When a Rose Is Just a Rose: The Illusion of Taxonomies in Infant Categorization

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The terms *basic, superordinate, subordinate,* and *global* are often used to describe the categories formed by infants. However, although infants' categories appear externally to match those formed by adults, it is not clear that they are grounded in an organized hierarchical system that embodies relations within and between domains; that is, a taxonomy. To assess whether it is appropriate to consider infants' categories as taxonomies, 3 criteria are examined: (a) similarity to adults' choice of category members, (b) hierarchical understanding, and (c) agreement with adults' bases for classification. It is argued that infants' categories do not meet these criteria and that it may be erroneous to apply the same labels to categories formed in the first 2 years as those in later life. To do so may be to hold an illusion of taxonomies about infants' categories.

What is meant when we label the categories that infants form as *superordinate, basic,* or *subordinate?* Presumably, these labels are applied to infants' categories because they resemble—at least in terms of the objects included in them—the taxonomies formed by adults.[1] Thus, infants may categorize, or group together, objects that adults know to be cars, dogs, tools, or plants, and as a consequence, these cate-

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[1]There appears to be a certain level of conceptual confusion in the literature about the term *taxonomic category* and the term *taxonomy.* A *taxonomic grouping* is a collection of objects that share some kind of property, be it perceptual, functional, or conceptual. Although this can be a useful description for any kind of category, it is often conflated with the notion of taxonomy, which is an organized system that embodies certain relations within a hierarchical- or matrix-based format.

gories are given adult-equivalent labels (e.g., Mandler & Bauer, 1988; Mandler, Bauer, & McDonough, 1991). There might also be reason to refer to infants' categories as *basic* or *superordinate* because an aspect of the underlying basis for the grouping matches that of adults.[2] For example, infants may group together hammers because they can be grasped and used to hit things or bananas because of their shape, coloration, and comestibility. Finally, the basic, superordinate, and subordinate labels may be applied to infants' and children's categories to imply relations that exist not only among category members but also between category levels (Rosch & Mervis, 1975; Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976; Sugarman, 1983). Evidence for this knowledge is sometimes taken to be the ability to group the same objects into multiple categories—for instance, a Rottweiler is a dog and also an animal—or appreciation of the asymmetry of class inclusion; for example, all dogs are animals but not all animals are dogs.

The labels *basic level* and *superordinate level,* therefore, seem to carry with them a number of assumptions about the behavior and mental states of infants. In some cases, it is assumed, either implicitly or explicitly, that infants' categories are taxonomies in the adult sense (e.g., Mandler, 1992; Mandler et al., 1991; Ross, 1980). In others, it is presumed that perceptually based categories are independent of taxonomically based ones (see Deàk & Bauer, 1995). However, it remains a moot point whether it is reasonable to hold such assumptions for the classes formed by infants. It may be, for example, that infants' basis for categorization—be it grounded in the perceptual (i.e., what can be seen) or the conceptual (i.e., what cannot be seen)—is considerably different from that of adults. Is, for instance, an infant's basic-level category of birds that is based on the property "has wings" really the same as adults' category of birds? Similarly, is an infant's superordinate-level category of vehicles that is based on the property "made from metal" equivalent to adults' category of vehicles? It is also disputable whether infants have acquired any notion of a category of things or of a hierarchy of categories when they form basic- or superordinate-level classes. Few would argue, for example, that the basic- and superordinate-level categorical representations that 3- and 4-month-old infants form in familiarization studies constitute adult-like categories (e.g., Behl-Chadha, 1996; Eimas & Quinn, 1994). These categories would be different in fundamental ways, and they would most likely not be based on an understanding of category relatedness, hierarchical structure, or "knowledge about what things are or where and when they are used" (Mandler & Bauer, 1988, p. 263).

