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Syntactic cues in the acquisition of collective nouns

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Abstract

One basic finding in the study of word learning is that children tend to construe a word describing an object as referring to the kind of whole object, rather than to a part of the object, one of its properties, or the substance it is made of. This has been taken as evidence that there exist certain special constraints on word meaning that guide children to favor the kind-of-object interpretation when exposed to a new word. There are descriptive problems with this proposal, however, as it cannot explain how children learn other kinds of words, such as names for specific people, substances, parts, events, collections, and periods of time. These problems motivate an alternative theory in which young children possess several distinct conceptual categories – including "individual", which is more abstract than "whole object" – and can use syntactic cues to determine the conceptual category that a new word belongs to. This theory is explored in two experiments in which we attempt to use syntactic cues to teach children and adults novel collective nouns – words that refer to groups of objects. The results indicate that children can use such cues to learn names for kinds of individuals that are not whole objects, although they are less able to do so than adults. Candidate explanations for why this developmental difference exists are discussed and implications are drawn for theories of word learning and conceptual representation.

1. Introduction

This article concerns the acquisition of names for material entities, such as objects (*dog*), substances (*water*), specific people (*Jane*), and collections of objects (*family*). Most research into word learning has focused on names for

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object kinds, and such names do appear to have a privileged status in lexical development. Evidence from both experiments and analyses of vocabulary development suggest that when children and adults are exposed to a novel word that refers to an unfamiliar object, they tend to interpret the word as referring to that kind of whole object – and not as naming a part of the object, a property of the object, or the stuff that the object is made of (e.g., Baldwin, 1989; Macnamara, 1982; Markman & Wachtel, 1988; Soja, Carey & Spelke, 1991; Taylor & Gelman, 1988; Waxman & Hall, 1993).

One explanation for this phenomenon is that children and adults possess certain special constraints on word learning. In particular, a "whole object assumption" (biasing in favor of the whole object interpretation) and a "taxonomic assumption" (biasing in favor of the "kind" interpretation) have been argued to apply even in children under 2 years of age (see Markman, 1990 for review). Such assumptions are specific to the process of word learning and not the result of more general principles of sorting or categorization. In support of this, Markman and Hutchinson (1984) found that when hearing an object (such as a dog) described as "a dax" and asked to "find another dax", children tend to assume that the word refers to that kind of object and will point to another dog. But when simply told "See this. Find another one", where no novel word is provided, children prefer to point to something that has a thematic relationship to the dog, such as a bone. This suggests that the bias to favor kinds of objects is limited to the domain of word learning.

Most of the words possessed by adults – and by 2-year-olds – are not names for kinds of objects. To account for this, Markman and Wachtel (1988) posit a further constraint stipulating that distinct words cannot have overlapping extensions ("mutual exclusivity"). This would be false as an absolute property of natural language (consider *dog* and *animal*, for instance). But it could nevertheless exist as a bias that sometimes overrides the whole object and taxonomic constraints. In particular, once a child had acquired a name for a given kind of object (e.g., *dog*), mutual exclusivity would bias her to infer that other words that describe members of that kind are not names for the object kind, and might instead refer to properties, parts, and so on.

There is by now abundant evidence in support of the special constraint view. Not only are children biased to favor the kind-of-object interpretation when exposed to a word that describes an unfamiliar object, but this bias can be overridden if the object already has its own name (Clark, 1987; Markman & Wachtel, 1988; Merriman & Bowman, 1989). The theory suffers from certain limitations, however, and some of these are discussed below (see also Bloom, 1994a). The remainder of this article will defend a different theory of children's word learning capacities, which is that they possess a set of conceptual categories (including a notion of "individual" that is more abstract than "whole object") and can use grammatical cues to determine which of these conceptual categories the meaning of a new word corresponds to.

This proposal diverges most radically from the special constraint theory with regard to how children learn words other than names for object kinds. To explore this, we report the results of two studies in which we attempt (with mixed success) to teach children and adults novel collective nouns. In the General Discussion, we discuss some implications of these results for theories of word learning and conceptual representation.

1.1. *Problems with the special constraint theory of word learning*

We should stress at the outset that we have no objections to the notion of constraints on word learning. Acquiring a word is a problem of induction and induction can succeed only if the learner possesses some *a priori* constraints on the space of possible hypotheses (see Fodor, 1975; Goodman, 1983). In particular, there are an infinite number of possible meanings consistent with any exposure or set of exposures to a new word (Quine, 1960), and so children must possess constraints (or biases) leading them to favor some of these meanings over others. The dispute is over the precise nature of these constraints.

In particular, a theory that assumes that object names have a unique status in word learning – and that words which refer to other categories can be acquired only as second-choices, after an object-kind label has already been learned – makes some problematic predictions about children's lexicons.

In a study of children's early productive use of words, Nelson, Hampson, and Shaw (1993) examined the speech of 45 children, who were an average age of 1 year and 8 months. They found that even at this age, nominals were not the only categories used; for example, children also used words denoting actions (*eat*) and properties (*nice*), which, at least for adults, correspond to verbs and adjectives. Nelson et al. also found that even when they restricted the analysis to nominals, only about half referred to basic-level object kinds. The rest referred to other conceptual categories, such as specific people (*Fred*), events (*party*), and temporal entities (*day*). Other studies looking at younger children's very first words (e.g., Bates, Bretherton, & Snyder, 1988; Bloom, 1990; Nelson, 1973), have obtained similar results.[1]

[1] One must be cautious when interpreting data from spontaneous speech, since children need not know the correct meaning of a word to use it appropriately. It is quite likely, for instance, that children's understanding of word like *nap* might differ in subtle ways from that of adults. But it is wildly improbable that *all* of their usages of such words are entirely confused, such that they think that they are all names for object kinds. We know of no reported cases where children were observed to treat words like *nap* and *spanking* as referring to kinds of objects, such that *nap* meant "bed" or *spanking* meant "hand". Similarly, there are no cases where children have been reported as treating pronouns and proper names like *she* and *Fred* as names for specific kinds. The only relevant errors that do occur are initial confusions with *mommy* and *daddy*, and the status of these errors is unclear, as such words are sometimes used as common nouns by adults (Macnamara, 1982).

The early acquisition of these words poses two distinct problems for the special constraint theory. First, some of them should not have been acquired if children possess the posited constraints. In particular, pronouns and proper names violate the taxonomic constraint; they are used to refer to objects, but refer to specific individuals rather than *kinds* of objects. Nevertheless, pronouns and proper names are used before children show evidence of having learned any word that refers to the kind that these specific individuals belong to (e.g., *person*, *man*, or *woman*), suggesting that their acquisition cannot be explained through mutual exclusivity. To put it another way, nominals like *she* and *Fred* do not appear to be "second-choices", acquired only after the object-kind name that refers to the same entity. Instead they are appropriately used very early in lexical acquisition. (It is less clear whether children are also capable of learning names for kinds of body parts – like *finger* and *eye* – before learning words like *person*; if they are, this would pose a similar problem for the whole object constraint.)

Second, many of children's nominals fall outside the purview of the proposed constraints. Substance names like *water*, names for events like *spanking*, and temporal terms like *minute* are not labels for objects in the first place and so the constraints cannot explain their acquisition. Even for the sorts of cases that mutual exclusivity works best for (names for artifact parts like *handle* and names for solid substances like *wood*, words which really do seem to be second-choices, learned only after a relevant object name has been acquired), the constraint does not explain *how* such words are acquired: it just provides an explanation for why they are learnable in the first place, given the existence of the whole object and taxonomic assumptions. This failure to explain how words that do not refer to object kinds are acquired is a serious gap, as the conceptual arguments for the necessity of constraints in the case of object names apply just as well for the acquisition of words like *water* and *handle*. It would be preferable for a theory of lexical development to account for the early acquisition of all names, not just names of object kinds.

