1995

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Most of the words known by adult speakers of English fall into the syntactic class of nominals, and most nominals refer to individuals. Some refer to specific individuals, as with proper names like *John* and *Boston*, and others refer to kinds of individuals, as with count nouns like *dog* and *joke*. In English and many other languages, nouns that refer to kinds of individuals are grammatically distinct from nouns that refer to kinds of stuff (the count-mass distinction) and are also grammatically distinct from words that refer to specific individuals, which are lexical NPs (see Bloom, 1990).

The research discussed below focuses on the cognitive nature of individuals. What are "possible individuals" in language and thought? To take an example from Quine (1960), we have a word corresponding to the category "rabbit", but we do not have a word for the category "undetached rabbit parts", and such a word would not be learnable under normal conditions. Similarly, we have a word that refers to a collection of trees (*forest*) but no word that refers to all the leaves on a given tree (Chomsky and Walker, 1978). The same issue arises for words for non-material entities, of course. What is it about the meanings of *joke*, *nap*, and *conference* that makes them possible kinds of individuals? An adequate theory of word learning and word meaning must tell us why some individuals are psychologically natural and others are not.

One can also ask whether this notion of individual changes in the course of development. Perhaps young children start off with a much more restricted concept encompassing only physical whole objects—only later does it broaden to include individuals such as collections, parts, and periods of time. An alternative proposal, defended here, is that there is substantial continuity in the conceptual systems of children and adults, with an abstract and adult-like understanding of individuals present long before the acquisition of language.

Some investigators propose that an understanding of what restrictions there are on possible individuals will emerge from a theory of constraints on word learning. For instance, Golinkoff, Mervis, and Hirsh-Pasek (1994) introduce their theory of "lexical principles", by stating that these "enable the child to avoid the Quinean (1960) conundrum of generating limitless, equally logical possibilities, for a word's meaning".

This cannot be entirely right, however. Even an animal incapable of applying lexical principles—such as a human infant, an adult chimpanzee, or a dog—must be constructed to prefer some concepts over others. As Goodman (1978) points out, the problem of "limitless, equally logical possibilities" exists for any act of induction—and successful induction is the stuff of life. If a child

D. MacLaughlin and S. McEwen (eds.), Proceedings of BUCLD 19, 107-117.

burns her hand on the stove, she is likely to infer that stoves are hot—not that undetached stove parts are hot, or that stoves until the year 2000 are hot, or that stoves and aardvarks are hot, although all of these alternatives are logically consistent with her experience. Such constraints on the child's inference are unlikely to have much to do with lexical principles, since a dog would come to a similar conclusion. To some extent, then, the problem of what is a possible word meaning, and more specifically, a possible individual, must be solved through a more general theory of conceptual representation.

This is not to preclude the possibility that further cognitive constraints exist that *are* specific to word learning, as argued by Golinkoff et al., Markman (1990), and others. The class of psychologically natural word meanings may well be smaller than the class of psychologically natural concepts. More generally, more is involved in word learning than simple induction. Learning the meaning of a word also requires some implicit grasp of notions of reference and intentionality (Macnamara 1982), as well as some understanding of the relationship between word meaning and syntactic structure (Gleitman, 1990; Pinker, 1989). The discussion that follows focuses on just one aspect of a complete theory of the word learning process (for a broader perspective, see Bloom, in press).

The natural starting point for a discussion of the category "individual" is to consider physical whole objects. The word "object" is ambiguous in some confusing ways, so to clarify things we will adopt here an abbreviated version of Spelke's (1994) definition. An object is an entity that is cohesive (it moves as a connected, bounded unit) and continuous (it moves on a connected and unobstructed path through space and time). Under this definition, a dog is an object, as is a table and a cup, but a hand is not a object, since it does not move independently from the body it is connected to—it is not bounded. A swarm of bees is also not an object, since it is not connected (a line from a point on one bee to a point on another bee will frequently cross over empty space) and does not move in an unobstructed path; for instance, two moving swarms of bees can cross each either other's path, occupying the same region of space at the same time. In addition, non-material entities like jokes and stories cannot be objects, as the criteria above cannot apply.

Defined in this restricted sense, there is considerable evidence that objects are highly salient individuals for young children. Most of the count nouns that 20-month-olds use in their spontaneous speech refer to objects (Nelson, Hampson, and Shaw, 1993), much more so than for older children or adults (Macnamara, 1982). The salience of objects shows up as well when children learn new words; they appear to be strongly biased to construe new words as referring to object kinds, and not as names for parts, properties, or anything else (e.g., Markman, 1990).

