., *dinosaur* and *crayon*). Such word pairs are important because children have not learned that they can co-extend, or apply to the same object. Such pairs therefore test children's ability to construct multiple representations "on-line" as opposed to producing word combinations learned through experience (e.g., *dog-animal*).

Two kinds of entities that have distinct taxonomic frames are *representational objects* and *people*. First, representational objects are artifacts intended to have a depictive, symbolic frame that is distinct from a functional or material frame. For example, almost all art is intended to represent something else, and modern Western culture is abundant with representational objects such as candy dispensers shaped like cartoon characters, plush animal toys, pasta shaped like school mascots, vegetable-shaped kitchen timers, and so forth. Pretechnological cultures produce costumes, totems, musical instruments, and tools that depict people or animals. Representational objects are historically and culturally ubiquitous, they have aesthetic, cultural, or ritual importance, and young children require little if any experience to perceive their depictive properties (Hochberg & Brooks, 1962). For these reasons, inability to coordinate representational and functional aspects would be a striking deficit. Yet such a deficit has been proposed: In Flavell's appearance-reality task (Flavell et al., 1983, 1987, 1986), preschoolers must name the appropriate frames of *deceptive* (i.e., with nonobvious functions) representational objects in response to questions about what such objects "look like" and "are really and truly." Children younger than 4 years old have difficulty matching representation and function labels with these questions. For example, children claim that an apple-shaped candle both "really and truly is" and "looks like" a candle. Preschoolers apparently conflate the depictive and functional frames of representational objects.

Second, as discussed earlier, people can be described in terms of a biological frame (e.g., *person*, *adult*, *woman*, and *boy*) and a role frame that includes occupations (e.g., *teacher* and *doctor*), avocations (*beach bum* and *volunteer*), and contextual roles (e.g., *customer* and *passenger*). In addition, people can be classified in a *kinship* or a *familial* role frame (e.g., *parent*, *mother*, and *brother*) that is partly related to the other frames. Preschoolers might not understand that people simultaneously belong to categories in each of these frames. For example, Sigel, Saltz, and Roskind (1967) found young children deny that a person can belong to both occupational and kinship categories. This

finding has been replicated (e.g., Jordan, 1980; Watson & Amgott-Kwan, 1983; Watson & Fischer, 1980), suggesting that children younger than age 6 do not understand that people have multiple roles.

Because both representational objects and people belong to multiple taxonomic frames (representation vs. function and biological vs. role) and, within each frame, to categories at different hierarchical levels, these kinds support multiple category names both within and between frames. As noted, however, preschoolers apparently have difficulty maintaining multiple between-frame categories of objects and people. In our procedure, children were given the opportunity to produce or accept several words for representational objects and people. To further test their ability to maintain multiple simultaneous representations, children judged the acceptability of pairs of words (e.g., "Is this a(n) [word₁] and a(n) [word₂] at the same time?").

Word pairs could be related in several ways, on the basis of whether they name within- or between-frame categories and on the basis of their hierarchical level of inclusion (e.g., basic level vs. superordinate). As an example, consider a representational object such as a dinosaur-shaped crayon. If a child produces three words for this object (*dinosaur*, *animal*, and *crayon*), these words combine into three pairs: *dinosaur-animal*, *dinosaur-crayon*, and *crayon-animal*. Although accepting any of these pairs implies the ability to maintain multiple categories, the pairs can be differentiated in two ways. First, the former pair might have been learned through experience (e.g., from caregivers, see Callanan, 1985, or books) because all dinosaurs are animals. The latter pairs, however, probably are not learned: If anything, a child would assume that no crayon is a dinosaur or an animal. If children have difficulty accepting multiple words for an entity, they ought to reject such pairs.

Second, these pairs can be differentiated according to how their constituent words are related. The first pair (*dinosaur-animal*) is *inclusive*, or within frame. The second (*crayon-animal*) is *overlapping*, or between frame. The third (*dinosaur-crayon*) is *overlapping basic*, it contains two basic-level between-frame words. It is unclear how this last type of pair will be treated by children because in mainstream cognitive psychology every object is conceived as belonging to only one basic-level category that has a privileged psychological status (e.g., Mervis & Pani, 1980; Rosch et al., 1976). If children have difficulty maintaining multiple representations, basic-level terms might "compete" for this privileged status, leading children to reject one. In any event, because inclusive pairs are potentially familiar, whereas overlapping pairs tend to be unlearned, if children reliably apply both inclusive and overlapping word pairs to single objects, it will demonstrate the ability to construct multiple representations. However, if children produce only inclusive pairs, it will suggest that multiple representations, and polynomy, depend on learned lexical relations and are restricted to within-frame relations. Finally, if children produce one word per object, it will suggest that representational limitations prevent them from maintaining multiple categories.

In Experiment 1 we examined 3- and 4-year-olds' abilities to produce and accept multiple words for representational objects and people. By examining responses to both kinds of materials we tested stimulus generalization. By administering both production and comprehension tasks we tested response generaliza-

tion. By comparing 3- and 4-year-olds' performances, we tested whether naming is consistent with hypotheses about the development of representational abilities (Flavell et al., 1986), which predict that 3-year-olds are unable to maintain and use multiple representations. Finally, to confirm the novelty of overlapping word pairs for representational objects, we asked parents whether their children were familiar with specific objects. If parents judge the objects to be unfamiliar, it can be assumed that overlapping word pairs are unfamiliar and unlearned.

Experiment 1

Children in Experiment 1 completed two tasks: an *object naming* task and a *story* task. In the *naming* task children labeled unfamiliar (but nameable) representational objects. These objects could take combinations of words familiar to middle-class English-speaking preschoolers. To elicit multiple labels, we used semantic contrast (Au & Markman, 1987; Waxman & Hatch, 1992) in the context of pragmatic conventions, as well as function demonstrations. Semantic contrast was used by asking, "Is this a(n) [X]?" where [X] inappropriately contrasts with an appropriate word. For example, the experimenter asked whether the *dinosaur*-*crayon* was a *plant*, eliciting the response, "No, it's an animal!" Children "correct" or replace a contrasting foil word (i.e., *plant*) with an object-appropriate word. In the current study foils were used to elicit inclusive words, as well as overlapping words from different taxonomic frames. Object functions were demonstrated to elicit function frame words. Finally, children's beliefs that word pairs simultaneously apply were tested (e.g., "Is this a(n) _____ and a(n) _____?"). Foil pairs containing an inappropriate word were given to test for response bias.

In the second task, the *story* task, children were told brief vignettes and were then asked to judge character labels. Children judged both accurate and foil words to assess their representations of people across biological, occupational, and kinship frames. Children were asked about basic-level biological (*man* or *woman*), occupational (*police officer* or *fire fighter*), and kinship (*mother* or *father*) words, and a superordinate biological word (*person*). As in the naming task, children were asked about appropriate and foil word pairs. This replicates previous studies (e.g., Sigel et al., 1967) on children's understanding of multiple roles.

If children cannot maintain simultaneous representations of several categories, they should produce only one word per object. Children might accept several words (in the *story* task) and word pairs (in both tasks) because of a yes response bias; if so, they should accept an equal number of foil words and pairs. If they accept many appropriate words but few foil words, however, performance will reflect construction and maintenance of multiple representations.

Method

Participants

Sixteen 3-year-olds (8 girls and 8 boys: mean age = 3.6 years, range = 3.5–3.7 years) and sixteen 4-year-olds (8 boys and 8 girls: mean age = 4.6 years, range = 4.5–4.9 years) participated. One additional 3-year-old was replaced for failure to complete the tasks. All children were

monolingual English speakers without language impairment. Participants were recruited by telephone from a database generated from birth announcements. Families lived in a large metropolitan area and were mostly White and middle class. Children received a gift for participating.

Materials

Eight representational objects (with distinct functional and representational frames) were used in the naming task. These included a crayon shaped like a dinosaur, a tin box painted like a toy store, a goose sticker, a book shaped like a car, a Dalmatian puppet, a pirate Troll doll, a rubber cracker magnet, and a pen shaped like an ear of corn. Several laminated paper dolls and accessories were used in the story task. These included two adult figures (woman and man), two children (boy and girl), two sets of street clothes (female and male stereotyped), police officers' and fire fighters' uniforms (one of each for the woman and man), vehicles (police car and fire engine), and two houses.

Procedure

Children were tested in a quiet room; sessions were videotaped. On entering the lab, the child and experimenter engaged in free play and conversation for about 5 min. During this time the experimenter asked the child to name a variety of toys to orient the child to the object naming task. Parents concurrently examined the naming task objects and reported which, if any, were familiar to the child. After free play, children completed the object naming task and story task. Task order was counterbalanced.

Object naming task. Each child was shown eight objects, one at a time, in a unique random order. The experimenter presented an object and asked, "What is this called?" After the child produced a word, the experimenter systematically elicited additional names, first by asking "What else is it?" If the child did not produce another word, the experimenter asked additional questions including, "Is it a(n) [X]?" where X is a foil that contrasts with an appropriate word. For example, if the child initially called the crayon "dinosaur," the experimenter asked "What kind of thing is a dinosaur? Is it a plant?" to elicit the appropriate response of "animal." Foils for each object are listed in Table 1. Probes and contrasting foils were used for any word produced by at least one pilot participant (several additional probes [such as *building*, *vegetable*, and *container*] listed in Table 1 were added during the course of the experiment as participants produced words not produced by pilot participants).