In this article, it is argued that it is erroneous to use adult-based categories of the world to interpret the ones formed by infants. It is questionable whether it can be assumed that infants' category membership decisions are governed by the same

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[2]Because of the lack of empirical research on infants' subordinate-level categorization, the discussion of taxonomies is restricted to basic- and superordinate-level classes.

principles, and therefore, the same bases, as those used by adults merely because the classes they form resemble conventional natural-language categories. It is also debatable whether infants have any understanding of hierarchical relations such as, for example, the asymmetry and transitivity rule. The implication is that researchers may overinterpret infants' ability to form categories at the basic or superordinate level; that is, there may be an illusion of taxonomies at work in researchers' conception of early categorization. Evidence is presented that infants in the 1st and 2nd year can form categories that resemble superordinate and basic domains, yet they do so by attending to properties other than those considered as qualifiers for adults' taxonomies.[3] In both such cases, it may be more accurate to label infants' early categories and even those formed in the 2nd year as *superordinate-like* and *basic-like* or, perhaps more accurately, by the basis used to form them. Finally, I claim that these categories are formed "online," in the sense that infants have no prior (perceptual or conceptual) knowledge of the category (see Jones & Smith, 1993; Thelen & Smith, 1994). Rather, they have certain constraints and expectations that lead them to attend to particular object parts.

EVIDENCE OF SIMILARITIES BETWEEN INFANTS' AND ADULTS' CATEGORIES

It has been known for some time that adults agree on the kinds of objects that constitute categories at the basic and the superordinate levels. Animals, vehicles, plants, and tools are commonly agreed-on examples of superordinate categories; dogs, cars, roses, and hammers are established examples of basic-level categories (Rosch et al., 1976). Recently, however, it has emerged that there is a level of concordance between adults and infants in their choice of category membership for certain natural and man-made objects. For instance, it has been shown with the familiarization technique that, by 3 months of age, infants can form a basic-like representation of cats that excludes dogs and of horses that excludes cats and zebras (Eimas & Quinn, 1994; Quinn, Eimas, & Rosenkrantz, 1993) and a superordinate- or global-like representation of animals that excludes furniture (Behl-Chadha, 1996). Further, it has been found with the object-examining procedure that 9-month-olds categorize the basic-level domains of birds and planes (Mandler & McDonough, 1993), and with the object-manipulation task, it has been shown that 16-month-olds categorize the

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[3]This in itself may be contentious because it is not yet clear exactly which processes and bases underlie adult categorization (e.g., Armstrong, Gleitman, & Gleitman, 1983; Keil, 1989; Medin, Wattenmaker, & Hampson, 1987; Murphy & Medin, 1985). Nonetheless, it is possible to make comparisons between adult and infant categorization where it is evident that adults and, in some cases, young children have developed certain kinds of knowledge or abilities, for example, the hierarchical organization of ontological knowledge or the transitivity rule.

superordinate, or global, domains of animals and vehicles (Mandler & Bauer, 1988). So it seems that, for a variety of domains, infants and adults make similar choices about the category membership of things.

In addition to agreement about the category membership of objects, there is also evidence of overlap in the properties used by adults and infants to determine category membership. The basic level, for example, is thought to be very much dependent on correlated clusters of attributes (Rosch et al., 1976), and there is evidence that infants as young as 7 months of age are sensitive to such clusters and can use them to categorize (Younger & Cohen, 1986). Likewise, the ability to form superordinate categories is thought to be somewhat dependent on conceptual information—animacy, for example—because of the perceptual dissimilarity of category members at that level (e.g., Mandler, 1992; Mandler et al., 1991). Indeed, there are data to suggest that 3-month-olds discriminate biological motion of people from similar but incoherent motion (Bertenthal, 1993) and that 9-month-olds discriminate animate from inanimate objects on the basis of certain motion cues (Poulin-Dubois, Lepage, & Ferland, 1996).