Similar observations can be made outside of language. Children only a few months old can track, individuate, and perform simple arithmetical calculations on sets of objects (e.g., Spelke, 1994, Wynn, 1992). Later in development, this focus on objects leads to some interesting errors. Shipley and Shepperson (1990) asked preschoolers to count different arrays, and found that they tend to count the distinct objects—even if explicitly asked to do otherwise. For instance, when

shown a display with five forks, one broken into two parts, and asked "Can you count the forks", the majority of preschoolers answer *six*, apparently because there are six objects in the display.

There are two distinct morals one could draw from these developmental results. They could be interpreted as showing that children start off with a notion of individual that is coextensive with the adult notion of object, and that only through neural maturation or conceptual development does this notion become more abstract. Alternatively, it might be that children do have an adult-like notion of individual (in fact, as a null hypothesis, we can conjecture that their notion is *exactly* the same as that of adults), but that children, like adults, view whole objects as excellent individuals, a propensity that Shipley and Shepperson describe as the "Discrete Physical Object bias". In some circumstances, this bias leads children to make mistakes, as with the fork experiment described above.

What evidence is there that children can grasp individuals that are not whole objects? The most striking results come from infant research. Even 6- to 9-month-olds are capable of determining the numerosities of distinct sounds (Starkey, Spelke, and Gelman, 1990) and distinct actions (Wynn, in press). This capacity plainly requires individuation, as infants have to know when each sound/action begins and ends, and must quantify over them as distinct individuals. And even though preschoolers are biased to make errors by the presence of objects in a counting situation, other research suggests that when a competing object interpretation is not available, children are quite free to quantify over other kinds of individuals. Wynn (1990) found that as soon as children begin to do linguistic counting ("one, two, three ...") with objects, they are capable of counting non-material entities such as sounds and actions.

It could be argued that such conceptual capacities might not show up in lexical acquisition, perhaps because a whole object constraint filters out all non-object individuals from consideration as word meanings. But this does not seem to be the case. Nelson et al. (1993) report that even 20-month-olds know some nominals that describe parts, events, quantities, actions, and periods of time. And Soja (1994) found that young children have some understanding of the syntax and semantics of proper names for abstract social entities, like *church* in the sentence *John goes to church*, in which the proper name does not denote a physical building or place, but instead refers to a more abstract social institution. Finally, as soon as children start to use nominal syntax in their productive speech, non-object individual names are marked appropriately as count nouns, just as objects names are (Gordon, 1992; Nelson et al., 1993).

There is also experimental evidence leading to the same conclusion: 3-year-olds can use count noun syntax to learn words that name discrete sounds or actions (Bloom, 1994), and 2-year-olds who are just beginning to show a sensitivity to count-mass syntax can use nominal syntax to learn that a word describing a non-solid substance refers to the bounded individual containing that substance, as with the words *puddle* and *pile* (Soja, 1992).

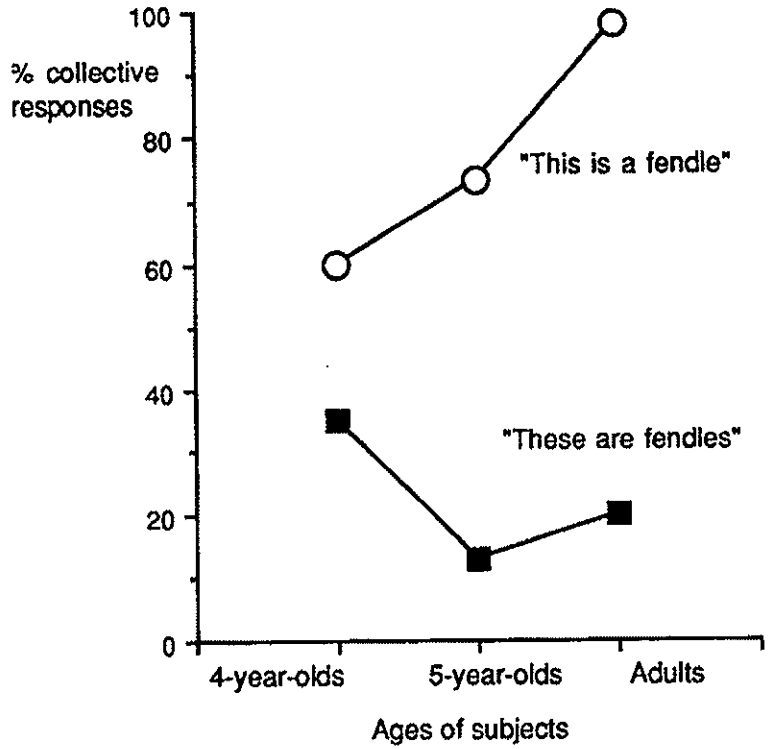
Although the findings above suggest that infants and children do have a notion of individual that does not reduce to their notion of object, they tell us little about the precise nature of this category. We have been exploring this question by focusing on the acquisition of collective nouns.