Several words were probed for every object. Probed words included basic-level function and representation words (the first words produced by pilot participants were identified as basic level), as well as sub- and superordinate terms. Different combinations of words were probed for different objects. To be conservative, only single lexical items were counted; modified or compound words were not counted separately (e.g., *store* and *toy store*). Foil words familiar to preschoolers were chosen; if no suitable foil was apparent the probe question was asked without a foil. Function was demonstrated when probing a function word (e.g., the experimenter wrote with the crayon) and children were asked "Is it anything else?" or "What do you call something that does this?"

After the experimenter attempted to elicit the words listed in Table 1, the child's belief that his or her labels applied simultaneously was tested. For every pairwise combination of child-produced labels, the experimenter asked, "Is this a(n) [X] and a(n) [Y] at the same time?" Some pairs were inclusive (e.g., *dinosaur*-*animal*); others were overlapping (e.g., *animal*-*crayon*) or overlapping basic (e.g., *dinosaur*-*crayon*). For every pair, a second pair was presented in which one word was replaced by a contrasting foil. Foil pairs were included to test for response bias. Questions were given in random order. Because pairs were derived from the words produced by the child, children who pro-

Table 1
Probed Words and Foil Words in the Object Naming Task

Object	Basic level	Superordinate	Subordinate
dinosaur	<i>dinosaur</i> /cat/fish	<i>animal</i> /plant/machine	<i>T. Rex</i> /long-neck/spike-tail
crayon	<i>crayon</i> /pencil/paper clip		
toy store	<i>store</i> /church/skyscraper	<i>building</i> /vehicle/cave	
box	<i>box</i> /bag/basket	<i>container</i> /machine/furniture	
goose	<i>goose</i> /chicken/robin	<i>bird (animal)</i> /fish	
sticker	<i>sticker</i> /paper clip		
car	<i>car</i> /motorcycle/boat		
book	<i>book</i> /magazine/videotape		
dog	<i>dog</i> /cat/fish/horse	<i>animal</i> /plant/bug	<i>Dalmatian</i> /collie
puppet	<i>puppet</i> /doll	<i>toy</i> /machine/cooking thing	
pirate	<i>pirate</i> /doctor/teacher		
Troll	<i>Troll</i> /Grinch/witch	<i>toy</i> /machine/cooking thing	
cracker	<i>cracker</i> /cake/bagel	<i>food</i> /drink/furniture	<i>Ritz</i> /Saltine/Wheat Thin
magnet	<i>magnet</i> /tape/staple		
corn	<i>corn</i> /carrot/onion	<i>vegetable</i> /food/fruit/nut/drink/ furniture	
pen	<i>pen</i> /eraser/paint brush		

Note. Probed words are italicized, followed by foil words. Representational words are on the first line for each object; functional words are on the second line. The number of super- and subordinate words probed differs across objects because probed words were established during pilot testing.

duced only one word for an object received no pair questions. For the same reason, different children received different numbers of pair probes.

To illustrate the procedure, if a child produced the labels *dinosaur*, *animal*, and *crayon*, he or she would then be asked, "Is this a crayon and a plant at the same time?" Similar pair questions would also be asked for *animal*–*dinosaur*, *dinosaur*–*crayon*, *dinosaur*–*pencil*, *cat*–*animal*, and *crayon*–*animal*. Note that some foil pairs are conventionally related (e.g., *cat*–*animal*), and others are nearly appropriate for the object (e.g., *dinosaur*–*pencil*). Such pairs stringently test children's attentiveness to pair questions.

Story task. Children were told vignettes about each of two characters, a man and a woman (see the Appendix). Each story briefly described that character's daily routine, incorporating a familiar occupation (police officer and fire fighter, counterbalanced by character and order).

Half of the children heard stories in which the character was portrayed as a parent (to test whether overlapping occupation and family role terms were accepted); the other half heard nonparent stories (to test whether hierarchically related biological terms were accepted). Children were asked several questions. Children who heard parent stories were asked, "Is [Sue/Bill] a [mother/father]?" "Is [Sue/Bill] a [police officer/fire fighter]?" and "Is [Sue/Bill] a person?" Children who heard nonparent stories were asked, "Is [Sue/Bill] a [man/woman]?" "Is [Sue/Bill] a [police officer/fire fighter]?" and "Is [Sue/Bill] a person?" Accepted words were combined into all possible pairs. Thus, depending on the number of words accepted (zero to three), a child would judge zero, one, or three pairs and the same number of foil pairs. To illustrate, if a child agreed that a character was a mother, a police officer, and a person, he or she would be asked in random order, "Is Sue a mother and a person?" "Is Sue a person and a police officer?" and "Is Sue a police officer and a mother?" as well as foil pairs (e.g., "Is Sue a brother and a police officer?" "Is Sue a doctor and a person?" and "Is Sue a plant and a mother?"). Pairs were inclusive (e.g., *woman*–*person*) or overlapping (e.g., *mother*–*fire fighter*). All overlapping pairs including an occupation word consisted of basic-level words (the only

clearly non-basic word was *person*). Children who heard parent stories judged role pairs (e.g., *mother*–*fire fighter*).

Results

Parental Familiarity Judgments

Parents judged a mean of 2.5% and 1% of representational objects as familiar to their 3- and 4-year-old children, respectively. No parent judged more than two objects as familiar. Although parents might underestimate object familiarity, it can be assumed that children were generally unfamiliar with the specific objects used and therefore were unlikely to have learned specific overlapping word pairs (e.g., *cracker*–*magnet*).

Object Naming Task

Three-year-olds produced a mean of 2.2 labels per object ($SD = 0.4$), and 4-year-olds a mean of 2.6 ($SD = 0.4$). The age difference, although small, was significant, $t(30) = 2.3$, $p = .04$ (two-tailed). The sex difference was nonsignificant, $t(30) < 1$. Three-year-olds' mean scores ranged from 1.5 to 2.9, and 4-year-olds' ranged from 1.7 to 3.2. Every child produced two or more labels for at least one object, and 29 of 32 children (90%) produced at least two labels for six or more of eight objects. Thus, children uniformly produced several words for representational objects.

Further, children's labels were appropriate and sensible, as illustrated in Table 2, which lists the frequencies of words pro-

Table 2
Words Produced by 3- and 4-Year-Olds in Experiment 1 and Children
in Experiment 2 in the Naming Task

Object	Words and no. of children
Experiment 1: 3-year-olds	
dinosaur crayon	dinosaur (16), crayon (10), animal (8), spike-tail (4), T. Rex (3), monster (1), toy (1)
toy store box	house (9), box (8), store (6), building (2), container (2), block (1), jar (1)
goose sticker	duck (13), sticker (13), bird (3), animal (2), goose (2), chicken (1)
car book	book (16), car (16)
dog puppet	dog (16), Dalmatian (13), puppet (13), animal (6), pet (2), toy (2)
pirate Troll	Troll (12), pirate (10), toy (5), Barbie (1), gunman (1)
cracker magnet	cracker (9), cookie (7), food (7), magnet (4)
corn pen	corn (16), food (9), pencil (8), pen (5), vegetable (1)
Experiment 1: 4-year-olds	
dinosaur crayon	dinosaur (16), crayon (14), animal (10), spike-tail (2), T. Rex (2), amphibian (1), monster (1)
toy store box	house (11), box (6), can (5), store (4), building (2), school (1), toy keeper (1)
goose sticker	sticker (16), duck (14), animal (9), goose (3), bird (1)
car book	book (16), car (16)
dog puppet	dog (16), puppet (14), animal (12), Dalmatian (10), pet (2), leopard (1), Pongo (1), toy (1)
pirate Troll	Troll (14), pirate (13), toy (9), captain (2), animal (1)
cracker magnet	cracker (14), magnet (11), food (10), cookie (2)
corn pen	corn (15), pen (14), food (9), pencil (2), carrot (1), fruit (1), toy (1), vegetable (1)
Experiment 2	
dinosaur crayon	crayon (21), dinosaur (19), T. Rex (9), animal (3), Godzilla (1), pencil (1), reptile (1), spike-tail (1), toy (1)
toy store box	store (15), box (14), house (11), can (5), building (2), Christmas things (1)
goose sticker	sticker (21), duck (13), bird (8), animal (2), goose (7)
car book	book (19), car (19), bus (1), toy (1), truck (1)
dog puppet	dog (21), puppet (17), Dalmatian (13), animal (6), toy (6)
pirate Troll	Troll (18), pirate (18), toy (14), bad guy (1), doll (1), private (1)
cracker magnet	magnet (18), cracker (17), cookie (8), food (8), Ritz (1), sticker (1)
corn pen	corn (22), pen (15), food (11), pencil (6), vegetable (3), crayon (1), toy (1)

Note. For Experiment 1, $n = 16$. For Experiment 2, $N = 22$. Number of children who produced each word is indicated within the parentheses. Modified words (e.g., *color crayon* for *crayon*) and synonyms (e.g., *sharp-tooth* for *T. Rex*) are combined.

duced for every object. There are several trends worth noting. First, token frequency differed widely across words. Most of the high-frequency words were basic level, although a few sub- and superordinates were common (e.g., *animal* and *Dalmatian*).⁴ Second, the number of unique word types differed across objects, presumably reflecting the content of preschoolers' lexicons. Third, there was word meaning or usage "sharpening" from 3 to 4 years. For example, many 3-year-olds called the corn pen "pencil," whereas most 4-year-olds called it "pen"; similarly, many 3-year-olds but few 4-year-olds called the cracker magnet "cookie." Such examples suggest that increasing accuracy of word meanings or usage, studied in toddlers by Mervis (1984, 1987), continues from 3 to 4 years even for ostensibly familiar words.

To elicit labels, the experimenter probed children with contrasting foils (e.g., asking whether a dinosaur was a plant in order to elicit a response of "animal"). Every child was asked about at least 20 foils (total). Three-year-olds accepted a mean of 0.6 ($SD = 0.7$), and 4-year-olds a mean of 0.1 ($SD = 0.3$).