A final concern is that the motivation for positing constraints like the whole object assumption is their role in solving the word learning problem. But although it is conceivable that the constraints that facilitate lexical learning have evolved solely for this purpose, it would be more parsimonious to explain children's success at word learning through more general properties of language and cognition. The argument below is that the bias to favor the kind-of-whole-object interpretation in certain situations exists only as a by-product of more fundamental psychological processes (e.g., Bloom, 1994a, 1994b; see also Markman, 1992). In particular, we argue here that the bias to favor the kind-of-object interpretation is a special case of two already-present aspects of children's knowledge: a specific mapping between count nouns and kinds of individuals, and a predisposition to construe objects as individuals.

1.2. An alternative theory of word learning

The theory explored here is defended in some detail in Bloom (in press), where it is placed in the context of "rationalist" perspectives on word learning. It is based on prior work by Brown (1957), Carey (1988), Gleitman (1990), and Macnamara (1982), and has three main premises.

The first is that children's concepts are both diverse and abstract. They are diverse in the sense that they belong to different ontological categories, including individuals, kinds of individuals, properties, events, and spatial relations. They are abstract in the sense that they do not reduce to sensory or perceptual categories. This is in sharp contrast to the premise, held in different forms by constructivists such as Piaget, empiricists such as Hume, and some modern-day connectionists, that the concepts possessed by infants and young children are initially arrays of perceptual features, and that only as a result of further experience – including language learning – do more diverse and abstract categories emerge (see also Quine, 1960).

The empiricist position is arguably untenable, in part because of the abundant experimental evidence from infant cognition research which suggests that infants possess distinct classes of abstract conceptual categories (e.g., Spelke, Breinlinger, Macomber, & Jacobson, 1992; Wynn, 1992). For instance, infants' understanding of number appears to be abstract, with 6-month-old children capable of matching the number of objects they are shown with the number of sounds that they hear (Starkey, Spelke, & Gelman, 1990). As noted above, similar findings emerge from studies of language acquisition; even 2-year-olds seem to have no special difficulty acquiring terms that refer to numbers, like *two*, temporal individuals, like *minute*, moral properties, like *good*, and social constructs, like *family*.

A second premise, first proposed by Brown (1957), is that these conceptual categories correspond to specific syntactic categories. After children have some grasp of language-particular properties of grammar, they can apply these syntax-semantics mappings in the course of word learning. In other words, they can use the syntactic category of a word as a cue to what it must mean. Evidence is reviewed below that at least some of these mappings can be used by 2- and 3-year-olds when learning the meanings of nouns.

The third premise concerns a different sort of cue to word meaning. Many traditional theories of word learning posit that children map words onto concepts through a sensitivity to spatio-temporal contiguity. The child is looking at a dog, hears "dog", and associates the sound of the word with her perceptual experience at the time the word is heard. Given the circumstances under which children are exposed to words, however, this mechanism is unlikely to work, as the required correlations between words and objects do not appear to exist (e.g., Bloom, in press; Chomsky, 1959; Landau & Gleitman, 1985). Even in cases where the connection is made explicit, as when an adult points to an object in the presence of the child and

says its name, children do not learn the word through the principles of association. Instead, they determine what the adult is looking at and assume that this is the referent – even if they themselves were looking at another object at the moment the word was used (Baldwin, 1991). This suggests that word learning is fundamentally an interpretive process, related to the child's capacity to infer the linguistic intentions of others. The child learns that "dog" means *dog* because she has the capacity to infer that adults intend to refer to dogs when they use the word (see also Macnamara, 1982).

The discussion below directly focuses on the first and second aspects of this proposal and how they differ from the special constraint view. Like the constraint theory, the view advanced here focuses on the acquisition of nominals. One specific account of the syntax-semantics mappings within the domain of English nominals is as follows (see also Bach, 1986; Bloom, 1994b; Jackendoff, 1991; Langacker, 1987; Macnamara, 1986).

There are three mappings of interest. One is between count nouns (words that can follow determiners such as *a* and *many*, and can be pluralized) and the category **kind of individual**, another is between mass nouns (words that can follow determiners like *some* and *much* but which cannot be pluralized and cannot follow determiners such as *a* and *many*) and the category of **kind of non-individuated entity** (or, more succinctly, **kind of stuff**), and a third is between lexical NPs (words which cannot be quantified at all) and the category of **individual**.[2] This is summarized in Table 1.

Such mappings are presumed to underlie knowledge of language in

Table 1
Proposed syntax–semantics mappings within the domain of nominals

Syntax	Semantics
Count nouns	Kinds of individuals
– They appear within Noun Phrases (NPs) that can refer to a single individual (*a dog*) or to multiple individuals (*many dogs*)	
Mass nouns	Kinds of non-individuated entities (or "stuff")
– They appear within NPs that can refer to portions of stuff (*some water, not much advice*)	
Lexical noun phrases	Individuals
– They can refer to specific individuals or sets of individuals, as with proper names (*Fred*) and pronouns (*she, they*)	

[2] One exception to this third mapping is the expletive *it* (as in *It is raining*) which has no semantic content at all. We know little about how children acquire such semantically empty NPs and, in particular, whether this acquisition is in some sense parasitic on children's understanding of their referential meanings (for some speculations, see Bloom, under review; Nishigauchi & Roeper, 1987).

general; their role is not restricted to language acquisition. It is the syntactic status of *hands*, *water*, and *he* that makes *cold hands* and *cold water*, but not *cold he*, acceptable, just as it is the syntax that makes *too much water*, but not *too much hands*, acceptable. And it is the mappings between syntax and semantics that govern the interpretation of words within these syntactic contexts. For instance, speakers of English understand the difference between *John ate chicken* versus *John ate a chicken* through an understanding of the semantic basis of count-mass syntax. Soja (1994) has argued that syntactic knowledge of this sort also underlies our understanding of the subtle meaning difference between *John went to the school* (*school* as a count noun – referring to the kind of place) versus *John went to school* (*school* as a lexical NP – referring to a specific habitual activity), and that such knowledge can be applied productively by adults and preschoolers.

One aspect of this proposal is that the category "individual" cannot be reduced to the category of "whole object". There exist individuals that are not whole objects, such as puddles (bounded substances), tails (parts), nightmares (cognitive events), and flocks (collections of objects). From the standpoint of grammar, such words are equivalent to object names; there is no difference between a count noun like *dog* and a count noun like *nightmare*. In general, the distinction between count nouns and mass nouns, at least for adults, is an abstract quantificational one, and does not reduce to words referring to kinds of whole objects versus words referring to kinds of non-solid substances.

In addition, however, there is evidence that whole objects are extremely salient individuals. When children and adults are exposed to a scene, they will initially tend to construe the objects – but not collections of objects or parts of objects, for instance – as individuals. Shipley and Shepperson (1990) posit that children possess a "Discrete Physical Object [DPO] bias" that shows up in non-linguistic tasks. When children are shown an array of objects and explicitly asked to count the colors, the parts, or the kinds, they show a strong tendency to ignore the instructions and count the objects. That is, when given a task in which they have to quantify over individuals, they choose objects as the individuals. It is not that children are *limited* to treating objects as individuals when asked to count – on the contrary, they can count sounds and actions just as early as they can count objects (Wynn, 1990). But when they are faced with a display of material entities, they find it difficult to override the DPO bias and focus on non-object individuals, even if they are explicitly asked to do so.

The existence of the mappings shown in Table 1, when combined with the findings of Shipley and Shepperson, suggest that we may not require special constraints to explain the developmental phenomena. Instead, the bias to construe novel words as naming kinds of whole objects emerges from:

(1) the cognitive bias to view whole objects as the most salient individuals (Shipley & Shepperson, 1990); and
(2) the knowledge that count nouns refer to kinds of individuals.