Collective nouns are count nouns that refer in the singular form to groups of objects.[1] The early acquisition of some of these nouns, such as *family* and *army* (see Callanan and Markman, 1982), poses interesting puzzles for a theory of word learning. A child has to figure out that *family* describes a group of people and not a single person, which requires somehow overriding the bias to treat objects as the most salient individuals. More generally, it is unclear what it is about families and armies that makes them possible individuals, so much so that young children can learn English count nouns that refer to them.

As a first step towards exploring this, Bloom and Kelemen (in press) investigated the role of syntactic cues in the acquisition of novel collective nouns. In one experiment, subjects from three age groups were tested: 4-year-olds, 5-year-olds, and adults. Each subject was shown three separate piles of four objects each, arranged in a row. Names for the piles were presented in one of two syntactic frames. In the plural count noun condition, the experimenter pointed to each of the piles in turn, saying "These are fendles ... and these are fendles ... and these are fendles", which is consistent with "fendle" being an object name, like "tree". In the singular count noun condition, the experimenter pointed to each group in turn, saying "This is a fendle .. and this is a fendle ... and this is a fendle", which is consistent with "fendle" being a collective noun, like "forest". Subjects were then tested by being shown one object and a pile of four objects and asked "Can you point to the fendle?" If they think the word is an object name, they should point to the single object; if they think it is a collective noun, they should point to the group.

The results are shown on the next page. Adults and 5-year-olds showed a significant sensitivity to syntax, but 4-year-olds did not, although their responses were in the right direction. An interesting finding is that, with increasing age, subjects produced increasingly more collective responses to the singular count noun condition. There was no corresponding tendency with the plural count noun condition—object responses did not increase systematically as a function of age.

Why did the younger children do so poorly? It could not have been the result of an indiscriminate object bias, since they made just about as many errors with "These are fendles" (mistakenly choosing the collection) as with "This is a fendle" (mistakenly choosing the single object). Part of the trend might be due to a general increase in attention to syntactic cues as children get older, something which has been found by many other investigators. (e.g., Gordon, 1985). But the gradual increase in collective responses to "This is a fendle" suggests a third alternative, one that has to do with the nature of the stimuli that the subjects were shown.



In particular, from a psychological standpoint, the groups of objects used in this study were poor candidates for being viewed as collections. Languages such as English do not have count nouns that refer to arbitrary groups of homogeneous entities that bear no relationship to one another. (Collective nouns such as *group* and *set* are apparent exceptions, but note that these are rarely used bare; they tend to appear instead in constructions such as *sets of Xs*.) Perhaps the unnaturalness of the stimuli is particularly troubling for young children; they cannot see the motivation for treating the groups of objects as single individuals and have problems viewing them as such. Adults are more willing to follow the experimenter's intent and construe the sets of objects as single individuals—just because they can infer from the syntax and the context that the experimenter *intended* them to view the objects in this manner (we will report a more direct test of this hypothesis below.)

This brings us back to the representational question: Exactly what is it about the collective nouns found in natural language that makes them learnable by young children and adults?

One possibility is that Gestalt principles of perceptual grouping play a role (e.g., Koffka, 1935, Palmer, 1992). Such principles are posited to explain the conditions under which entities are naturally grouped during perception. For the Gestalt principle of proximity specifies that we will perceive the Xs below as fall into three groups and not, say, two (with the X from the bottom left of the right-most cluster as one group, and all the other Xs as the other group). This is one of several principles that have been advanced as capturing our intuitions about natural groupings.

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XX XX XX

It seemed reasonable enough to posit that some collections are thought of as individuals because they obey such principles. Flocks and packs, for instance, consist of objects in close proximity, and they also share the property of common fate, as their component objects move together as a single unit. Perhaps the same properties that determine the perceptual grouping of entities can serve—at least in the perceptual domain—to define these groups as individuals.

Interestingly, this does *not* seem to be the case. Recall that in the experiment described above, the stimuli were three groups of four objects, each group composed of objects adjacent to one another and relatively distant from the other groups. Still, this was not sufficient for the 4-year-olds to treat the groups as individuals, even when the syntax favored the collective interpretation.