To evaluate children's readiness to provide multiple words,

and the efficacy of the word eliciting procedure, we transcribed available videotapes.⁵ Probes (i.e., attempts by an experimenter to elicit a word), ineffective probes (i.e., probe that did not elicit a unique label), and spontaneous productions (i.e., words produced without a preceding probe) were counted. Children

⁴ The words that we construed as basic level were the first labels produced on a mean of 7.7 out of 8.0 trials ($SD = 0.5$) by 3-year-olds and 7.9 out of 8.0 trials ($SD = 0.3$) by 4-year-olds. Three-year-olds' first words were more likely than chance to refer to the representational (i.e., depictive) frame ($M = 5.8$ out of 8.0 objects, $SD = 1.0$), $t(15) = 6.6$, $p < .01$ (two-tailed). Four-year-olds ($M = 5.3$ out of 8.0 objects, $SD = 1.4$) were also above chance, $t(15) = 3.4$, $p < .01$ (two-tailed). This is not surprising if it is assumed that the representational aspect is immediately apparent, whereas function may only be revealed by interacting with and exploring objects. For example, it was not visually apparent that the crayon dinosaur was a crayon.

⁵ Several videotapes were unavailable at the time of transcription (more than 1 year after the data were collected). The remaining fourteen 3-year-olds and eight 4-year-olds appear to be representative of the total sample.

Table 3
Mean Number of Word Pairs Asked and Accepted and Standard Deviations by Semantic Relation in the Naming Task in Experiments 1 and 2

Experiment	Inclusive		Overlapping		Overlapping basic		Foil	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Experiment 1								
Three-year-olds								
No. asked	4.6		4.2		5.5		14.3	
No. accepted	4.2	2.8	3.5	3.0	4.9	1.9	0.7	1.5
Four-year-olds								
No. asked	5.7		5.1		6.9		17.7	
No. accepted	5.4	3.1	4.5	3.3	6.2	1.5	0.2	0.5
Experiment 2 ^a								
No. asked	4.0		4.1		7.6		15.8	
No. accepted	3.8	2.8	4.0	2.7	7.2	1.5	4.4	7.2

^a Indicates all children.

heard a mean of 2.9 probes per object, or a mean total (per child) of 23.3 (means are not integers because several probes were added during the experiment). In response, children produced a mean of 2.4 words per object ($SD = 0.5$), or a mean total of 19.1 ($SD = 3.6$). The discrepancy between number of probes and number of words produced was partly due to ineffective probes ($M = 6.9$ per child, $SD = 2.8$). The majority of ineffective probes were attempts to elicit superordinate terms ($M = 3.8$); in addition, means of 1.9 basic-level and 1.1 subordinate probes were ineffective (but note that there were not equal numbers of probes for subordinate, basic, and superordinate words; see Table 1). The discrepancy was also due to spontaneous productions ($M = 2.3$ words per child, $SD = 1.5$), which were mostly of basic-level terms ($M = 2.0$). Thus, there was not a one-to-one relationship between probes and words produced: Almost half of the attempts to elicit superordinate words failed, and children spontaneously produced basic-level words for about one fourth of the objects.

Three-year-olds were queried about a mean of 14.3 word pairs (total) and about an equivalent number of foil pairs. They accepted a mean of 12.7 ($SD = 6.6$) appropriate pairs and 0.7 ($SD = 1.5$) foil pairs. Four-year-olds were queried about a mean of 17.7 appropriate pairs and about an equivalent number of foil pairs. They accepted a mean of 16.1 ($SD = 7.2$) appropriate pairs and 0.2 ($SD = 0.5$) foil pairs (see Table 3). Three-year-olds accepted a grand total of 203 out of 229 appropriate pairs, and 4-year-olds accepted 257 out of 283 appropriate pairs. One child in each age group accepted fewer than half of the appropriate pairs, and one 3-year-old accepted more than half of the foil pairs. The mean number and percentage of word pairs presented and affirmed, by age and pair type, are shown in Table 3. Overall, most pairs of each type (other than foils) were accepted, and no meaningful differences among pair types are apparent (statistical analyses were not conducted because all means approached ceiling). Thus, children overwhelmingly judged that two or more words can simultaneously refer to an object.

Story Task

Children could accept from 0 to 3.0 appropriate words and 0 to 3.0 foil words per story. Overall, 3- and 4-year-olds, respec-

tively, accepted 2.5 ($SD = 0.5$) and 2.9 ($SD = 0.2$) mean appropriate words per story. Both significantly exceeded one, $t(15) = 11.5$, $p < .001$ and $t(15) = 37.8$, $p < .001$ (two-tailed), contradicting assertions by Sigel et al. (1967), Jordan (1980), Watson and Fischer (1980), and others. Children's acceptance of various words differed, as shown in Table 4. Each word type could be accepted for zero to two characters (*man/woman* and *mother/father* were combined for ease of analysis; both were accepted at ceiling). A 2 (between-subjects: 3- vs. 4-year-olds) \times 3 (within-subject: *person* vs. [occupation] vs. *man/woman* or *mother/father*) mixed-measure analysis of variance (ANOVA) revealed a main effect of age, $F(1, 30) = 7.3$, $p < .02$, a main effect of label type, $F(2, 60) = 9.1$, $p < .0001$, and a significant interaction, $F(2, 60) = 4.8$, $p < .02$. Follow-up t tests (two-tailed) revealed that 3-year-olds accepted fewer occupation words than *person*, $t(31) = 2.4$, $p < .03$, and fewer than *woman/man* or *mother/father*, $t(31) = 3.5$, $p < .002$. These results must be interpreted cautiously because of ceiling effects. Nevertheless, they suggest that unlike *person*, *man/woman*, and *mother/father*, 3-year-olds do not invariably accept occupation labels. Neither do children indiscriminately accept foils: All children rejected all six foils except one 3-year-old and one 4-year-old who each accepted one foil (both incorrect occupations). Thus, no response bias was evident.

As in the naming task, children were questioned about word pairs. To receive credit, children had to accept both words singly and as a pair (e.g., reply yes to "Is Sue a(n) [X] and a(n) [Y] at the same time?"). We first asked whether children were less likely to accept overlapping pairs (because they were unfamiliar, whereas inclusive pairs were potentially familiar). Recall that children who heard nonparent stories could accept up to two inclusive pairs (e.g., *woman-person* and *fire fighter-person*) and one overlapping basic pair (e.g., *fire fighter-woman*). Children in the parent story condition could accept two inclusive pairs (*fire fighter-person* and *mother-person*) and one overlapping basic role pair (e.g., *mother-fire fighter*).⁶ A mixed-measure

⁶ Occupation and family role words are not necessarily inclusive within the biological superordinate *person* because nonhumans may take role labels (e.g., the *mother bird*). Nevertheless, *person* was treated as

Table 4
Mean Numbers of Words Accepted in the Story Task and Standard Deviations,
by Word Type and Age in Experiments 1 and 2

Experiment	<i>Mother/father</i>		<i>Woman/man</i>		<i>Person</i>		Occupation label	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Experiment 1								
Three-year-olds	2.0	0	2.0	0	1.9	0.3	1.3	0.8
Four-year-olds	2.0	0	2.0	0	1.9	0.2	1.9	0.3
Experiment 2								
All children	3.6	0.8	3.6	0.7	3.5	1.1	3.4	1.0

Note. Children accepted up to two (Experiment 1) or four (Experiment 2) words per type. In Experiment 1, participants responded to either *mother/father* or *woman/man*.

sure ANOVA was conducted on the number of pairs accepted by each child, with age (3- vs. 4-year-olds) and condition (non-parent vs. parent story) as between-subjects effects and pair type (overlapping vs. inclusive) as within-subject effects (inclusive responses were halved for comparability). Only the repeated measure was significant, $F(1, 28) = 5.0, p < .04$. Follow-up t tests revealed no significant effects when collapsing across either age or condition. Follow-up one-way tests revealed that the within-subject effect was due solely to the occupation term: Overlapping role pairs (e.g., *mother-fire fighter*) were accepted less than inclusive family role pairs (e.g., *mother-person*): $M_s = 1.2$ versus 1.5 (both $SD_s = 0.8$), $F(1, 63) = 9.3, p < .005$. Similarly, inclusive pairs with an occupation term (e.g., *fire fighter-person*) were accepted less often than inclusive pairs without one (e.g., *mother-person*): $M_s = 1.2$ versus 1.5 ($SD_s = 0.9$ and 0.7 , respectively), $F(1, 63) = 8.9, p < .006$. Thus, the presence of an occupation term, rather than type of semantic relation, was definitive. This effect was further examined in Experiment 2.

As in the naming task, children were queried about foil pairs. Three-year-olds accepted a total of 5 out of 69 foil pairs. No child accepted more than 1 pair. One 4-year-old accepted 1 foil pair (out of a total of 72). This selectivity is noteworthy because some foil words were correct for the other story (e.g., *fire fighter* was a foil for one character, but appropriate for the other).

Intertask Association

Perhaps children differ in their abilities to generate, maintain, and name multiple categories. Intertask consistency was examined to determine whether the tasks measured an underlying ability (e.g., representational flexibility). The correlation between number of words produced per object in the naming task and the number of (correct) words accepted in the story task was calculated. The relation, $r = .43$ ($R^2 = .19$), exceeded chance, $t(30) = 2.6, p < .01$. It appears, then, that a common

variable contributes to both tasks. Possible variables were explored in Experiment 2.