CRITERIA FOR INFANT TAXONOMIES

Does the convergence of these facts mean that infants have the ability to form adult-like basic- and superordinate-level categories? That is, do infants' categories possess the characteristics of adults' categories, whatever those characteristics might be, or are they just superficial versions of the categories formed in later life? One way to assess this question is to reduce it further into three separate but interrelated questions or criteria. First, are infants' category boundaries equivalent to those of adults? In other words, do infants and adults include the same breadth of objects in the categories that they form? Second, is there evidence that infants understand hierarchical relations that embody, for example, aspects of the asymmetry and transitivity of class inclusion? Third, do infants use the same or similar bases as adults to categorize at the basic and superordinate levels? That is, to what attributes do infants attend to make category membership decisions? Note that, although each of these criteria is examined separately, undoubtedly there exists a good deal of overlap among them. Moreover, because an assessment of the first two issues is somewhat dependent on an evaluation of the final criterion—that is, the basis for categorization—the majority of this article is devoted to that issue.

The answer to the first question, at least, is somewhat clear. Mervis (1987) showed that 2-year-olds form basic-level categories (termed *child basic*) that are broader or narrower than those of adult categorizers. Thus, infants may include bats in their category of birds, or they may exclude footballs from their category of balls. At the outset, therefore, the objects that infants include in any given category are similar but not identical to those included by adults. Crucially, according to

Mervis, whether or not there is direct correspondence between the categories formed by infants and adults, both are derived from attention to the overall shape of an object (or parts in particular configurations) and function. In other words, child-basic categories are "determined by the same principles that determine adult basic-level categories" (Lakoff, 1987, p. 49). Deviations from adult categories are thought to occur not because of the infants' principle for categorization—the shape–function principle—but rather because their limited knowledge leads them to attend to inappropriate attributes.

The problem with this formulation, however, is that it implies that infants may form child-basic categories by attending to attributes that are ultimately irrelevant for membership to a particular domain. For instance, an infant's category of birds that is based on the attribute "eats food from garbage cans" may ostensibly match an adult's category of birds, but to call it child basic is to highlight only the most superficial aspect of a taxonomy, namely, the things included within a grouping. It makes more sense to use the label *child basic* when the basis or foundation of a category—in addition to its borders—approximates that of adults. An assessment of infants' category boundaries is, therefore, helpful but ultimately uninformative without an understanding of how membership decisions are made. Nevertheless, Mervis's (1987) work is useful in that it reveals that infants' category boundaries are both similar and different to the ones formed by adults, and these boundaries are likely to change, contingent on an ever-growing knowledge base and the availability of attributes by which to categorize. This general view was recently extended by Smith and Samuelson (1997), who characterized it as "wise stability … coupled with street-smart variability" (p. 190; see also Madole & Oakes, 1999).

The second issue, namely, an understanding of hierarchical relations and the inductions available via those relations, has been examined with older children (e.g., Blewitt, 1989, 1994; Inhelder & Piaget, 1964) but has been largely overlooked by those working with infants. According to Blewitt (1989, 1994), an understanding of hierarchies is evidenced by the ability to form categories at different levels of abstraction and the ability to categorize the same object into multiple categories. Markman (1989), however, believed more conservative criteria are required. She cited, for example, an understanding of the mutual exclusivity principle or aspects of the principle such as the asymmetry and transitivity of class inclusion. Regardless, although there is limited evidence that 2- and 3-year-olds possess both of these categorization skills (Blewitt, 1994), it remains to be seen whether any of the conditions for an understanding of hierarchical relations are met in infancy. There is certainly a large body of research that shows that infants can form superordinate as well as basic-like categories (e.g., Behl-Chadha, 1996; Eimas & Quinn, 1994; Mandler & Bauer, 1988; Mandler et al., 1991), yet it is equivocal whether these categories represent different levels of generality or whether infants understand the mutual exclusivity of the objects involved. In other words, infants may rely on the same attributes to form both kinds of category; for instance, it is possible to