To explore this further, we conducted an experiment in which we showed adults 12 novel objects, in three different piles (as in the Xs depicted above), and told them simply "These are fendles" without pointing to any of the objects or the piles (Bloom and Fountain, in prep.) Unlike the Bloom and Kelemen study, the syntax here does not favor a unique interpretation of the new word: "fendle" could be a name for the object (in which case there would be 12 fendles) or it could be a name for the collection (in which case there would be 3 fendles). If proximity plays an important role, the collective interpretation should predominate. This was compared to a condition in which the objects were all in a single pile, so that no Gestalt principles would apply. We found that regardless of whether or not the objects were grouped, adults almost always construed "fendle" as an object name.

These findings suggest that principles which determine natural groupings are not themselves sufficient to cause people to treat collections of objects as *individuals*. We found that although subjects were clearly viewing the objects as falling into distinct groups, this was not enough for them to view the groups as individuals, perhaps because of the arbitrariness of the groupings— the objects within each group have no principled relationship to one another that distinguishes them from the objects within any other group.

This motivates the hypothesis, which is related to proposals by Carey (1988), Dennett (1991), and Keil (1994), that "individual" is basically an explanatory notion. Generally, it is argued that people possess interpretive systems, sometimes described as "stances" or "naive theories". The role of these

systems is to explain and predict phenomena within the environment. To do so, as discussed by Dennett (1991), these systems posit entities—individuals—that are understood as the participants in causal interactions. Put differently, we view something as an individual only if doing so allows us to better understand and predict the interactions that hold within a given domain.

This is probably why the Discrete Physical Object bias posited by Shipley and Shepperson (1990) exists in the first place. Any mobile animal would do well to parse the environment into objects, and, as a result, this sort of individuation has been to some degree hard-wired by natural selection. Human infants, and no doubt infants of other species, possess innate mechanisms that analyze the external world into a world of distinct bounded objects—like dogs and cups—that persist over time (e.g., Spelke, 1994).

Some individuals, however, become established as the result of conceptual development. It is as the result of social learning, for instance, that we come to parse sequences of human action into elections and divorces, or groups of people into specific nations and clans. We do so because we recognize that divorces and France are participants in causal interactions, just as real in the social domain as dogs and cups are in the external material world.

This suggests that people should treat groups of objects as individuals if and only if there is some explanatory motivation to do so. To test this, Bloom and Fountain (in prep.) presented adults with groups of objects depicted on a computer screen and described the scene as: "These are fendles". Unlike the previous studies, the items in each group moved together as a single unit, the groups themselves going past each other, avoiding each other, and so on. We reasoned that this pattern of movement would make the groups appear as distinct causal agents, which in turn would induce subjects to view them as individuals and thus treat "fendle" as a collective noun. As predicted, most viewed it as a collective noun (73% collective responses). However, in a control condition in which the same groups of objects were depicted as stationary, as in the previous Gestalt study, subjects gave only 16% collective responses. These results support the hypothesis that causal factors are sufficient to motivate a collective interpretation.

To further explore the factors underlying individuation in this context, Bloom and Fountain (in prep.) conducted another experiment in which adults were shown the same objects moving in the identical patterns. This time, however, each group was surrounded by a circle. Subjects were told "These are fendles on plates" to make it clear that we were defining the circles as plates. If the effect in the previous study was due to the Gestalt principle of common fate, rather than to higher-level explanatory considerations, then the group interpretation should still predominate here, because this Gestalt principle still applies. In contrast, if subjects previously viewed the groups as individuals because of the explanatory value of such an interpretation in understanding the patterns of motion, then the introduction of the "plates" here should decrease the frequency of this construal, since it completely explains the common motion of items within each group.

This is precisely what we found: very few of the subjects in the plate condition treated the new word as a collective noun (only 13%), suggesting that common fate is not sufficient to induce a collective interpretation. Higher-level causal considerations are required as well.

But this raises another question. Although common fate is not sufficient to induce adults to view a collection of objects as a single individual, it could be argued that common fate is *necessary*. Perhaps people will spontaneously give a collective interpretation to a group of objects if the group is moving; we may extend whatever principles serve to categorize moving entities as objects to these moving *groups*, and thus treat them in the same way. In other words, perhaps we only treat collections as individuals if they are sufficiently object-like in their properties.

To test this, Bloom and Fountain (in prep.) conducted another experiment as follows: We first showed adults three stationary groups of four objects each on a computer screen and described them in the standard way: "These are fendles". But then three machines were depicted as rising up and surrounding each of the groups in a dramatic fashion, with colored balloons popping out of each machine when it made contact with a group. The machines then gradually retreated from the screen, leaving the screen empty except for the original, still stationary, groups.