Discussion

These findings challenge the view that preschoolers cannot represent multiple categories simultaneously (e.g., Inhelder & Piaget, 1964) and are consistent with Deák's (1994, 1995) arguments to the contrary. The findings also show that preschoolers can maintain multiple categories that are either inclusive (i.e., within frame; see also Waxman & Hatch, 1992) or overlapping (i.e., between frame). These findings are inconsistent with Flavell et al.'s (1986) assertion that 3-year-olds "act as if they . . . form only one encoding or representation of the stimulus and then report that representation no matter which question they are asked" (1986, p. 57). The absence of qualitative age differences is surprising, given Flavell et al.'s assertions (see also Perner, 1991) that representational abilities shift between ages 3 and 4. Observed age differences were modest and quantitative and could have been due to vocabulary growth. The role of vocabulary growth is suggested by the fact that in the naming task many superordinate probes were ineffective, whereas some basic-level words were produced spontaneously (children learn basic-level words before superordinate words; for example, Anglin, 1977).

How are researchers to understand the discrepancy between the current findings and those of Flavell and others? This is a difficult question because Flavell et al.'s (1986) object identity appearance-reality task is similar to our naming task in important ways. For example, both require children to name objects that look like one thing but function like another and to produce different names for different aspects (i.e., taxonomic frames) of those objects. Yet younger participants typically perform poorly in the appearance-reality task, whereas they performed well in our task. Perhaps this is because Flavell et al.'s task requires children to match between-frame words to specific predicates (e.g., "really and truly"); whereas in our task, taxonomic frame was implied by contrasting foils and demonstration of object function. Alternatively, our task may have been easier because the stimuli were not deliberately deceptive, as were Flavell et al.'s. This suggests that 3-year-olds' appearance-reality difficulties may be due to task or stimulus factors (see Brenne-man & Gelman, 1993; Rice, Koinis, Sullivan, Tager-Flusberg, &

a generic superordinate. This was for simplicity of analysis and because children only judged people, so in this task every character was a person regardless of occupation or kinship roles. This decision had no influence on the results because pairs with a clear inclusion relation—*man/woman* and *person*—were accepted as often as pairs with an ambiguous inclusion relation—*mother/father* and *person*.

Winner, 1997). On the other hand, if both tasks do tap representational facility, performance across the two tasks should be similar. The relationship between tasks was tested in Experiment 2.

The finding that children apply several different category words to an entity (i.e., polynomy) is inconsistent with suggestions that children initially tend to allow only one word for an object (e.g., Markman, 1989, 1992). This finding is, however, consistent with other recent studies (e.g., Au & Glusman, 1990; Mervis et al., 1994; Waxman & Hatch, 1992). Our findings add to previous studies in several ways. Most important, they show that children apply multiple words from different taxonomic frames (see also Clark & Svaib, 1997). This is particularly impressive given that the objects were unfamiliar (by parental report); thus, it is unlikely that children ever heard the between-frame word pairs modeled. In addition, preschoolers showed polynomy in production as well as in comprehension and for different ontological kinds (objects and people). Finally, preschoolers judged that pairs of words simultaneous apply. This finding eliminates the possibility that children corrected, replaced, or forgot previously applied words (Merriman & Bowman, 1989).

In the story task, occupation words and pairs were most often rejected. This may have been due to children's stereotypical beliefs about sex roles; for example, beliefs that women are not police officers or fire fighters. This was tested by comparing children's rejection of occupation terms for male and female characters. Six 3-year-olds (37%) and one 4-year-old (6%) rejected the occupation term for the male character, and six 3-year-olds (37%) and two 4-year-olds (12%) rejected the occupation term for the female character. Five (62%) 3-year-olds and four 4-year-olds (50%) rejected the *father-occupation* pair, whereas four 3-year-olds (50%) and three 4-year-olds (37%) rejected the *mother-occupation* pair. Thus, although even toddlers know some sex role stereotypes (Kuhn, Nash, & Brucken, 1978), preschoolers did not disproportionately reject male-stereotyped occupations for female characters.

Alternately, children might have inaccurate meanings for occupation words. They might believe that occupation labels are contingent on current activity so that a person can only be called a fire fighter when fighting fires. Thus, the question "Is ——— a father and a police officer *at the same time?*" [*italics added*] would be answered no based on the child's reasoning that a person cannot simultaneously engage in both activities. Importantly, the phrase "at the same time" implies simultaneity, which violates the (inaccurate) criterion of nonconcurrent activity. This possibility was examined in Experiment 2 by changing the question to eliminate the phrase "at the same time."

Experiment 2

Because the findings from Experiment 1 have broad implications for our understanding of preschoolers' representational and linguistic abilities, Experiment 2 was designed to replicate and extend those findings. To establish the generalizability of the phenomena, we conducted Experiment 2 in a different setting, used children of a wider age range (the results of Experiment 1 did not justify further study of age effects), and used different experimenters. The probes in the naming task were standardized.

Several procedural changes were made to the story task. To increase task sensitivity and reliability, we used four stories per child instead of two. To obtain a richer profile of polynomy, we had the children judge four labels per character (i.e., *woman/man, person/mother/father, and police officer/fire fighter/doctor/teacher*). Finally, the phrase "at the same time" was eliminated from the pair questions. This may have reduced the tendency to reject pairs that included occupation words, if the tendency was due to a belief that people cannot simultaneously engage in two role-based activities.

Another purpose was to investigate individual differences found in Experiment 1. Performance on the object naming and story tasks was significantly correlated, suggesting a common underlying ability. There are at least two plausible common contributors. One is representational ability: Perhaps some children can better maintain and coordinate, and label, multiple categories. Second, vocabulary differences might determine the number of words produced, accepted, or both.

To test these alternatives, the experimenter gave every child two additional tasks: an appearance-reality (object identity) task and the Peabody Picture Vocabulary Test—Revised (i.e., PPVT-R; Dunn & Dunn, 1981). The appearance-reality task is often treated as an index of children's representational facility (Flavell et al., 1986). Children see representational objects with dissociated appearance and function (e.g., a sponge that looks like a rock) and answer questions that imply an object's appearance (e.g., rock) and its function (e.g., sponge).

The PPVT-R is a standardized test that estimates children's receptive vocabulary. Participants choose one of four drawings denoted by a word. Performance is standardized by age. The test is normed for children as young as age 2.6 and has reasonably high split-half and alternate form reliability (Sattler, 1988).

We predicted replication of the naming task results. We predicted greater acceptance of story task pairs (particularly those with an occupation word) because of the revised question. We predicted that vocabulary size (as measured by the PPVT-R), but not appearance-reality performance, would correlate with the number of labels produced in the naming task. This reflects our belief that the appearance-reality task does not strictly assess children's representational ability (see the *Discussion* section).

Recall that the object naming and appearance-reality tasks share important similarities (e.g., both use representational objects and children must name different taxonomic frames). In contrast, in the PPVT-R children view pictures that, unlike objects, are impoverished and cannot be explored (Deák & Bauer, 1996). Children need only point to a picture, and not produce words. In the naming and appearance-reality tasks different aspects of the same object are confusable; in the PPVT-R the referents (i.e., pictures) are confusable.

Given these considerations, the object naming and appearance-reality tasks might elicit similar performance because of incidental similarities. This correlation would be even greater if, as Flavell et al. (1986) claimed, such tasks measure representational ability. However, if appearance-reality performance rests on other incidental factors, and the naming task depends on vocabulary, then the PPVT-R should better predict naming task performance. Because the experimenter provides the labels (e.g., *rock* and *sponge*) in the appearance-reality task, vocabulary is not implicated. We predicted that individual differences

in the naming task would be due to vocabulary rather than representational ability, which is sufficient (by age 3) to support multiple categorization and polynomy. The relative dissimilarity of the vocabulary measure, and similarity of the appearance-reality task, to the naming task made this a strong test of our prediction.

Method

Participants

Twenty-two preschoolers (7 girls and 15 boys; mean age = 4.5 years, range = 3.0 to 5.7 years) participated. Two additional children failed to complete both sessions. All children were monolingual English speakers with no known language delay. Children were recruited from classes in a half-day preschool. Families were residents of a large metropolitan area and were largely White and middle class.

Materials

The naming task objects were the same as in Experiment 1. The story task materials included all of those from Experiment 1, as well as another house, a doctor's office and a classroom, two additional children, two adult figures (one male and one female), a doctor's outfit (i.e., a white lab coat with stethoscope and so forth), and a teacher's outfit (i.e., casual work clothes, books, pencils, and so forth).

The objects used in the appearance-reality task included a candle that looks like an apple and a pen that looks like a snake (training items) and a watermelon sponge, a camera water squirter, a crayon eraser, and a chewing gum magnet (test items).

Procedure

Children were tested in a quiet room in their preschool. The four tasks were administered in two sessions, two tasks per session, to avoid fatigue. No more than 1 week elapsed between sessions. Task order was counterbalanced so that each child received a different task order (22 of 24 possible task orders were used). Children first engaged in free play with the experimenter until they seemed at ease.

Object naming task. This task was administered as in Experiment 1, except that several foil words were replaced by more age-appropriate words and every children was probed for every word listed in Table 1. As before, object presentation order was random.

Story task. Several changes were made. First, each child listened to additional stories about a doctor and a teacher, for a total of four stories. Second, every child answered four questions about every character: *person*, *man/woman*, *mother/father*, and *police officer/fire fighter/doctor/teacher*. Thus, every child was queried about 32 words (16 appropriate and 16 foil). Two foil words were generated for every appropriate word. Appropriate and foil words are listed in Table 5. Stories were presented in random order, and assignment of dolls to occupations was counterbalanced. The experimenter presented appropriate and foil probes in random order. After children judged appropriate and foil probes, they judged all pairs of accepted words and foil pairs. Thus, if a child accepted 3 appropriate words, he or she would be questioned about 3 possible pairs and 3 foil pairs (in random order). Third, word pair questions were phrased, "Is [character's name] a(n) [X] and a(n) [Y]?" (deleting "at the same time").