form a category of animals and a category of dogs by attending to the attribute "has a tail." Such categories should be considered as fundamentally equivalent; the basis is identical, and it is the context (available stimuli) that varies, leaving questions about hierarchical relations no longer germane (see Rakison & Butterworth, 1998a; Rakison & Cohen, 1999). Ultimately, the dearth of studies on this problem may result from the lack of appropriate experimental techniques or from the belief that infants are incapable of understanding the implications of hierarchical relations. Nevertheless, given the contrasting findings in studies of mutual exclusivity with older children (e.g., Blewitt, 1994; Inhelder & Piaget, 1964) and the almost total absence of research with infants on this topic, there is little to suggest that they understand the hierarchical nature of taxonomies.

This conception of infants' understanding of hierarchical relations leads to an important point. In the same way that Mandler (1992; Mandler et al., 1991) argued that infants' superordinate categories should be labeled as *global* because of the lack of basic-level domains nested within them, so it may be incorrect to use the label *child basic* if there is no evidence of adult- or child-superordinate categories hierarchically above them. A version of this argument was first put forward by Vygotsky (1962). He believed, as did Mervis (1987), that children form concepts first at the middle level of generality, that is, the basic level. However, he also claimed that these concepts would not match those held by adults until the other levels of generality, the superordinate and subordinate levels, were acquired. According to Vygotsky, it is the ability to think across these structured levels of generality rather than deal with isolated concepts that is indicative of an adult-like conceptual system.

The third question, whether the bases for infant categorization match those of adults, has recently begun to receive some attention in the literature. This is to some extent not surprising because it has become clear that certain issues in infant categorization, including the two addressed previously, cannot be resolved without an understanding of what directs the process to begin with. As predicted by Mervis (1987), there is evidence, albeit limited, that infants under 2 years of age attend to the function (e.g., Madole, Oakes, & Cohen, 1993; Nelson, 1973) and shape of objects to categorize (e.g., Landau, Smith, & Jones, 1992; Smith & Samuelson, 1997). However, it has also become evident that other perceptible attributes play an important role in infants' categorization of real-world objects. Quinn and Eimas (1996a), for example, used the familiarization technique to show that 3- to 4-month-olds can form a categorical representation of cats that excludes dogs based on facial information but not on body information. Using the same technique, Behl-Chadha (1996) found that 3- to 4-month-old infants can form categorical representations for mammals that exclude birds, fish, and furniture and categorical representations of beds, chairs, couches, cabinets, and tables that exclude mammals. As pointed out earlier, these categorical representations are presumably quite different from the more complex representations possessed by older

children and adults, a fact highlighted by Behl-Chadha's use of the term *superordinate-like* to describe them.

The ability to form superordinate categories has often been taken as a sign of "sensitivity to higher-order taxonomic relations among stimuli" (Fenson, Cameron, & Kennedy, 1988, p. 897). This is because superordinate categories are thought to be linked less by perceptual and functional associations and more by abstract, conceptual connections (Mandler et al., 1991). To test this assumption, Fenson et al. examined 26-month-olds' performance in match-to-sample tasks with superordinate and basic matches that varied in perceptual likeness. Results revealed that children matched categorically related superordinate and basic pictures as long as there was a moderate perceptual likeness between the two exemplars. For instance, they were just as likely to match a hammer with a saw (superordinate match) as they were to match a golf ball with a football (basic match). The authors interpreted this result to mean that even 2-year-olds' superordinate-level categories are perceptually bound and consequently that they are no different in kind to basic-level classes. More important, Fenson et al. argued that "to call these categories superordinate risks associations with characteristics commonly associated with superordinate classes such as hierarchical structuring … that are probably not present this early in development" (p. 906).