If a child is shown a novel object and hears a count noun used to describe it (e.g., *This is a wug*), these factors will conspire to guide her to construe the noun as referring to the kind of object. If there is no syntactic support, the object will still be the favored interpretation, since it is a salient individual (through the DPO bias) and in most cases there will be no equivalently salient category that the word could refer to. In contrast, if there is count noun syntax but no objects for the DPO bias to apply to, the child will shift to an interpretation consistent with another type of individual – presumably this is how children learn event names like *nap*, temporal expressions like *minute*, and names for bounded substances like *puddle* (see Soja, 1992).

The other mappings in Table 1 can explain the acquisition of names for non-solid substances and for specific individuals. Since the referents of words like *water* and *milk* are not individuatable objects, the DPO bias will not apply. In addition, such words are mass nouns and thus the mapping between syntax and semantics will guide children to assume that they refer to kinds of stuff, not kinds of individuals.[3]

Children will hear pronouns and proper names used to refer to objects, such as people, and so the DPO bias will apply, directing children to focus on these objects as individuals. This precludes a mass noun interpretation of these words. Since they are presented with lexical NP syntax, as in *This is Fred*, children will interpret them as referring to the individuals themselves, not to the kinds of individuals (see also Hall, 1994, for discussion of semantic considerations that favor the individual interpretation over the kind-of-individual interpretation). Even 1- and 2-year-olds syntactically distinguish count nouns and mass nouns from lexical NPs in their spontaneous speech, suggesting that they possess enough knowledge of syntax for this procedure to work (Bloom, 1990).

Are young children actually able to use syntactic cues to word meaning? This question was originally addressed by Brown (1957), who showed preschoolers a picture of a novel action performed on a novel substance with a novel object. Children were told either "Do you know what it means to sib? In this picture, you can see sibbing" (verb syntax); "Do you know what a sib is? In this picture, you can see a sib" (count noun syntax); or "Have you seen any sib? In this picture, you can see sib" (mass noun syntax). They were then shown three pictures, one depicting the same action, another

[3] For solid-substance names, the cues conflict. The syntax motivates the kind-of-stuff interpretation (since words like *wood* and *metal* are mass nouns) but the DPO bias focuses children on the individual objects, not the stuff they are made of. The existence of this conflict suggests that these words should be hard for children to learn, and this appears to be the case: children tend to misconstrue a novel mass noun describing an object (e.g., *This is wood* used to describe a block of wood) as a name for the kind of object, not as the kind of solid-substance (Dickinson, 1988; Markman & Wachtel, 1988; Prasada, 1993; Soja, 1992).

depicting the same object, and the third depicting the same substance. They were asked to "show me another picture of *sibbing*" (or "another picture of *a sib*", or "another picture of *sib*"). Brown found that the preschoolers tended to construe the verb as referring to the action, the count noun as referring to the object, and the mass noun as referring to the substance, suggesting that syntactic cues help in the course of word learning.

Further empirical work has extended Brown's research in the domain of count-mass syntax. Soja (1992) found that once 2-year-olds show productive command of the grammatical contrast between count nouns and mass nouns, their knowledge of syntax-semantics mappings allows them to use syntactic information to infer whether a word refers to a non-solid substance (such as *water*) or to a bounded individual composed of that non-solid substance (such as *puddle*). In another study (Bloom, 1994b), 3- and 4-year-olds were shown a pile of small objects, of a size such that one could name the array with either a plural count noun (such as *peas*) or a mass noun (such as *rice*). When given a plural count noun (*some sibs*) to describe the array, preschoolers interpreted the noun as an object name; when given a mass noun (*some sib*), they interpreted it as referring to the stuff. Similarly, preschoolers were also found to construe a plural count noun describing a series of *sounds* as referring to the individual sounds, and a mass noun describing the same series as referring to the undifferentiated noise (Bloom, 1994b). These findings show that sensitivity to the relation between count-mass syntax and word meaning shows up early in language development and that this distinction does not semantically reduce to objects versus non-solid substances – count noun syntax can cue children to abstract individuals, such as bounded substances (Soja, 1992) and individual sounds (Bloom, 1994b).

A sensitivity to the semantic difference between nouns and lexical NPs appears to emerge even earlier in language development. Katz, Baker, and Macnamara (1974) found that 17-month-olds attended to the difference between count noun syntax (*This is a sib*) and Noun Phrase syntax (*This is sib*) when determining whether a novel word was a name for a kind of object or a proper name (see also Gelman & Taylor, 1984; Hall, 1991; Littschwager & Markman, 1993).

There are similar findings in linguistic domains other than nominals. Unlike nouns, adjectives appear to draw children's attention towards properties (Gelman & Markman, 1985; Taylor & Gelman, 1988; Hall, Waxman, & Hurwitz, 1993; Waxman, 1990), while prepositions draw children's attention to spatial relations (Landau & Stecker, 1990). The contrast between transitive and intransitive verbs can lead 2-year-olds to infer the number of participants in the event denoted by the verb (Naigles, 1990), and Gleitman (1990) and Landau and Gleitman (1985) argue at length that sensitivity to syntactic cues – a process described as "syntactic bootstrapping" – plays a crucial role in the course of the acquisition of verb meanings (see Pinker, 1994, for discussion).

1.3. Motivation for the current study

The evidence reviewed above suggests that children can use syntax to learn names for specific individuals (such as *Fred*), to learn names for kinds of individuals that are not whole objects (such as *puddle*), and to acquire adjectives, mass nouns, and prepositions, which correspond to semantic categories other than individuals or kinds of individuals. But it is unclear whether children can learn a name for a kind of individual which is more abstract than whole object in an instance where the whole object interpretation is conceptually available. In other words, it is an open question whether they can hear a novel count noun applied to an object or set of objects, and interpret the noun as referring to a kind of individual – but not construe the whole objects as the relevant individuals. This scenario serves to directly contrast the theory proposed here (which predicts this sort of acquisition to be possible) with the special constraint theory (which predicts that it should not be possible). It is also directly relevant for certain types of learning that have rarely been explored, such as the acquisition of collective nouns.

Collective nouns are those count nouns that in the singular form refer to groups of objects, not single objects. For instance, *a family* refers to several people, and not to a single person, and *a flock* refers to several birds, not a single bird. Some of these nouns, like *army* and *family*, are learned relatively early (Callanan & Markman, 1982), while others such as *committee* and *school* (of fish) are acquired later.

Collective nouns are interesting for several reasons. As non-object names that refer to material individuals, they provide an intriguing opportunity for the empirical study of the semantic nature of "individual". What is it about the mental representation of a flock, for example, that allows us to construe it as an individual? Why are other collections of objects, such as the collection of leaves on a given tree (Chomsky & Walker, 1978), not conceptualized as individuals? These issues are briefly explored in the General Discussion.

More pertinent to the issue here, however, is that different theories of lexical development make contrasting predictions about how such nouns are acquired. A proponent of the special constraint theory might argue that the only way a child is going to learn a word like *army* is by first using the constraints to learn the object name *soldier*. Only then can she construe a word that refers to a group of soldiers as referring to the whole collection – the army – because only then does mutual exclusivity make this interpretation available. This hypothesis gains support from the observation that the collective nouns that children know describe objects that have their own names – forests are groups of *trees*, flocks are groups of *birds*, armies are groups of *soldiers*, and so on. There also exist "group nouns" (Jackendoff, 1977) that do not specify the precise kinds of entities that they are collections of, such as *group*, *pile*, and *stack*, but these too might be acquired only in cases where the object names are already known. Perhaps

children are only able to learn the word *pile* if it is used to describe a pile of objects that they already have a name for, as in the expression *a pile of socks*.

A theory that assumes that children possess a mapping between the grammatical category *count noun* and the semantic category *kind of individual* makes a different prediction, which is that syntactic cues can lead the child to the collective interpretation regardless of whether or not she knows the names of the objects that make up a collection. This prediction motivates the experiment that follows.