Appearance-reality task. The procedure was modeled after Flavell et al. (1986). Children were shown two training objects and then four test objects. Order of the training objects was counterbalanced, and order of the test objects was randomized. The experimenter first explained, "We're going to talk about how things look to your eyes and what they really are." The experimenter then presented the training objects, one

Table 5

Probe Words and Foil Probe Words in the Story Task in Experiment 2

Probed word	Foil words
man	woman, little boy
woman	man, little girl
person	animal, bird
mother	brother, uncle
father	sister, grandmother
police officer	nurse, helicopter pilot
fire fighter	construction worker, lumberjack
doctor	soldier, maid
teacher	musician, cook

at a time, and asked, for example, "What does this look like to your eyes right now?" and "What is this really and truly [an apple or a candle]?" After each question the experimenter provided feedback, for example, "[That's right/actually], it looks like an apple. See, it's round and red like an apple, but really and truly it's not an apple. Really and truly it's a candle." This procedure was repeated for the other training object. Training was intended to clarify the meanings of "looks like to your eyes" and "really and truly."

After training, the experimenter demonstrated each test object one at a time, asking the child, "What does it look like?" After the child answered, the experimenter replied, "That's right, it looks like a(n) [X]. But you can't [eat it/take pictures with it/draw with it]. Let's see what it really is. See, it's a [Y]. You can [clean up with it/squirt water with it/erase with it/stick it to metal]." Demonstrations were intended to familiarize children with the objects' functions so that they would have sufficient knowledge to answer test questions.

After each demonstration, the experimenter presented the object again and asked an *appearance* question and a *reality* question. The appearance question was "What does this look like to your eyes right now? Does it look like a(n) [X] or a(n) [Y]?" The reality question was "What is this really and truly? Is it really and truly a(n) [X] or a(n) [Y]?" For each question, [X] and [Y] were the appearance word (e.g., *watermelon*) and the reality word (e.g., *sponge*). Question type and word order were counterbalanced across objects and children.

PPVT-R. The vocabulary instrument was administered according to standard guidelines (Dunn & Dunn, 1981). Children are shown pages with four pictures and asked to "Show me the [X]." The experimenter records which picture is chosen. Several practice items are given to ensure that young children understand the task. Pages are ordered by difficulty, and the number of correct answers (before reaching a ceiling criterion) constitutes a score that can be standardized for age.

Results

Object Naming Task

Children produced an overall mean of 2.4 words per object ($SD = 0.3$, range = 2.0–3.0), similar to Experiment 1 ($M = 2.4$, $SD = 0.4$). The correlation between age in months and mean number of words per object was $r = .41$ ($p > .05$), consistent with the modest but positive age trend found in Experiment 1. No sex difference was found, $t(21) < 1$. Twenty-one of 22 children produced at least 2.0 words for at least six of eight objects. Words produced, and their frequencies, are presented at the bottom of Table 2. Children accepted a mean of 0.4 foils

out of 20.0, or 2% ($SD = 1.5$). Experimenters gave a total of 29 probes per child, and children produced a mean of 19.4 total words in response ($SD = 2.7$), similar to Experiment 1.⁷

Children judged a mean of 15.7 word pairs and 15.8 foil pairs. They accepted a mean of 15.0 ($SD = 5.7$) appropriate pairs (a grand total of 330 out of 346 pairs were accepted) and 4.4 ($SD = 7.2$) foil pairs (see Table 3). Fourteen children accepted every appropriate pair; no child rejected more than half. Six children showed a yes-response bias, accepting a majority of foil pairs (a mean of 13.8 out of 16.0); the remaining children accepted a mean of 1.6 foil pairs (out of 15.7). The former response bias group accepted a mean of 15.2 ($SD = 8.2$) out of 15.3 appropriate pairs, whereas the latter no response bias group accepted a mean of 14.9 ($SD = 4.8$) out of 15.9 appropriate pairs. These data suggest that the yes response bias did not substantially affect the number of appropriate pairs accepted. The response bias is nevertheless unexplained.

Children were divided post hoc into groups of those younger than 49 months ($n = 7$) and those 49 months or older ($n = 15$); the mean total appropriate pairs accepted (12.1 vs. 16.3) did not differ across age groups, $t(20) = 1.7$, $p > .1$. As in Experiment 1, children accepted uniformly high percentages of all types of word pairs (see Table 3).

Story Task

Children accepted an overall mean of 3.5 appropriate words ($SD = 0.9$) out of 4.0 per character. Fourteen out of 22 children accepted every word for every character, and only 1 child accepted fewer than 2.0 words per character. Unlike Experiment 1, there were no differences across word types (see Table 4). To determine if 3-year-olds accepted fewer occupation words (as in Experiment 1), we compared children younger than 49 months ($M = 2.9$, $SD = 1.2$) with children 49 months or older ($M = 3.6$, $SD = 0.9$). The tendency for older children to accept more occupation words was not reliable, $t(20) < 1$. Children accepted an overall mean of 0.1 foil words ($SD = 0.2$) out of four per character.

Overall, children accepted a mean of 4.4 ($SD = 2.1$) pairs out of 6.0 per character. As in Experiment 1, credit was given only for accepting both words singly and as a pair. Three-year-olds accepted a mean of 3.2 pairs ($SD = 2.4$), 4- to 5-year-olds accepted a mean of 5.0 ($SD = 1.7$). The age difference was marginally significant, $t(20) = 1.9$, $p < .1$.⁸

Every child could accept up to 4.0 inclusive pairs (e.g., *father-man*, *father-person*, *man-person*, and *teacher-person*) and 2.0 overlapping pairs (e.g., *teacher-father* and *teacher-man*) per character. Children accepted an overall mean of 2.9 out of 4.0 (72%, $SD = 1.4$) inclusive pairs per story and 1.4 out of 2.0 (70%, $SD = 0.8$) overlapping pairs. Pairs were divided according to whether they included an occupation word (up to three per character). Children accepted a mean of 2.2 ($SD = 1.1$) pairs with, and 2.2 ($SD = 1.0$) pairs without, an occupation word. Thus, no difference was found on the basis of either the semantic relations or the presence of occupation words. This suggests that the phrase "at the same time" encouraged children in Experiment 1 to reject pairs with an occupation word. To examine this more closely, we compared the 16 participants in Experiment 1 who heard parent stories (8 girls and 7 boys:

mean age = 48 months, range = 41–57 months) with 14 participants in the current study within a similar age range (4 girls and 10 boys: mean age = 49 months, range = 38–58 months). The number of accepted role pairs common to both studies (specifically, *fire fighter/police officer* and *mother/father*), between 0 and 2.0, was compared. This is the most closely matched interexperiment comparison possible. More pairs were accepted in this experiment ($M_s = 1.5$ vs. 1.0, both $SD_s = 0.8$) than Experiment 1, although the difference did not achieve conventional significance, $t(28) = 1.7$, $p < .10$. Thus, there is suggestive but inconclusive evidence that "at the same time" increased children's rejection of role pairs. Incidental procedural differences might have attenuated this effect (e.g., children were queried about more foil words and pairs in Experiment 2).

Children accepted a mean total of 1.4 ($SD = 1.7$) out of 6.0 foil pairs per story. Four response-biased children accepted over half of the foil pairs ($M = 4.6$ per story); the remaining children accepted a mean of 0.7 foil pairs per story. As in the object naming task, it is critical to determine whether response-biased children also accepted more appropriate pairs. They accepted a mean of 4.1 ($SD = 1.9$) appropriate pairs per story, whereas unbiased children accepted a mean of 4.5 ($SD = 2.1$). Thus, the response bias did not increase acceptance of appropriate pairs.

Appearance-Reality Task

Children answered two questions ("really and truly" and "looks to your eyes right now like") per object. Children's response pattern for an item could be correct (i.e., function word for "really and truly" and representation word for "looks like"; for example, "looks like" candy but "really and truly" is a magnet), phenomenistic (representation word for both questions), intellectual realistic (function word for both questions), or incongruous (both responses incorrect). Children produced the correct response pattern for a mean of 1.6 out of 4.0 objects.

Children tended to produce "intellectual realism" errors (Flavell et al., 1986), that is, naming an object's function in response to "looks like" questions. Children made a mean of 2.0 realism errors ($SD = 1.5$) and a mean of 0.2 phenomenalism errors ($SD = 0.5$). A total of only 3.0 incongruous responses was produced. Thus, whereas the mean number of correct response patterns is comparable to numbers reported by Flavell (e.g., Flavell et al., 1983, 1987, 1986), our participants showed more one-sided intellectual realism. This may be because our objects were somewhat less deceptive, with more obvious functions, than those used by Flavell and colleagues.

PPVT-R

Children's mean age-corrected PPVT-R score was 112 ($SD = 15.6$). The test is normed at mean = 100 ($SD = 15$); thus,

⁷ Sessions in Experiment 2 were not videotaped because of persistent equipment malfunction. Information on spontaneous productions and ineffective probes is therefore unavailable. Number of probes is calculated from the standard protocol.

⁸ Both the distribution of words accepted per character and the distribution of percentage of word pairs accepted, are negatively skewed because of ceiling effects. Consequently, the inferential statistics reported in this section should be interpreted with caution.

scores were higher than the national sample mean (c. 1980). This probably reflects the fact that participants were recruited from a laboratory preschool at a university, and their verbal abilities may have been slightly advanced (though probably similar to participants in previous studies of word learning and representational ability).