Rakison (e.g., Rakison & Butterworth, 1998a, 1998b; Rakison & Cohen, 1999) reached a similar conclusion following a number of studies on infant superordinate- and basic-level categorization with the object-manipulation procedure. The studies revealed that infants as old as 18 to 22 months form categories that match ostensibly adult conventional natural-language domains but that are in fact rooted in single attributes, namely, object parts. In one study, for example, Rakison and Butterworth (1998a, Experiment 1) found that infants categorized different-part contrasts—for example, animals versus vehicles or furniture versus vehicles—approximately 8 months before they categorized same-part contrasts; for example, animals versus furniture or animals versus insects. In a second study, the same authors (Rakison & Butterworth, 1998a, Experiment 2) examined more closely the basis for superordinate categorization with a novel version of the object manipulation procedure. Infants at 14, 18, and 22 months were presented with four tasks: a contrast of normal animals and normal vehicles, a contrast of animals without legs and vehicles without wheels, and a contrast of animals and vehicles, all of which possessed both legs and wheels. In a final condition, called an *across-category confound* task, infants were presented with two animals and two vehicles that possessed wheels but not legs and two animals and two vehicles that possessed legs but not wheels.[4] Results revealed that infants categorized normal animals from vehicles but failed to categorize when objects had matching object

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[4]This task has also been labeled the *switched-parts task* (Rakison & Cohen, 1999).

parts, that is, when animals and vehicles had both legs and wheels and when animals and vehicles had no legs or wheels. Results from the across-category confound revealed that 14- and 18-month-olds did not group objects on the basis of superordinate category membership but instead by attending to object parts (e.g., legs, wheels). In other words, they formed categories that could be labeled as *objects with legs* and *objects with wheels.*

These results were taken to mean that infants do not possess a rigid notion of superordinate category membership for the animal, vehicle, furniture, or insect domains. Rather, infants categorize, in object-manipulation tasks at least, by attending to object parts even if it means grouping together objects from different adult-defined domains. This conclusion suggests that infant classification may occur online in the sense that what constitutes a category depends on the available stimuli and, possibly, the particular attributes of those stimuli (see Jones & Smith, 1993; Smith & Samuelson, 1997; Thelen & Smith, 1994). It is unlikely, for instance, that the infants in these tasks had grouped together previously a cow with wheels and a motorbike or a train with legs and a walrus. There is little reason, therefore, to presume that infants, even those as old as 18 months, understand that certain objects are "the same kind of thing" (Sugarman, 1983). Moreover, given that superordinate-level categorization is often taken as evidence of an understanding of the hierarchical nature of taxonomies (Markman, 1989), these results are perhaps a further indication that infants have not yet developed such knowledge. In other words, infants might not form superordinate categories at all but rather groupings that resemble those formed by adults on the surface only.

A more recent series of studies was designed to examine whether infants might also attend to a single, large object part to form basic-like categories. Rakison and Cohen (1999) used the same tasks as those in Rakison and Butterworth (1998a, Experiment 2) to investigate whether 14- to 22-month-olds were tested with contrasts of cows and cars. In other words, infants received one task in which the stimuli were unmodified, one task in which a single part of each stimulus was removed (e.g., wheels and legs for cows and cars), one task in which all the stimuli had the same parts (e.g., both legs and wheels), and one task in which half the stimuli from each category had one part and half the stimuli from the same category had a different part. In addition, as a means of investigating infants' knowledge of the functional aspect of objects and their parts, the number of infants' appropriate functional responses, for example, "rolling" and "jumping," was analyzed.

The results of the tasks revealed that infants do indeed attend to functional object parts to form basic-like classes but only under specific within- and between-category similarity conditions. Unsurprisingly, infants in all three age groups categorized unmodified cars from unmodified cows. However, 14-month-olds failed to categorize cows from cars when object parts were removed, that is, legs and wheels, and 14- and 18-month-olds failed to categorize cows from cars when the same object parts were possessed across all exemplars.