EXPERIMENT 1

When people are shown a single unfamiliar object described by a singular count noun (*This is a fendle*), they will tend to interpret the word as naming the kind of object; if they see a group of unfamiliar objects and hear a plural count noun (*These are fendles*), they will again treat the word as naming the kind of whole object. The special constraint theory and the theory proposed here explain this phenomenon differently. The special constraint theory posits that the whole object and taxonomic assumptions favor the object kind interpretation regardless of the syntactic cues. The alternative explanation is that people know that an NP with a singular count noun refers to one individual and an NP with a plural count noun refers to more than one individual – and in each case, the DPO bias makes the objects the most salient individuals.

Consider now a case in which a speaker is referring to many objects but the syntax is consistent with that of reference to a single individual. The special constraint theory still predicts a bias towards the whole object interpretation. In contrast, we suggest that syntax will guide children and adults to construe the word as describing a single individual, and since the context indicates that the speaker intends to describe all of the objects, the word will be construed as describing an individual that contains all of the objects, that is, as a collective noun. To explore this, subjects were shown pictures of groups of objects. These were described with singular count noun or plural count noun syntax. We predict that the syntactic context will draw children and adults towards different interpretations of the novel word.

A second manipulation concerns the nature of the collections. In half of the pictures of groups, the objects were next to one another but not connected (the unconnected groups). In the other pictures, they were depicted as being connected by strings (the connected groups). A tentative prediction is that when the objects are shown as connected, the set of objects will make for a more salient individual, appearing more "coherent" in the eyes of the subject even though it clearly is an array of different objects. As a result of this, one might expect there to be more collective interpretations in this condition.

2. Method

2.1. Subjects

The subjects were 16 4- and 5-year-old children from daycares in the Tucson area (10 girls and 6 boys; mean age = 5 years, 0 months, age range = 4 years, 0 months to 5 years, 8 months) and 16 University of Arizona undergraduates who received class credit for their participation. All subjects were native English speakers.

2.2. Stimuli

For the pretest, there were two pairs of picture cards. The first pair consisted of a line-drawing of a tree and a line-drawing of five trees. The second pair consisted of a line-drawing of a single dog and a line-drawing of five dogs.

Eight sets of cards were used in the main experiment. Each set contained three line-drawn pictures: a training picture and two test cards. The training picture showed a collection of five identical novel objects. One of the test cards depicted the same five objects (but in a different configuration) and the other test card showed a single object of the same kind standing alone. For half of the sets, the groups of objects were depicted as unconnected; for the other, they were depicted as physically connected by means of a string looped around a part of each of the objects. Within both the connected and unconnected sets of objects, half were novel animals and the other half were novel machines. An example of a connected set is shown in Fig. 1. All training and testing cards were 12.5×12.5 cm.

2.3. Procedure

Subjects were introduced to a puppet and told that they were going to look at some pictures with the puppet and that he would ask them some questions about the pictures. They were then told in a stage whisper by the experimenter that the puppet was not very smart and they would have to tell him their answers slowly and carefully. (The identical protocol was used for both children and adults. Prior to testing, the adults were told that the study had been designed to be appropriate for young children and that parts of the study might seem silly.)

Subjects were divided into two groups: half were in the *plural count noun* group and half were in the *singular count noun* group. Each subject received four trials in random order: a connected animal trial, an unconnected animal trial, a connected machine trial and an unconnected machine trial. All of the words used were two-syllable nonsense words: *fendle*, *blicket*, *kempu*, and *malto*. Each subject heard each of the four labels once. Subjects were presented with one of two assignments of nonsense words to stimuli – the

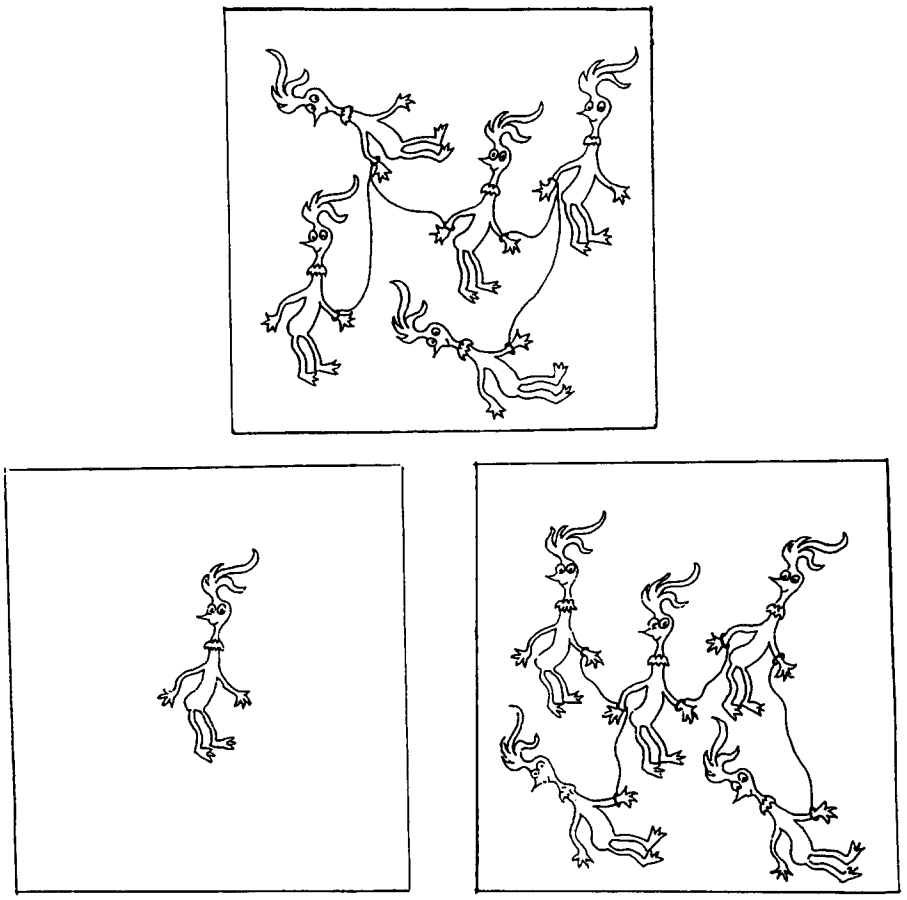

Fig. 1. Example of stimuli set used in Experiment 1.

nonsense words applied to the connected stimuli in one assignment were applied to the unconnected stimuli in the other. Half the subjects received one assignment, half the other.[4]

Subjects were tested individually while seated at a table with an experimenter. Children were tested in a quite area of their day care and adults were tested in a small testing room.

[4] Due to experimental error, there was an inadvertent relationship between assignment of syntactic condition and nonsense word-stimuli assignment, such that more than half of the singular count group received one assignment and more than half of the plural count group received the other. Since there was no effect of the type of stimuli (connected vs. unconnected) on subjects' responses, it is unlikely that this could have had any effect on the results reported below.

Pretest

In the pretest, subjects were shown a picture of a tree and a picture of five trees and asked "Can you point to the forest?" They were then shown a picture of a dog and a picture of five dogs and asked "Can you point to the dog?" This was included to establish how subjects respond when asked about familiar object names and collective nouns.

Main study

After completion of the pretest, subjects were told "Now I am going to teach you and Big Bird [the puppet] some new words. I'd like you to help Big Bird learn what the words mean, all right?" A training card showing five objects was then placed in front of the subject. The experimenter waved her hand over the card (taking care not to point to any particular object inside the card) and presented the new word. Subjects in the plural count condition were told (using *fendle* as an example of the novel word) "These are fendles. There are fendles over here. Can you tell Big Bird what we have over here?" Subjects in the singular count condition were told: "This is a fendle. There is a fendle over here. Can you tell Big Bird what we have over here?"