Intertask Association

To determine whether individual differences in the object naming and story tasks were related to representational ability, vocabulary, or both, we calculated correlations among three scores from each child: mean number of words per object produced in the naming task, number of correct response patterns in the appearance–reality task, and age-corrected PPVT–R.⁹ Age in months was partialled out because some measures were positively correlated with age. The results are shown in Table 6. The only significant correlation was between number of words in the naming task and vocabulary. Apparently polynomy, the ability to produce multiple words for an object, is related to vocabulary but not to appearance–reality performance.

An interesting relation was found between the order of words produced in the naming task and errors in the appearance–reality task. Recall that in Experiment 1 children's first word tended to refer to an object's representational rather than to its functional frame (e.g., *dinosaur* rather than *crayon*). This was replicated: Children's first labels referred to the representational frame of a mean of 4.8 out of 8.0 objects ($SD = 1.6$). However, children made a preponderance of intellectual realism errors, which are overextensions of function words. Function may have been more salient in the appearance–reality task because children were shown objects' functions before naming. In the naming task children were not always initially aware of an object's function.

Discussion

These data closely replicate the major findings from the object naming and story tasks in Experiment 1. Children from 3 to 5 years readily apply multiple words to a referent. The most striking difference was that several children in the current experiment were biased to accept foil pairs. However, this bias did not apparently increase children's tendency to accept appropriate pairs because response-biased and unbiased children accepted about the same number and proportion of appropriate pairs.

Table 6
Partial Correlations (Controlled for Age) Between Tasks in Experiment 2

Task	Appearance reality	PPVT–R
Naming	.09	.44*
Appearance–reality		–.18

Note. Mean number of words per object produced in the naming task, mean number of correct response patterns in the appearance–reality task, and age-corrected PPVT–R were calculated to derive partial correlations. PPVT–R = Peabody Picture Vocabulary Test—Revised.

* $p < .03$.

Overall, children were quite selective in extending appropriate words to objects and people.

Children extended inclusive, overlapping, and overlapping basic pairs. In the story task in Experiment 1 children accepted fewer pairs containing an occupation word (e.g., *mother–teacher*). This did not replicate ($M_s = 2.2$ out of 3.0 for both types), possibly because of eliminating the phrase “at the same time,” which might have misled children who held the mistaken belief that roles are contingent on current activity. Evidence of this effect was not conclusive, however, thus warranting further study.

The finding that individual differences in the number of words produced are related to vocabulary size, not to appearance–reality performance, is inconsistent with Flavell et al.'s (1986) dual-encoding hypothesis. Many children performed poorly on the appearance–reality task yet produced multiple words for single objects. Thus, most children “failed” the appearance–reality test but “passed” the polynomy test. One interpretation is that the appearance–reality task does not measure children's ability to coordinate and maintain multiple representations but measures other skills, such as remembering several words for different aspects of deceptive objects, or knowing which label is related to each of two predicates (e.g., “looks like”). In support, Merriman, Jarvis, and Marazita (1995) found that appearance–reality performance is affected by the specific predicate used (e.g., “is” vs. “is really and truly”). Further, Brenne- man and Gelman (1993) and Rice et al. (1997; see also Siegal, 1991) have shown that when the task is changed pragmatically or structurally (e.g., to an object-matching task), 3-year-olds can solve appearance–reality problems. Thus, the task might measure the ability to adapt naming to linguistic and pragmatic context rather than to representational flexibility.

Data from the story task, in addition to confirming representational flexibility and polynomy in preschoolers, contradict long-standing conclusions about children's limited concepts of social and kinship roles (e.g., Sigel et al., 1967). Although the results of Experiment 1 suggest that 3-year-olds tend to restrict people to one role, that trend did not replicate. Thus, children 2 to 3 years younger than in previous studies (e.g., Jordan, 1980; Sigel et al., 1967; Watson & Fischer, 1980) reliably accepted multiple appropriate words for a character, including multiple kinship and occupation role words. It is not clear why children performed so poorly in previous studies, although procedural factors in those studies might have biased children to believe that only one word was allowed. For instance, in Sigel et al.'s and Jordan's procedures, pictures were grouped in discrete labeled rows, and a focal item was moved from one row to another. Children

⁹ Several additional scores were excluded from the analysis because of extreme, negative skew (skewness values between -1.5 and -2.1). These were the mean number of words accepted in the story task, the percentage of appropriate pairs accepted in the naming task, and the percentage of appropriate pairs accepted in the story task. Such skewed distributions are inappropriate for correlational analysis, which assumes linearity throughout the distribution. However, the fact that children performed close to ceiling on these variables, although they performed poorly on the appearance–reality task (1.6 out of 4.0 correct), suggests that the former measures are unrelated to appearance–reality performance.

might have assumed that the experimenter intended the rows to be mutually exclusive and movement of an item to signify a permanent change in membership. In contrast, our participants were told a brief vignette with relevant information about two roles. This effectively elicited children's knowledge about multiple roles. Watson and Fischer also presented vignettes, but their participants role played another character in the scenario. The role-playing task might have been difficult for children and impaired overall performance. Further study is called for to explain the discrepancy. Note, however, that children's ability to coordinate role and nonrole categories is confirmed by Clark and Svaib (1997), who showed children scenes of animals in various occupations. Children as young as 2.5 years correctly answered questions such as "Is this cat an animal?" and "Is this nurse a dog?" suggesting that the ability to apply occupational and biological words to characters is not an artifact of specific procedures or materials and that the ability is present in toddlers.

General Discussion

Preschoolers apply multiple words to things in a systematic manner. They neither restrict entities to a single category nor assume that entities have but one name. This has implications for our understanding of preschoolers' conceptual, representational, and linguistic abilities.

With regard to preschoolers' conceptual and representational abilities, the data show the ability to represent simultaneously several categories for an object or person. Preschoolers understand that an entity can simultaneously belong to several categories with various semantic relations (though they might not fully grasp the implications of those relations). They understand that objects belong to more- and less-inclusive categories (see also Au & Glusman, 1990; Smith, 1979; Steinberg & Anderson, 1975; Waxman & Hatch, 1992; Waxman & Senghas, 1992) and categories from different taxonomic frames. This is consistent with recent findings that preschoolers are capable of *flexible induction*. Flexible induction is the ability to categorize an object differently in response to different goals or purposes. Strong tests of flexible induction require several closely spaced inductive inferences about the same objects as the context or task changes. For example, Deák (1995) asked children to generalize several novel facts about each of several sets of novel objects. Children as young as 3.5 years flexibly extended novel attributes according to the relevant similarity that changed from trial to trial. For example, when told that a standard object "is made of mylar," children generalized that fact to another object made of the same material. When later told that the standard "has an infix," they generalized that fact to a different object with the same part. This required flexible shifting of attention in response to changing tasks (i.e., questions), which, in turn, implies flexible construction of task-specific categories (e.g., a material-based category or a part-based category). The naming task is another test of flexible induction because children must shift their choice of category label in response to successive probe questions, foils, and function demonstrations. Thus, the current findings support Deák's (1994, 1995) arguments that young preschoolers flexibly shift their inductive decisions in response to changing contexts and tasks.

The ability to categorize entities simultaneously in several taxonomic frames extends both Rosch's account of basic-level categories (Rosch, 1978; Rosch et al., 1976) and the view that inferences about kinds are limited by ontological hierarchies (e.g., Keil, 1979). First, Rosch's framework presumes that each entity belongs to a single hierarchy, with one basic-level construal. The fact that entities can be conceptualized as belonging to several hierarchies, each with a separate basic level, leads to new implications. For example, Rosch's framework predicts that participants most readily label entities (and verify labels) at the basic level (Murphy & Smith, 1982; Rosch et al., 1976), but it does not predict how several basic-level terms are activated and how one is chosen. Second, ontological hierarchies are typically construed as rigid and unitary rather than as articulated and complex. The current findings suggest that an entity can activate nodes at the intersection of several "branches" of separate trees (i.e., frames). Activation is task dependent (see Barsalou, 1991), as shown by the contingency between specific pragmatic or semantic probes and children's choices of words at different levels (more or less inclusive) of different frames.

Another implication of these data is that if preschoolers have a dual-encoding deficit it is modest and relative, not absolute. Why, then, do children (especially 3-year-olds) perform poorly on the appearance-reality task? As previously argued, it might be due to language and task factors. Specific predicates (i.e., "really and truly" or "looks like") imply specific taxonomic frames (function or appearance). Incorrect answers may reflect a representational deficit in maintaining both frames, or they may reflect incorrect mappings of predicates onto frames, or failure to discriminate the predicates' meanings. Although Flavell et al. (1986) argued against the latter interpretations on the basis of training studies, it is notoriously difficult to interpret negative results of training—particularly, in this case, because training efforts have been minimal (e.g., Taylor & Hort, 1990) and have focused on the color appearance-reality task, which might have quite different psychological properties than the object identity appearance-reality task.¹⁰ Thus, there is no compelling evidence that children's appearance-reality task failures are due to conceptual or representational deficits.