We predicted that this would make the groups of objects salient as individuals, not because of anything they were doing, but because they are the static targets of other causally potent entities. The results supported this hypothesis; the majority of the subjects interpreted the word "fendle" as a collective noun, not an object name, suggesting that even a stationary group of objects can be viewed as an individual under the appropriate conditions.

A final study focused on the most minimal case possible. Can people construe a group of objects as a single individual solely because they know it is viewed as an individual *in the mind of another person*? These sorts of cases arguably exist when we learn proper names for discontinuous entities like certain pieces of modern art (such as Eva Hesse's *Tori*, composed of several distinct pieces of fiberglass) or certain social institutions (such as *University of Arizona*, composed of several buildings in different locations). The referents of such proper names are, at least under one mode of construal, groups of objects, and it is intentional and social considerations that cause us to view these groups as individuals. The same considerations apply more generally for kinds of social groupings such as committee or gangs.

Each subject was shown a group of five objects, placed next to one another, and told either "the name for this is: fendle" (neutral syntax, in which "fendle" could be an object name, a collective name, or a proper name) or "This is a fendle" (singular count noun syntax, which is only consistent with "fendle" being a collective noun). The other manipulation was quite subtle: For half of the subjects, the objects were dumped on the table. For the other half, the experimenter carefully and slowly placed the objects on the table. In this second condition we wished to give the impression that the experimenter *intended* to create a group with a precise internal structure, even though in fact the configurations on the table in both conditions were virtually identical.

The prediction was that there would be more collective responses when the syntax forced the collective interpretation, and that there would be more collective responses in the intentional condition, since the experimenter was giving the impression that the group exists as a distinct entity in her own mind.

We tested adults and 4- and 5-year-olds. Both predictions were confirmed for the adults: Collective responses were significantly greater with the singular count noun condition than with the neutral syntax condition, and were also significantly greater when the experimenter slowly and carefully laid out the objects than when she just dumped them. This suggests that the manipulations of syntax and intentionality both play a role in adults' interpretation of word meaning.

The child data, however, support neither hypothesis. Although there were more collective responses with the singular count noun than with the plural count noun, this was not significant, and there was also no effect of intentionality.

The set of experiments reported above suggest that, for adults, the category of "individual" is an explanatory one, emerging from our attempts to make sense of causal interactions in different domains. Although this category cannot be derived from Gestalt principles, one should not underestimate the importance of such principles. Our sensitivity to them has no doubt evolved because, in the normal state of affairs, principles such as proximity and common fate *do* serve to identify individuals in the environment. If several objects are in proximity and obey common fate it is likely that the objects correspond to a causally potent individual. The experiments above, however, suggest that the groupings provided by these principles are best viewed as cues to possible individuals; they are not criterial.

The results for children are less conclusive, however. Evidence reviewed at the beginning of this paper indicates that preschoolers (and infants) do possess an abstract notion of individual, but the findings reported here suggests that 4- and 5-year-olds are less capable than adults of using syntactic cues to acquire arbitrary collective nouns. Preschoolers also seem oblivious to intentional cues, at least in the single study that we have done so far.

One possibility is that the understanding of abstract individuals really is weaker in children; perhaps their notion of *individual* does not include entities that exist solely through the intention of others. Alternatively, they might be able to represent such entities but have problems attending to the subtle cues that were used in the experiments carried out thus far.

We are continuing to address these issues experimentally. One particularly interesting question is how young children will fare on the sorts of moving object displays that adults easily treat as collections, without the support of syntactic or intentional cues. It is possible that even 2- and 3-year-olds will treat groups as single individuals in these circumstances, and we are currently developing experiments to test this hypothesis.

Notes

* The research presented in this paper was supported by grants from the Spencer Foundation and the Sloan Foundation to the first author. We thank Karen Wynn for very helpful comments on an earlier draft of this paper. An earlier version of this paper, without the final two studies, is presented in Bloom and Kelemen (1995).

1. Words such as *bunch* and *forest* are typically viewed as collective nouns (e.g., Bloom and Kelemen, in press; Callanan and Markman, 1982), but they do not count as such under the definition of "object" given above. A bunch of grapes is itself actually a single connected object—it is connected and bounded and moves in a connected unobstructed path. Similarly, a forest is not really a collection of trees, since the trees do not count as objects using the above criteria. Instead a forest is more of a connected eco-system that contains trees as sub-parts. The best examples of collective nouns for the purposes here are groups of people or other animals (e.g., *committee*, *team*, *flock*, *pack*, *school*, etc.), since these groups themselves are clearly not objects, and their members clearly are.

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