Once the subject repeated the novel word – either "fendles" (for plural count) or "fendle"/"a fendle" (for singular count) – the training card was removed and replaced by the two test cards, one showing the same five objects in another configuration and the other showing a single object. The orientation of the cards (which one was to the right of the subject; which one was to the left) was random. Big Bird then asked "Can you show me the fendle?" After a response the materials were cleared away. This procedure was the same for all four trials and took approximately 10 minutes to complete.

3. Results and discussion

3.1. Pretest

Out of 16 children, 11 children (69%) responded correctly to both parts of the pretest. Five children (31%) failed the pretest. Of the children who failed, 3 (19%) picked the single tree when asked to point to the forest and 2 (12%) picked the five dogs when asked to point to the dog. All of the adults performed perfectly on the pretest. It is interesting to note that there appears to be no systematic bias towards errors with the collective noun: *forest* did not appear to be significantly more difficult than the object name *dog*. A *t*-test comparing the ages of children passing the pretest with the ages of those who had failed found no significant age differences.

3.2. Main study

For the main analyses, the dependent measure was the number of times that the subjects pointed to the collection of five objects when asked "Can you point to the fendle?" Preliminary analyses found no effect of animacy for either adults or children.

A $2 \times 2 \times 2$ ANOVA was conducted with age (children vs. adults) and syntax (singular count vs. plural count) as between-subject factors and connectedness (connected vs. unconnected) as a within-subject factor. Fig. 2 shows the mean percentage of collective responses in each condition.

There was a significant effect of syntax, with collective responses more frequent in the singular count noun condition than in the plural count condition (84% vs. 8%; $F(1, 28) = 56.2$, $p < .005$), but there was no effect of age or connectedness. There was also a significant Age × Syntax interaction ($F(1, 28) = 5.3$, $p < .05$), with adults showing more sensitivity than children to the syntactic manipulation.

To explore the interaction, separate 2×2 ANOVAs were performed on the children and adults, with syntax as a between-subject factor and connectedness as a within-subject factor. Children's responses showed a

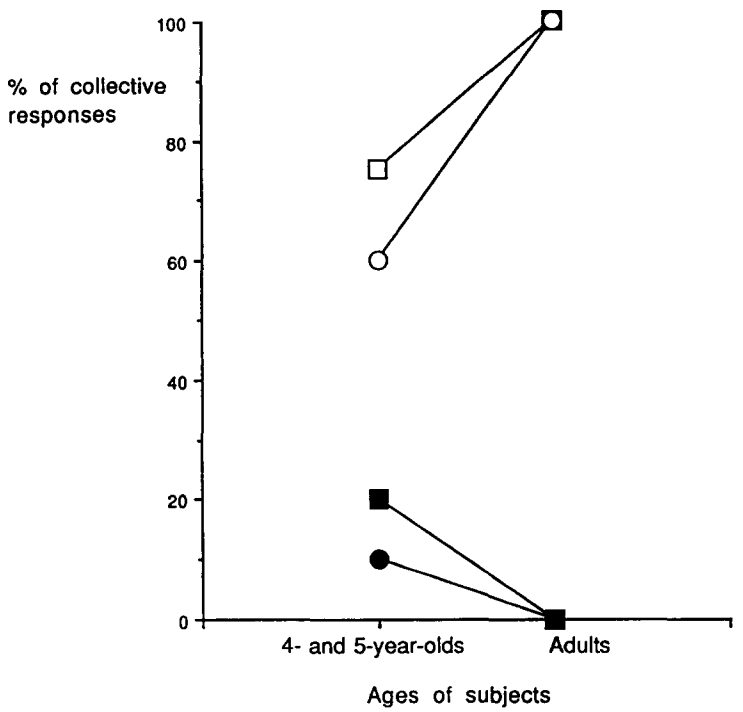

Fig. 2. Children and adult interpretations as a function of syntactic cues and connectedness in Experiment 1. □, Singular–connected; ○, singular–unconnected, ■, plural–connected; ●, plural–unconnected.

main effect of syntax ($F(1, 14) = 6.8$, $p < .05$); those exposed to singular count noun syntax interpreted the words as collective nouns significantly more than those exposed to plural count noun syntax (68% vs. 15%). This indicates that syntax is sufficient, most of the time, to force one construal over another in the circumstances studied here.

Further analyses found that the proportion of children in the plural count noun condition who pointed to the single object was significantly greater than chance ($t(7) = -2.8$, $p < .05$), but the proportion of children in the singular count noun condition who pointed to the collection was not. This could be because of the small sample size (8 children in the singular count noun group), but it could also be the result of developmental differences in sensitivity to singular count syntax and/or the capacity to construe a collection of objects as an individual. We return to these possibilities in the General Discussion.

Although the children gave more collective responses with the connected stimuli than with the unconnected stimuli (48% vs. 35%), this difference was not significant, and there was no interaction between syntax and connectedness.

Adult performance was at ceiling with regard to sensitivity to syntax. Subjects in the single count noun condition understood all novels words as collective nouns and those in the plural count noun condition interpreted all words as referring to single objects. There was therefore no main effect of connectedness and no interaction.

In sum, both children and adults are sensitive to syntax when acquiring object names and collective nouns, though adults are more sensitive than children. Contrary to the second prediction, however, the connectedness of the objects had no effect.

EXPERIMENT 2

The second experiment was designed to extend the previous one in several ways. First, three different age groups were included – 4-year-olds, 5-year-olds, and adults – so as to better explore any developmental trends. Second, instead of pictures of objects, real objects were used. To the extent that there is a DPO bias, it might apply more strongly with actual objects than with depictions of objects. If so, the first experiment, which used pictures, might have made it unrealistically easy for subjects to abandon the object interpretation and choose the alternative collective noun construal.

The procedure was also slightly modified, in that instead of pointing to a single group while presenting the new word, there were three groups, each of which was pointed to and named once. This was done to better focus the subjects on the desired interpretation; if they do possess the capacity to attend to syntactic cues, hearing three distinct groups each called "a fendle" might be more effective at eliciting this capacity than hearing the phrase for only a single group.

A final change is that half of the stimuli used in this study were familiar objects. A proposal based on mutual exclusivity would suggest that the acquisition of collective nouns would be facilitated (and perhaps only possible) when the objects that are parts of the collection already have their own names, since only then would people be free to seek out other, non object-kind, interpretations of the word. As a result, one would expect more collective responses when the objects already have names. This hypothesis is explored below.

4. Method

4.1. Subjects

The subjects were 24 4-year-old children (9 girls and 15 boys, mean age; 4 years, 6 months; range: 4 years, 1 month to 4 years, 11 months) and 24 5-year-old children (12 girls and 12 boys, mean age: 5 years, 5 months, range: 5 years, 0 months to 5 years, 11 months) from daycares in the Tucson area. Twenty-four University of Arizona students also participated, receiving class credit for their participation. All the subjects were native speakers of English. None of the subjects took part in Experiment 1.

4.2. Stimuli and design

Pretest materials were the same as those in Experiment 1. There were four homogeneous sets of test materials. Two sets consisted of familiar objects: plastic spoons and pens. The other two sets consisted of unfamiliar objects: gray metal clips and short blue plastic tubes. All test materials were contained in separate zip-loc bags.

Each subject was presented with four trials which alternated between familiar object trials and unfamiliar object trials. Half of the subjects received an unfamiliar object set in their first trial and half saw a familiar object set. The order of presentation for each of the four object sets and the novel labels (the same as in Experiment 1) was counterbalanced. Half of the subjects were in the *plural count noun* group and half were in the *singular count noun* group.

Subjects were tested individually while seated at a table with an experimenter. Children were tested in a quite area of their day care and adults were tested in a small testing room.

4.3. Procedure

The pretest was identical to that of Experiment 1. After the pretest had been completed, the experimenter told the subjects that they were going to be taught some new words with the puppet and, since he was not very smart, they should help him learn their meanings. (As in Experiment 1,

adults were forewarned that the study had been designed to be appropriate for young children and that parts of the study might seem silly.)