With respect to language development, our data suggest that preschoolers might be able to use labels to specify selectively and pragmatically a referent (see Olson, 1970). For example, preschoolers might choose names to disambiguate a target object (e.g., a crayon dinosaur) from a field of distractors (other non-crayon dinosaurs; for example, "I want the *crayon*!"). This would allow the child to communicate more clearly but clarity would be limited by the child's lexicon (e.g., if dinosaurs differ only by species, the child must know species names in order to specify an individual) and their perspective-taking abilities (Glucksberg, Krauss, & Weisberg, 1966). The importance of lexical development for polynomy is demonstrated not only by

¹⁰ Ray (1996) found a relationship between children's performance on object property (e.g., color) and object identity appearance-reality tasks, $r = .48, p < .01$. (Flavell et al., 1986, also found such a relation but did not control for age, rendering it uninterpretable. Ray partialled out age.) Performance on one task accounts for only one quarter of the variance on the other, indicating that the tasks have mostly unique sources of variance.

the correlation between number of words produced and PPVT-R scores in Experiment 2 but also by probe effectiveness in Experiment 1: Attempts to elicit superordinate words were least effective, and spontaneously produced words were mostly basic level. Children know far more basic-level than superordinate words (Anglin, 1977), and they sometimes misconstrue superordinates (Markman & Seibert, 1976). Thus, the children might not have produced superordinates because they did not know them, yet they knew basic-level words sufficiently to produce them unprompted. The relation between polynomy, vocabulary, and pragmatic clarity is important and requires further research.

These findings narrow the scope of a proposed constraint on word meaning. The ME bias (Liittschwager & Markman, 1994; Markman, 1989; Markman & Wachtel, 1988; Merriman & Bowman, 1989; Merriman et al., 1995; Woodward & Markman, 1991) purportedly predisposes preschoolers to believe that an object can have only one name, thus restricting them from applying multiple words. The bias is believed to be overcome only by direct evidence that two words co-extend. Markman and Wachtel, for example, asserted that "children should be biased to assume, especially at first, that terms are mutually exclusive, and only relinquish that assumption when confronted with clear evidence to the contrary" (p. 124; see also Merriman & Bowman, 1989, p. 28).¹¹

The ME bias purportedly helps children limit the possible meanings of novel words (see Markman, 1989; Quine, 1960) and is reflected most clearly in children's tendency to map novel words onto unnamed objects, which Merriman and Bowman (1989) call *disambiguation*. For example, if asked to "show me the dax," children tend to choose an unnameable object (or feature or part) over a nameable one. Disambiguation, however, has many plausible alternative explanations (some of which are discussed by Merriman et al., 1995). Consequently, a general reluctance to allow words to overlap, or *restriction*, may be the core feature of ME (Merriman & Bowman, 1989). Evidence of polynomy—particularly with unlearned word combinations—is inconsistent with restriction.

Although ME is often framed as a word learning bias (i.e., a bias to restrict the extensions of new words from already named things), Markman (1989, 1992; see also Flavell et al., 1986) speculated that ME rests on a general representational deficit (e.g., dual encoding). This would parsimoniously explain ME as well as, for example, preschoolers' denials that a person can be a father and a doctor and their appearance-reality errors (Markman, 1992). Because naming depends on categorization, inability to represent multiple categories could account for restriction and dual encoding. The fact that children readily produce multiple words for objects allows researchers to reject this explanation. Contrary to claims that the core of ME is a restriction or a representational deficit, children readily produce multiple words for unfamiliar items. Relinquishing ME does not, as Markman and Wachtel (1988) and Merriman and Bowman (1989) implied, depend on prior learning: Children accepted numerous novel pairs of words (e.g., *dog-puppet* and *book-car*). Contrary to Markman's (1992) speculations, then, ME is not due to a general deficit in maintaining multiple representations.

Instead, ME may be restricted to word-learning situations. This certainly is not parsimonious (i.e., why should children

restrict a new word and an old word, but not a novel pair of old words, from co-extension?), but the alternative is rejection of ME as it stands. This alternative is in fact advocated by Mervis et al. (1994). Mervis et al.'s alternative (see also Golinkoff et al., 1994), the novel name-nameless category (N3C) bias, does not stipulate a belief that one object has only one name (or one category) but merely has the tendency to look for an unnamed category for a novel word. This is the reciprocal of the lexical gap filler (LGF) constraint (Clark, 1987), the tendency to seek novel words for unnamed categories. Together, N3C and LGF can account for much evidence cited in support of ME. Unlike ME, however, the former does not assume that children limit the number of words for an entity. Thus, whereas these principles do not explain all of the evidence in support of ME (e.g., the correction effect; Merriman & Bowman, 1989), neither are they inconsistent with data such as those reported here.

These data also illustrate pragmatic dynamics in naming and reference. The eliciting procedure in the naming task often took the form of a word game: The experimenter suggested a "silly" word for an object (i.e., the foil), which the child rejected and corrected, often with amusement or indignation. The fact that children correct the foil with a word from the same domain or aspect (e.g., function or occupation) and level of inclusion (i.e., basic or superordinate) is probably due to the maxim of relevance (Grice, 1975), as well as semantic and cognitive factors (e.g., the foil might associatively prime the appropriate word). It is unclear what other interactions and situations lead children to adapt their word choices, but the fact that children sometimes spontaneously produced additional words indicates that the particular word-eliciting methods used here were not necessary for polynomy. Many conversational contexts lead speakers to produce the same word for an entity within a conversation, but across conversations and contexts children and adults probably use different words for an object (see Murphy & Wisniewski, 1989, for evidence that basic-level and superordinate words are differentially primed by different contexts). Further study is needed to determine factors that lead children to choose or switch words for an entity. A more complete understanding of these factors might also promote the study of children's semantic representations. For example, by utilizing children's tendency to replace foil words at the same level of inclusion, researchers might study children's vertical (inclusive) semantic networks (Deák & Maratsos, 1997).

The process by which specific semantic and pragmatic conditions affect children's word choice is not clearly understood. What is clear is that in some conditions, children as young as 3 years readily produce and affirm multiple appropriate words

¹¹ Obviously this prediction could be overstated. For example, a child who has learned that *rabbit* and *animal* are co-extensive should infer that *bunny* and *animal* are also co-extensive. Further, once a child has learned that *animal* is co-extensive with *dog*, *cat*, *mouse*, *cow*, and *lion*, he or she might infer that *gerbil*, *horse*, and *wolf* are also co-extensive with *animal*. This exception pertains largely to inclusive (i.e., hierarchically related) pairs, not overlapping pairs (e.g., knowledge that *cat* overlaps with *pet* does not support the inference that *gerbil* overlaps with *pet*). For relevant evidence, see Lopez et al. (1992) and Smith (1979).

for an entity. This challenges accounts that preschoolers assume objects have only one name. More important, it challenges the view that young children cannot maintain simultaneous representations of multiple categories or cannot conceptualize an entity as belonging to categories in different taxonomic frames. Further study is needed to document the development of this representational and conceptual flexibility.