By 22 months, infants categorized successfully on all three tasks. On the fourth task, the across-category confound, all three age groups categorized objects as cows and cars rather than by parts. This finding suggests that infants' partonomic bias is influenced greatly by high levels of between-category dissimilarity. In a similar series of tasks with cows and birds, however, infants performed quite differently (Rakison, 1999). Infants at 14- and 18-month-olds failed to categorize unmodified birds and cows, birds and cows without functional object parts, and birds and cows that shared object parts. This suggests that high between-category similarity, and not inductions from knowledge about category relations, may be primarily responsible for infants' failure to classify two basic-level domains within a single superordinate. Interestingly, however, 14-month-olds categorized by parts rather than category membership (or movement domain) on the across-category confound. In addition, the 22-month-olds failed to categorize cows and birds without parts, that is, legs and wings, and cows and birds that had both legs and wings. This suggests an important role for object parts in category membership decisions at the end of the 2nd year but one that is very much dependent on the attribute contrast given in any given context.

The analyses of infants' functional responses provided an explanation for their attention to large object parts in categorization. Infants at 14 and 18 months of age made more functional responses to objects with parts than those without parts, whereas, at 22 months of age, infants made an equivalent number of functional responses to both types of stimuli. Furthermore, on the across-category confound tasks, infants made significantly more functional responses based on parts than on category membership, for example, rolling a cow with wheels rather than a car with legs. In conjunction, these behaviors were taken to mean that infants develop expectations about the movements of objects that are associated initially with their large, moving parts and then later with the object itself. These expectations are rooted in information available in the perceptual array and signify, perhaps, the beginnings of the kind of generalizable ontological knowledge that is evident in older children (e.g., Keil, 1989). However, it is unlikely that this knowledge in infancy encapsulates any kind of relation among objects in a hierarchical system. In other words, infants might form superordinate- or basic-like categories and may even expect different objects to move differently, yet they have no understanding of the ontological relation between, for example, animals and dogs, dogs and cats, and even possibly dogs and other dogs.

To examine the extent to which infants' category membership decisions match those of older, presumably more advanced categorizers, Koenig and Rakison (1999) presented adults and 3-year-olds with cow–car, cow–bird, and animal–vehicle contrasts in the across-category confound design. In contrast to the object-manipulation tasks with younger infants, the 3-year-olds and adults were explicitly asked to sort the eight objects into two groups of four. Results revealed that 3-year-olds tended to categorize by object parts rather than category member-

ship on the contrast of cows and birds and the contrast of animals and vehicles. In other words, they formed categories of objects with legs, objects with wings, and objects with wheels. Adults categorized animals and vehicles by category membership, and they were just as likely to categorize cows and birds by category membership as by parts. On the contrast of cows and cars, both 3-year-olds and adults formed groupings by category rather than by object parts. When asked for the rationale for their groupings, adults and children often explained their category-based groupings by referring to the ontological status or perceptual appearance of the objects ("These are cows, and these are cars ," "These look like cars"), and they explained their part-based groupings by referring to functional properties of the parts ("These things fly, and these things walk").

Thus, infant categories are possibly quite different from the more complex organizational taxonomies evident in later life, although, in all likelihood, they act as the foundation for those taxonomies and the richly structured inductions that they support. This having been said, it is currently unclear precisely how infants' perceptual categorical representations develop into later conceptual knowledge. It has been argued here that infants gradually acquire knowledge that is thought of as conceptual through the correlation of static and dynamic perceptual cues (see also Rakison & Butterworth, 1998b). This general view, which characterizes the development of representational content in terms of continuity, is similar to that proposed by a number of other developmentalists (e.g., Madole & Oakes, 1999; Quinn & Eimas, 1996b). In contrast, Mandler (1992, 1993) argued that early perceptual representations are recoded by a process called *perceptual analysis* into a conceptual format that embodies a meaning. This view, which is primarily a top-down approach that emphasizes a perceptual–conceptual dichotomy, has received a great deal of attention in the developmental literature. It is not clear, however, exactly how the process of perceptual analysis transforms information in the perceptual array from one representational format to another or whether a theory that emphasizes discontinuity is reconcilable with much of the data presented here. Nevertheless, given that there is evidence to support both the perceptual and the conceptual theorist, an important aim for future research must be to examine the way in which early categorical representations are related to those possessed by older children and adults.