The experimenter then picked up a zip-loc bag and began the training phase by removing three groups of four objects each and placing them on the table. Pointing to each group in turn – from the experiment's left to the experimenter's right – the experimenter used the novel word to label each of the groups of objects. In the plural count noun condition, subjects heard "these are fendles . . . and these are fendles . . . and these are fendles". In the singular count condition subjects heard: "this is a fendle . . . and this is a fendle . . . and this is a fendle". The groups of objects were then picked up and placed back in the bag.[5]

Following this, the experimenter placed another group of four objects (of the same kind) in front of the subject and a single object (also of the same kind) next to the group. The experimenter then asked "Can you point to the fendle?" while the puppet nodded excitedly to encourage the children to respond. After a response, the materials were replaced in the bag and the procedure was repeated for the next three trials. The entire procedure took approximately 10 minutes to complete.

5. Results and discussion

5.1. Pretest

Adults performed perfectly on the pretest. Of the 24 4-year-old children, 14 (58%) passed the pretest and 10 (42%) failed. Of the 14 children who passed the pretest, 4 children met the criteria of answering both questions correctly but did not adopt an orthodox method in responding to the second question "Can you point to the dog?" Instead of pointing to the picture depicting a single dog these children carefully pointed to a single dog in the picture depicting five dogs. This was counted as correct. (No children pointed to a single tree of the five when asked to point to the forest, and this type of response never occurred in the main study.) Of the 10 4-year-olds who failed the pretest, seven responded to both questions by pointing to the single object and the other three pointed to the collections of objects on both occasions. A *t*-test comparing the ages of the 14 children passing the pretest with the 10 children who failed showed no significant age differences.

Of the 24 5-year olds, 12 passed the pretest and 12 failed. Of those who failed, six pointed to a single object in response to both questions and the

[5] Since multiple groups were used in this study, it turned out to be unfeasible to ask children to repeat the novel word in the same manner as done in Experiment 1. Given that there were three piles in front of the children, if they were given a question such as "Could you tell Big Bird what we have over here?", they would be correct in answering "fendles" regardless of how the word was presented and how they were interpreting it.

other six always pointed to the group of objects. A t-test comparing the ages of the 12 children passing the pretest (mean age: 5 years, 7 months) with the ages of the 12 who failed (mean age: 5 years, 4 months) found a marginally significant age difference ($t(22) = 2.0$, $p < .06$).

5.2. Main study

The dependent variable in all analyses was the number of times that subjects pointed to the collection of objects. A $3 \times 2 \times 2$ ANOVA was conducted with age (4-year-olds vs. 5-year-olds vs. adults) and syntax (singular count noun vs. plural count noun) as between-subject factors and familiarity (familiar vs. unfamiliar) as a within-subject factor. The percentage of collective responses made by children and adults in each condition is shown in Fig. 3.

There was a main effect of syntax, with collective responses being more frequent in the singular count noun condition than in the plural count noun condition (73% vs. 23%; $F(1, 66) = 51.4$, $p < .005$). There was also a significant Syntax × Age interaction ($F(1, 66) = 4.2$, $p < .05$), but there was no significant effect of age, no effect of familiarity, and no other interaction effects.

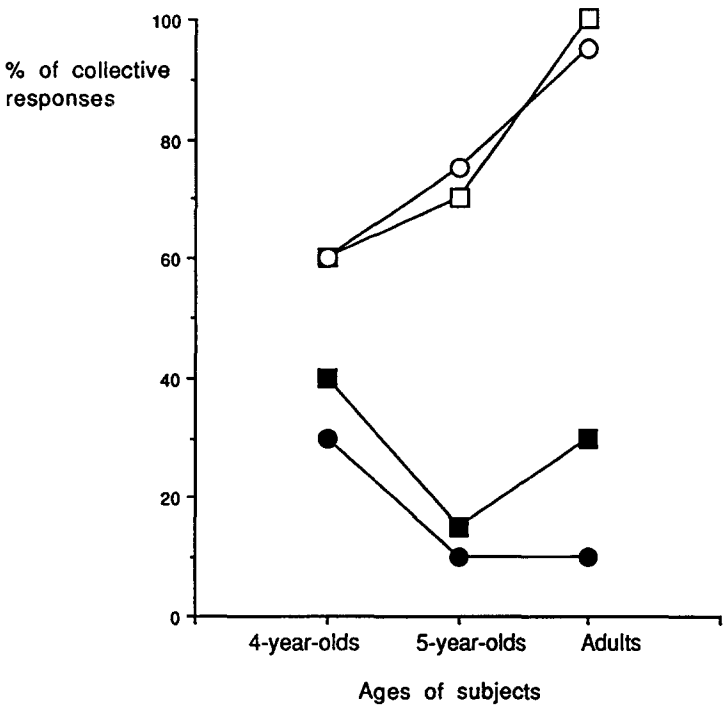

Fig. 3. Children and adult interpretations as a function of syntactic cues and familiarity in Experiment 2. □, Singular–familiar; ○, singular–unfamiliar, ■, plural–familiar; ●, plural–unfamiliar.

To explore the results further, separate 2×2 ANOVAs were performed on each of the three age groups, with syntax as the between-subject factor and familiarity as the within-subject factor. The analysis of the 4-year-olds indicated that although responses showed a trend in the right direction, there was no main effect of syntax. For the children exposed to the singular count noun, 60% responded with the collective interpretation; for the children exposed to the plural count noun, 35% responded with the collective interpretation. An analysis of just the 4-year-olds who passed the pretest also failed to find an effect – 64% collective responses for the singular count noun condition versus 39% collective responses for the plural count noun condition.

The proportion of the 4-year-olds' collective interpretations in the singular count noun condition was not significantly greater than chance, but there was a marginally significant trend in the plural count noun condition to favor the object interpretation over chance ($t(11) = -1.6$, $p = .07$, one-tailed). There was no main effect of familiarity and no interaction between familiarity and syntax.

Analyses of the 5-year-olds found a main effect of syntax. The children in the singular count condition pointed to the collection 73% of the time and children in the plural count condition pointed to the collection 13% of the time ($F(1, 22) = 21.2$, $p < .001$). (Children who passed the pretest gave 79% collection responses in the singular count noun condition and 8% in the plural count noun condition; $F(1, 10) = 29.5$, $p < .001$). The proportion of 5-year-olds' object responses in the plural count condition was significantly greater than chance ($t(11) = -4.5$, $p < .005$), as was the proportion of collective responses in the singular count condition ($t(11) = 2.3$, $p < .05$). There was no main effect of familiarity and no interaction between familiarity and syntax.

Adults also showed a strong effect of syntax ($F(1, 22) = 75.7$, $p < .001$), tending to give a collective response with singular count noun syntax (98%) but not with plural count noun syntax (20%). Both the proportion of object responses in the plural count condition ($t(11) = -3.4$) and the proportion of collective responses in the singular count condition ($t(11) = 23$) were significantly greater than chance (both $ps < .005$). Interestingly, adults did show a main effect of familiarity; the familiar objects were given a collective interpretation more often than the unfamiliar objects, as predicted by mutual exclusivity (65% vs. 53%; $F(1, 22) = 6.4$, $p < .02$). There was no interaction between familiarity and syntax.

One interesting phenomenon is that while there is no monotonic trend with age in the nature of responses with plural count noun syntax, there is a gradual increase in the nature of singular count noun syntax responses, with subjects producing increasingly more collection responses as they get older. A contrast analysis on the singular count noun responses for all subjects was carried out, testing the hypothesis that there is a linear trend by age (Rosenthal & Rosnow, 1985). This hypothesis was confirmed ($F(1, 33) =$

9.04, $p < .01$). In addition, a series of pairwise Scheffe F-tests on singular count noun responses found that adults gave significantly more collective responses than 4-year-olds when exposed to a singular count noun ($F(2, 33) = 4.6$, $p < .05$). No other pairwise comparisons were significant. Some explanations for this developmental difference are discussed below.