References

- Anderson, J. R. (1974). Retrieval of propositional information from long-term memory. *Cognitive Psychology*, 6, 451–474.
- Anglin, J. (1977). *Word, object, and conceptual development*. New York: Norton.
- Au, T. K., & Glusman, M. (1990). The principle of mutual exclusivity in word learning: To honor or not to honor? *Child Development*, 61, 1474–1490.
- Au, T. K., & Markman, E. M. (1987). Acquiring word meanings via linguistic contrast. *Cognitive Development*, 2, 217–236.
- Banigan, R. L., & Marvis, C. B. (1988). Role of adult input in young children's category evolution: II. An experimental study. *Journal of Child Language*, 15, 493–504.
- Barsalou, L. W. (1991). Deriving categories to achieve goals. In G. Bower (Ed.), *Psychology of learning and motivation: Advances in research and theory* (Vol. 27, pp. 1–64). New York: Academic Press.
- Brenneman, K., & Gelman, R. (1993, March). *Reasoning about object identities in the appearance reality situation*. Paper presented at the biennial meeting of the Society for Research in Child Development, New Orleans, LA.
- Callanan, M. A. (1985). How parents label objects for young children: The role of input in the acquisition of category hierarchies. *Child Development*, 56, 508–523.
- Case, R. (1978). Intellectual development from birth to adulthood: A Neo-Piagetian interpretation. In R. S. Siegler (Ed.), *Children's thinking: What develops?* (pp. 37–71). Hillsdale, NJ: Erlbaum.
- Clark, E. V. (1987). The principle of contrast: A constraint on language acquisition. In B. MacWhinney (Ed.), *Mechanisms on language acquisition* (pp. 1–34). Hillsdale, NJ: Erlbaum.
- Clark, E. V., & Svaib, T. A. (1997). Speaker perspective and reference in young children. *First Language*, 17, 57–74.
- Deák, G. (1994). *Flexibility of categorization in children and adults*. Unpublished manuscript, University of Minnesota, Twin Cities Campus (Minneapolis).
- Deák, G. (1995). *The functional nature of induction: Flexibility in children's inferences about object properties*. Unpublished doctoral dissertation, University of Minnesota, Twin Cities Campus (Minneapolis).
- Deák, G., & Bauer, P. J. (1996). The dynamics of preschoolers' categorization choices. *Child Development*, 67, 740–767.
- Deák, G., & Maratsos, M. (1997). Reference and representation: What polynomy tells us about children's conceptual structures. In E. Clark (Ed.), *Proceedings of the 28th Annual Child Language Research Forum* (pp. 73–83). Stanford, CA: CSLI.
- Duncker, K. (1945). On problem-solving. *Psychological Monographs*, 58 (5, No. 270).
- Dunn, L. M., & Dunn, L. M. (1981). *Peabody Picture Vocabulary Test — Revised*. Circle Pines, MN: American Guidance Service.
- Elkind, D. (1978). *The child's reality: Three developmental themes*. Hillsdale, NJ: Erlbaum.
- Flavell, J. H. (1985). *Cognitive development* (2nd ed.). Englewood Cliffs, NJ: Prentice Hall.
- Flavell, J. H., Flavell, E. R., & Green, F. L. (1983). Development of the appearance-reality distinction. *Cognitive Psychology*, 15, 95–120.
- Flavell, J. H., Flavell, E. R., & Green, F. L. (1987). Young children's knowledge about the apparent-real and pretend-real distinctions. *Developmental Psychology*, 23, 816–822.
- 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).
- Gick, M. L., & Holyoak, K. J. (1980). Analogical problem-solving. *Cognitive Psychology*, 12, 306–355.
- Glucksberg, S., Krauss, R. M., & Weisberg, R. (1966). Referential communication in nursery-school children: Method and some preliminary findings. *Journal of Experimental Child Psychology*, 3, 333–342.
- Golinkoff, R. M., Mervis, C. B., & Hirsh-Pasek, K. (1994). Early object labels: The case for lexical principles. *Journal of Child Language*, 21, 125–155.
- Grice, H. P. (1975). Logic and conversation. In P. Cole & J. L. Morgan (Eds.), *Syntax and semantics* (Vol. 3, pp. 41–58). New York: Seminar Press.
- Hall, D. G. (1996). Naming solids and nonsolids: Children's default construals. *Cognitive Development*, 11, 229–264.
- Hochberg, J., & Brooks, V. (1962). Pictorial recognition as an unlearned ability: A study of one child's performance. *American Journal of Psychology*, 75, 624–628.
- Inhelder, B., & Piaget, J. (1964). *The early growth of logic in the child*. New York: Harper & Row.
- Jordan, V. B. (1980). Conserving kinship concepts: A developmental study in social cognition. *Child Development*, 51, 146–155.
- Karmiloff-Smith, A. (1992). *Beyond modularity*. Cambridge, MA: MIT Press.
- Keil, F. C. (1979). *Semantic and conceptual development: An ontological perspective*. Cambridge, MA: Harvard University Press.
- Kuhn, D., Nash, S. C., & Bruckner, L. (1978). Sex role concepts of two- and three-year-olds. *Child Development*, 49, 445–451.
- Liittschwager, J. C., & Markman, E. M. (1994). Sixteen- and 24-month-olds' use of mutual exclusivity as a default assumption in second-label learning. *Developmental Psychology*, 30, 955–968.
- Lopez, A., Gelman, S. A., Gutheil, G., & Smith, E. E. (1992). The development of category-based induction. *Child Development*, 63, 1070–1090.
- Markman, E. M. (1989). *Categorization and naming in children: Problems of induction*. Cambridge, MA: Bradford/MIT Press.
- Markman, E. M. (1992). Constraints on word learning: Speculations about their nature, origins, and domain specificity. In M. R. Gunnar & M. Maratsos (Eds.), *The Minnesota Symposium on Child Psychology* (Vol. 25, pp. 59–101). Hillsdale, NJ: Erlbaum.
- Markman, E. M., & Seibert, J. (1976). Classes and collections: Internal organization and resulting holistic properties. *Cognitive Psychology*, 8, 561–577.
- Markman, E. M., & Wachtel, G. F. (1988). Children's use of mutual exclusivity to constrain the meanings of words. *Cognitive Psychology*, 20, 121–157.
- 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, Serial No. 220).
- Merriman, W. E., Jarvis, L. H., & Marazita, J. M. (1995). How shall a deceptive thing be called? *Journal of Child Language*, 22, 129–149.
- 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* (pp. 147–183). Hillsdale, NJ: Erlbaum.
- Mervis, C. B. (1984). Early lexical development: The contributions of mother and child. In C. Sophian (Ed.), *Origins of cognitive skills* (pp. 339–370). Hillsdale, NJ: Erlbaum.
- Mervis, C. B. (1987). Child-basic object categories and early lexical

- development. In U. Neisser (Ed.), *Concepts and conceptual development* (pp. 201–233). New York: Cambridge.
- Mervis, C. B., Golinkoff, R. M., & Bertrand, J. (1994). Two-year-olds readily learn multiple labels for the same basic-level category. *Child Development*, 65, 1163–1177.
- Mervis, C. B., & Pani, J. R. (1980). Acquisition of basic-level categories. *Cognitive Psychology*, 12, 496–522.
- Murphy, G. L., & Smith, E. E. (1982). Basic-level superiority in picture categorization. *Journal of Verbal Learning and Verbal Behavior*, 21, 1–20.
- Murphy, G. L., & Wisniewski, E. J. (1989). Categorizing objects in isolation and in scenes: What a superordinate is good for. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 15(4), 572–586.
- Olson, D. R. (1970). Language and thought: Aspects of a cognitive theory of semantics. *Psychological Review*, 77, 257–273.
- Perner, J. (1991). *Understanding the representational mind*. Cambridge, MA: MIT Press.
- Piaget, J. (1965). *The child's conception of number*. New York: Norton. (Original work published 1941)
- Quine, W. V. O. (1960). *Word and object*. Cambridge, MA: MIT Press.
- Ray, S. D. (1996). *Appearance-reality and perspective-taking in young children*. Unpublished master's thesis, Middle Tennessee State University.
- Rice, C., Koinis, D., Sullivan, K., Tager-Flusberg, H., & Winner, E. (1997). When 3-year-olds pass the appearance-reality test. *Developmental Psychology*, 33, 54–61.
- Rosch, E. H. (1978). Principles of categorization. In E. H. Rosch & B. B. Lloyd (Eds.), *Cognition and categorization* (pp. 27–48). Hillsdale, NJ: Erlbaum.
- Rosch, E. H., Mervis, C. B., Gray, W., Johnson, D., & Boyes-Braem, P. (1976). Basic objects in natural categories. *Cognitive Psychology*, 3, 382–439.
- Sattler, J. M. (1988). *Assessment of children* (3rd ed.) San Diego, CA: Sattler.
- Siegal, M. (1991). *Knowing children: Experiments in conversation and cognition*. Hillsdale, NJ: Erlbaum.
- Sigel, I. E., Saltz, E., & Roskind, W. (1967). Variables determining concept conservation in children. *Journal of Experimental Psychology*, 74, 471–475.
- Smith, C. L. (1979). Children's understanding of natural language hierarchies. *Journal of Experimental Child Psychology*, 27, 437–458.
- Steinberg, E. R., & Anderson, R. C. (1975). Hierarchical semantic organization in 6-year-olds. *Journal of Experimental Child Psychology*, 19, 544–553.
- Taylor, M., & Hort, B. (1990). Can children be trained in making the distinction between appearance and reality? *Cognitive Development*, 5, 89–99.
- Watson, M. W., & Amgott-Kwan, T. (1983). Transitions in children's understanding of parental roles. *Developmental Psychology*, 19, 659–666.
- Watson, M. W., & Fischer, K. W. (1980). Development of social rules in elicited and spontaneous behavior during the preschool years. *Developmental Psychology*, 16, 483–494.
- Waxman, S. R., & Hatch, T. (1992). Beyond the basics: Preschool children label objects flexibly at multiple hierarchical levels. *Journal of Child Language*, 19, 153–166.
- Waxman, S. R., & Senghas, A. (1992). Relations among word meanings in early lexical development. *Developmental Psychology*, 28, 862–873.
- Winer, G. A. (1980). Class-inclusion reasoning in children: A review of the empirical literature. *Child Development*, 51, 309–328.
- Winer, G. A., Rasnake, L. K., & Smith, D. A. (1987). Language versus logic: Responses to misleading classificatory questions. *Journal of Psycholinguistic Research*, 16, 311–327.
- Woodward, A. L., & Markman, E. M. (1991). Constraints on learning as default assumptions: Comments on Merriman and Bowman's "The Mutual Exclusivity Bias in Children's Word Learning." *Developmental Review*, 11, 137–163.
- Zelazo, P. D., & Frye, D. (1996). Cognitive complexity and control: A theory of the development of deliberate reasoning and intentional action. In M. Stamenov (Ed.), *Language structure, discourse, and the access to consciousness* (pp. 113–153). Philadelphia: John Benjamins.

(Appendix follows)

Appendix

Stories: Experiments 1 and 2

Experiment 1: Sample Nonparent Story

Police Officer

This is _____. _____ lives in this house. Every morning [she or he] wakes up and has breakfast. Then _____ puts on [her or his] uniform and goes to work. _____ works in a police car. All day long [she or he] helps people and catches crooks. At the end of the day [she or he] comes home. [She or he] changes out of [his or her] uniform, [she or he] has dinner, and later [she or he] goes to bed.

Experiment 1: Sample Parent Story

Police Officer

This is _____. _____ lives in this house. Every morning [she or he] wakes up [his or her] child. The family has breakfast. Then _____ puts on [her or his] uniform and goes to work. _____ works in a police car. All day long [she or he] helps people and catches crooks. At the end of the day [she or he] comes home and kisses [his or] child. [She or he] changes out of [her or his] uniform, the family has dinner, and later they go to bed.

Experiment 2: Sample Stories

Teacher

This is _____. _____ lives in a house. Every morning [she or he] wakes up [her or his] child. The family has breakfast. Then _____ gets dressed for work and goes to work. _____ works in a classroom in a school. All day long [she or he] helps children learn, and reads books with children. At the end of the day [she or he] comes home and kisses [her or his] child. [She or he] changes out of [her or his] work clothes, the family has dinner, and they go to bed.

Doctor

This is _____. _____ lives in a house. Every morning [she or he] wakes up [her or his] child. The family has breakfast. Then _____ puts on [her or his] white coat and goes to work. _____ works in a hospital. All day long [she or he] examines children to see if they are healthy, and gives them pills or shots if they are sick. At the end of the day [she or he] comes home and kisses [his or her] child. [She or he] changes out of [her or his] white coat, the family has dinner, and they go to bed.

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