CONCLUSIONS

In the introduction, I proposed that the categories that infants form should not be labeled *global, superordinate,* or *basic* unless there is evidence to show that they are comparable in terms of category members, hierarchical structure, and basis to those formed by adults. With regards to the first criterion, the choice of objects included in early categories, infants make class membership decisions that often coincide

with those of adults (Mervis, 1987). It is not clear, however, whether the notion of child-basic categories clouds the issue of taxonomies by highlighting the external appearance of infants' categories rather than the basis for classification or to what extent the bases used to form these early categories match those relied on in later life. For the second criterion, an understanding of hierarchical structures, it is clear that such knowledge is in place by the 3rd year, but there is currently an absence of data about infants' ability to form categories at different levels of generality or to make use of principles relating to mutual exclusivity. Finally, for the third criterion, the early basis for categorization, there are data that infants as young as 3 months and as old as 22 months attend to perceptible attributes to form basic- and superordinate-like categories. It is suggested that these categories are not conceptually coherent because they appear to be mutable and reliant on context-dependent attributes (Rakison & Butterworth, 1998a, 1998b; see also Deàk & Bauer, 1995).

Thus, it may well be that adults use their knowledge about the world to interpret as taxonomies the categories formed by infants. The ability to generate categories that match externally adult classes does not mean that infants form basic-level categories of cars, cows, dogs, or planes; global categories of mammals; or superordinate categories of animals, vehicles, plants, or tools. Likewise, when infants in object-manipulation studies fail to form categories that match adult taxonomies, it does not necessarily mean that they have not categorized at all. It is quite possible that infants attend to a basis for categorization not anticipated by the experimenter. In such cases, infants might find an attribute on which to ground a category, although this systematic behavior would go unnoticed because of experimenters' a priori expectations about the stimuli.

Infants can form categories that appear to correspond with adults' superordinate or basic-level categories, although they do so by attending to perceptible attributes and not because of an understanding of category relations. Given this basis for categorization, the groupings may be more correctly described as "objects with legs" or "objects with wheels" and then possibly later as "objects that walk," "objects that roll," and so on. Infants do form taxonomic categories, that is, categories where an attribute defines class inclusion; however, it is unlikely that they are the same taxonomic categories that adults form. More specifically, there is very little evidence, at least given the three criteria examined here, that infants understand in any sense that categories have an internal structure, for example, all dogs bark, and an external structure, for example, all dogs are animals. Thus, we may hold an illusion of taxonomies in regard to the object groupings made by infants. To label these early categories as *basic* or *superordinate* is to imply that relations exist between different category levels as well as among objects of the same category, and there is little in the literature to suggest that infants have knowledge about either type of relation.

To finish, it should be noted that, in a sense, this view is not new. As discussed earlier, Mervis (1987) argued that it is more appropriate to refer to early ba-

sic-level categories as *child basic* to represent the fact that they may be broader or narrower than those formed by adults. Similarly, Mandler and her colleagues (Mandler et al., 1991) argued that infants should not be credited with forming superordinate categories because they "do not necessarily include well-differentiated, basic-level subclasses nested within them" (p. 290). The claim presented here is, however, somewhat more extreme than that of Mervis or of Mandler. It calls for a radical rethinking of the study of infant classification that moves away from stressing the categories that infants can form and moves toward a focus on the principles that govern early categorization and, in particular, the bases to which infants attend. Care must be taken in the choice of labels that are applied to infants' categories. It may be misleading, for instance, to claim that infants form basic- or superordinate-level categories. The need to relabel infants' categories is not just a question of semantics; it represents a needed shift in the way in which we approach the development of categories in the first years of life.

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