One prediction made above, based on mutual exclusivity, is that collective responses should be more prevalent with objects whose names are already known by the subjects. The results were surprising; there was no main effect of familarity and no interaction between age and familiarity. The analysis of the adult data, however, found that they were significantly more likely to give a collective response if the object already had a name, an effect that did not show up with the 4-year-olds or the 5-year-olds. The reason for the lack of an effect of familiarity for the children is unclear, since other investigators have found that 4- and 5-year-olds have no problem applying mutual exclusivity, for example, when learning substance names (Markman & Wachtel, 1988). A tentative hypothesis is that the children we tested viewed this study as an exercise in learning an entirely new language. If so, then mutual exclusivity would not apply, as it does not preclude two words from *different* languages from having overlapping reference.

GENERAL DISCUSSION

The main findings from the above two experiments can be summed up as follows. Adults and 5-year-olds (and in Experiment 1, adults and 4- and 5-year-olds) are sensitive to syntactic cues when acquiring object names and collective nouns. They can learn a collective noun that describes an array of objects even if the objects that make up the collection are unfamiliar and have no prior name. In fact, for all ages tested, subjects treated the word as an object name over half of the time when it was presented as a plural count noun ("These are fendles"), and they treated the word as a collective noun over half of the time when it was presented as a singular count noun ("This is a fendle"). Sensitivity to syntax appears to improve with age, however, and adults are better at using these cues than children. Finally, there is a gradual increase with age in the tendency to construe a singular noun as referring to a collection, while there is no such increase in the tendency to treat the plural count noun as an object name.

Two less central hypotheses were not supported. For children and adults, it made no difference whether or not the groups of objects were depicted as connected, contrary to the hypothesis that connectedness would lead the subjects to better view the groups as single individuals. Also, while adults are more likely to give a collective response when objects already have known names, which is in accord with the predictions of mutual exclusivity, this did not occur with children.

These results provide some mixed support for the theory proposed here.

Children and adults *are* capable of learning collective nouns through syntactic support and do not need to know the name for the kind of object for this learning to be successful. On the other hand, adults are more attentive to syntactic cues than children, significantly so with regard to the difference between the 4- and 5-year-olds versus the adults in Experiment 1 and the 4-year-olds versus the adults in Experiment 2. Further, the 4-year-olds in Experiment 2 did not show a significant main effect of syntax, and while the children in Experiment 1 were sensitive to syntax, their proportion of collective noun responses in the singular count condition was not significantly greater than chance.

How can we explain these developmental differences? Below we discuss three possibilities.

(1) Young children have problems overriding the whole object bias

The first type of explanation is most congenial to the special constraint theory. This is that children start off with an overall bias to favor the whole object interpretation when learning a novel label, and only later, as a result of language learning and/or conceptual change, do they become capable of attending to syntactic cues and learning labels that refer to individuals other than whole objects. Under this proposal, the children in our experiments performed worse than the adults because they found it difficult to override their bias to construe a novel word as referring to a kind of whole object and/or were less sensitive to the semantic implications of the syntactic manipulation.

This does not adequately explain the pattern of responses, however. For one thing, it predicts that the object nouns (where the child is shown the group and told "These are fendles") should be much easier to learn than the collective nouns (where the child is shown the group and told "This is a fendle"). In fact, the only errors that should occur at all are with the collective nouns; children should systematically misinterpret them as object names.

There is some trend in that direction; errors with object nouns are consistently less frequent than errors with collective nouns. But these differences were relatively small and, with the 4-year-olds in Experiment 2, the number of errors in the singular count condition and the plural count condition were virtually identical. In other words, it is not that the failure of 4-year-olds was because they always treated the word as an object name, regardless of how it was presented. On the contrary, their errors were about evenly matched – 40% of the time when the word was presented as a singular count noun, they interpreted it as naming the kind of object, and 35% of the time when the word was presented as a plural count noun, they took it as naming the kind of collection. Note also that in both experiments, the most common response when presented with a singular count noun was

the collective interpretation, not the object interpretation. Finally, consider the pretest, in which children were tested on their knowledge of the meanings of the object noun *dog* and the collective noun *forest*. While children were not perfect with *forest*, they were usually correct (Experiment 1, 4- and 5-year-olds: 81%; Experiment 2, 4-year-olds: 71%, 5-year-olds: 75%), and they did not make significantly more errors with *forest* than they did with *dog*.

This is not to deny that children might be less sensitive to syntax or that they might be more prone to favor the object interpretation in certain contexts – both possibilities might be true (as discussed below). But the considerations above suggest that the behavior of the children in this study is not consistent with the proposal that their errors are due to the existence of special constraints.

(2) Young children are less sensitive to syntactic cues than adults

A second hypothesis has to do with sensitivity to syntax. There is considerable support for the view that children are less sensitive than adults to syntactic cues when inferring word meanings (e.g., Landau, Smith, & Jones, 1988; Soja, 1992). In the domain here, it is possible that although children know that an NP with a singular count noun denotes a single individual (including, potentially, a collection of objects) and that an NP with a plural count noun denotes more than one individual, they just tend not to pay as much attention to this difference between *a fendle* and *fendles* as adults do. In particular, they might know that count nouns can apply to individuals other than whole objects (even 2-year-olds seems to know this; Soja, 1992), but they do not apply this knowledge as consistently as adults.

The existence of such child–adult differences with regard to sensitivity to syntax is fully consistent with the theory proposed here. In fact, any theory of acquisition that assumes that people can attend to more than one type of information in the course of word learning must admit the possibility of this sort of developmental change. Under the theory proposed here, there are multiple cues that conspire to direct a child towards a particular meaning; these include the perceived intention of the language user, perceptual/cognitive biases in how we construe the world (such as the DPO bias), and mappings between syntactic structure and conceptual categories. How these cues are weighed is a subtle matter and there may well be differences between children and adults, as well as individual differences between adults.

The difficulty in weighing cues can be illustrated with an example. Imagine someone pointing to a salient part of a novel object and saying "Look at the fendle". Here different cues to word meaning conflict. On the one hand, the person is pointing to the part and so is possibly intending to refer to it. Also, the syntax of the word is compatible with this interpreta-

tion, since a part be construed as an individual and the NP *the fendle* serves to establish reference to an individual. On the other hand, we are prone to construe the whole object, not the part, as the most salient individual, and the fact we have no prior name for the whole object means that a constraint such as mutual exclusivity will not bias against this interpretation. These latter considerations might cause us to assume that the person *meant* to refer to the whole object but was pointing to the wrong place. Matters get more complicated when we consider what would happen if the person just mumbled "fendle", or if she was only pointing in a vague manner, or pointing in one direction but looking elsewhere. In these sorts of cases, there is no clear solution, as there might be several valid ways of taking into consideration these different cues to word meaning.

There is some debate over the extent to which adults intentionally try to help children in the word learning process (for different views, see Nelson, 1988; Gleitman, 1990; Bloom, in press), but nobody argues that adults purposefully use clashing syntactic frames and intentional cues in a malevolent attempt to confuse their children. In this regard, multiple cues to word meaning should be viewed in the same light as the multiple cues that interact in the course of certain aspects of visual perception (e.g., those that determine figure–ground segmentation; Peterson & Gibson, 1993) – in the normal environment, they aid successful perception; they do not hinder it.

(3) There are developmental differences in the notion of "individual"

Children's limited sensitivity to syntactic information might partially explain the child–adult differences, but there is a further possibility. The stimuli used in Experiment 1 were groups of novel machines or novel animals; in Experiment 2, they were piles of unfamiliar or familiar objects. From the standpoint of language and cognition, these were highly implausible referents for collective nouns. Languages such as English do not have collective nouns that refer to arbitrary groups of machines or animals, or to arbitrary piles of specific objects, and thus such collective nouns might prove particularly difficult to learn.

Why would such collections pose difficulties from the standpoint of word learning? One candidate explanation has to do with the nature of the semantic category "individual". Once we determine that *dog* and *cup* are intended to refer to dogs and cups, we have no problems viewing these objects as appropriate referents for count nouns. Discrete physical objects are highly salient individuals, presumably because our perceptual and cognitive systems have evolved to construe them in this manner (see Spelke, 1994). But we have no such inherent bias with regard to arbitrary collections of objects. In order to conceptualize them as individuals, we need some motivation to see them as distinct entities in their own right. Real collective nouns, such as *family*, *bunch*, and *army*, refer to sets of objects that bear

some salient and enduring relationship with one another, either by being spatially and/or physically connected, like the grapes in a bunch, or by having more abstract social connections like the members of a family or the soldiers in an army.[6]

One proposal is that such individuals are the products of our "naive theories" or "stances". We construe families and bunches and armies as individuals because we construe them as distinct causal entities in our mental models of the physical and social world (for discussion, see Bloom, in press; Dennett, 1991). In contrast, the groups of entities in Experiment 1 and the piles of objects in Experiment 2 have no conceptual status as distinct entities. The only reason to treat them as collections is because – in the singular count condition – this is the only interpretation consistent with the sorts of arrays being pointed to and the syntax used to describe them.

It might be that the unnaturalness of the stimuli affects children more than adults. Young children may fail to see *why* the groups of objects constitute individuals and thus sometimes ignore the syntax and treat the labels as object names, since objects *are* cognitively salient individuals. The gradual increase in collective responses with age might be due to an increasing ability to construe the groups as collections despite its arbitrariness, solely because this is the only interpretation consistent with the linguistic and non-linguistic behavior of the experimenter.[7]

This hypothesis suggests that if young children were exposed to more cognitively natural sets of entities, they would be more willing to treat them as individuals and better able to learn collective nouns that name them. It is not impossible to construct such individuals and study how people construe them (Bloom & Fountain, in prep.). Consider, for example, the display in Fig. 4.

In one study, adults were shown such a display on a computer screen and heard it described with a plural count noun: "These are fendles". There are two conceivable interpretations as to what the word might mean, both

[6] Not all nouns have conditions on the kinds of objects they refer to, however. As noted above, group nouns such as *group*, *pile*, *heap*, *stack*, *cluster*, *multitude*, and *triad* can describe entities that belong to a range of different kinds, as in *a pile of books/CDs/socks/sand*. Unlike collective nouns like *family*, these nouns are defined through properties such as the numerosities of the collections they refer to, the collections' configuration and density, and how they are created. The acquisition and representation of these words poses some interesting puzzles not directly addressed by the theory presented here.

[7] This capacity to construe a set of objects as a single individual solely on the basis of intentional and syntactic cues shows up in another domain of word learning: the acquisition of names for modern art. An adult is capable of construing (for instance) several pieces of fiberglass arranged on the floor as an individual (as in Eva Hesse's *Tori*), and can learn a name for those pieces of fiberglass, even if he or she does not understand why the pieces go together or what the specific intent of the artwork is. Arguably, this is because the adult assumes that the group is an individual in the mind of its creator (the artist) and, as a result, it gains psychological coherence; it becomes real because someone else intends it to be real (Bloom, 1994a, in press; see also Levinson, 1989).

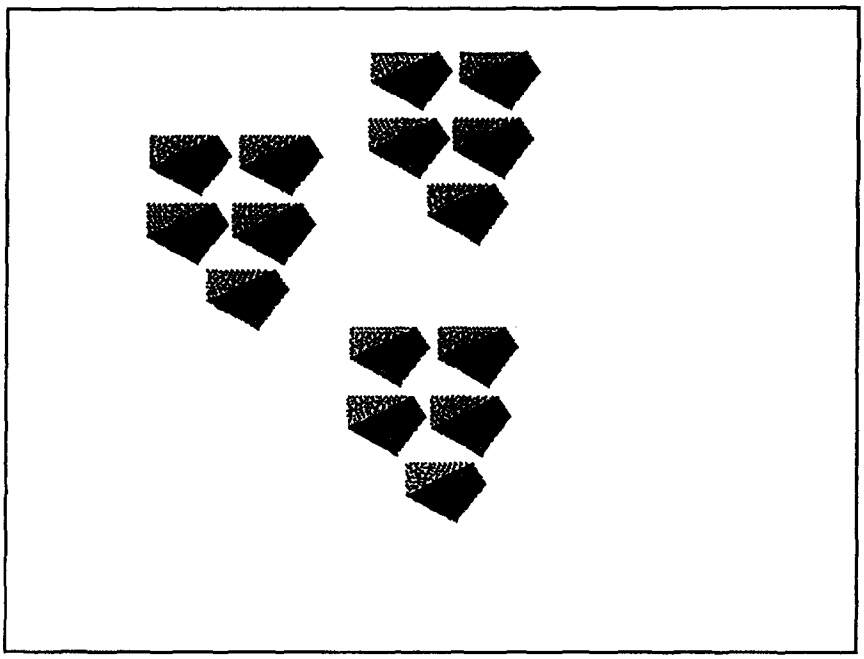

Fig. 4. Ambiguous display: are there 15 individuals (where individual = object) or are there 3 (where individual = collection)?

consistent with the syntax; it could be an object name, and so there would be 15 fendles, or it could be a name for the groups of objects, so that there would be 3 fendles. When the objects are stationary, adults virtually always interpret *fendle* as an object name; apparently mere grouping is not enough to drive them towards a collective interpretation.

Another group of subjects was shown a similar display, but this time each group of objects was moving across the screen in a unique pattern, distinct from the other groups. This provided the subjects with some motivation to view each group as a distinct causal entity in its own right. As predicted, they then showed a strong bias to treat "fendles" as referring to the groups, not the objects. Further experiments are exploring whether this collective interpretation is due to higher-level explanatory considerations (as proposed here) – or whether it is because of factors such as the Gestalt principle of common fate or, alternatively, because these moving groups share some of the same properties that serve to define objects (e.g., Spelke et al., 1992).

It is an interesting question whether a 4-year-old – or a much younger child – shown the same display of moving groups would also converge on the collective interpretation. More generally, attempts to teach children names for individuals that are not objects, such as collections, sounds, and events, could serve as a useful methodology with which to explore the nature and

development of the category of "individual". One prediction is that if the individuals are salient enough, very young children should be able to acquire such names, even for collections of objects in which the objects themselves belong to unfamiliar kinds.

In support of this speculation, there is some reason to believe that collections do have some psychological reality as individuals for young children. For one thing, words like *family* and *forest* show up early in lexical development. Furthermore, there is evidence that children perform better on Piagetian class-inclusion tasks when tested with collective nouns than with superordinate nouns (Markman, 1973; Markman & Seibert, 1976) and that they even sometimes spontaneously distort superordinate nouns into collective terms (Callanan & Markman, 1982; Markman, Horton, & McLanahan, 1980; but see also Macnamara, 1986 for a critical discussion).

The studies reported here found a sensitivity to syntax only in older children and the one semantic cue we manipulated, the connectedness of the objects, had no effect. Because of this, any inferences about younger children must be tentative. But the research reviewed above shows that 2- and 3-year-olds possess some sensitivity to syntax and some capacity to grasp individuals that are more abstract than whole objects. So the speculation that such children can acquire novel collective nouns of the sort shown in Fig. 4 is not entirely unwarranted.

The goal of the research reported here was to explore a perspective on lexical development in which the bias to interpret novel labels as referring to kinds of whole objects is a by-product of more general aspects of language and cognition. This alternative is motivated by data from children as young as two, such as the fact that they can acquire pronouns and proper names, and can use syntax to acquire aspects of word meaning. The positive results reported here with regard to the acquisition of collective nouns by older children suggests that continued research along these lines might give us further insight into the development of language and cognition.

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