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## The influence of labels and facts on children's and adults' categorization



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### ABSTRACT

Language has been assumed to influence categorization for both adults and children but the precise role and potency of linguistic labels in category formation remains open. Here we explore how linguistic labels help fit objects into categories when relevant perceptual information is either ambiguous or inconsistent with the labels. We also ask how the effects of labels compare to those of other types of information such as facts. We presented 4-year-old children and adults with tasks in which they had to categorize a perceptually ambiguous natural-kind stimulus with one of two equidistant standards (Exp. 1 and 2) or group an ambiguous natural-kind stimulus into a category with a perceptually dissimilar standard (Exp. 3). Participants had access to labels (e.g., “This one is a lorp/pim”), observable facts (e.g., “This one has a long/short beak”), or unobservable facts (e.g., “This one drinks water/milk”) that grouped the ambiguous stimulus with one of the standards. Both children and adults followed label- and fact-driven category boundaries for perceptually ambiguous stimuli (Exp. 1 and 2), and continued to do so even when the labels or facts pointed to perceptually incongruent categories (Exp. 3). These findings suggest a strong causal role for both labels and facts in categorization and have implications about theories of how categorization develops in children.

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## Introduction

One of the most central processes in human cognition is categorization, that is, the grouping of discriminable properties, objects, or events into classes. Categorization is a complex process relying on a variety of cues, including perceptual information (Imai, Gentner, & Uchida, 1994; Landau, Smith, & Jones, 1998; Oakes & Rakison, 2003; Quinn, Norris, Pasko, Schmader, & Mash, 1999; Smith, Jones, Landau, Gershkoff-Stowe, & Samuelson, 2002), conceptual information (Booth & Waxman, 2002a,b; Booth, Waxman, & Huang, 2005; Waxman & Namy, 1997), and linguistic information (Casasola & Bhagwat, 2007; Ferry, Hespos, & Waxman, 2010; Fulkerson & Waxman, 2007; Landau & Shipley, 2001; Plunkett, Hu, & Cohen, 2008). In this study, we were interested in determining the circumstances under which linguistic cues (*labels*) and conceptual cues (*facts*) can influence categorization performance in both adults and young children.

### *Role of labels in categorization*

Even though infants can form categories in the absence of linguistic labels (Casasola, Cohen, & Chiarello, 2003; Feigenson, Carey, & Spelke, 2002; Hespos & Baillargeon, 2001; Quinn, 2004; Quinn, Eimas, & Rosenkrantz, 1993; Spelke, 1990; Waxman & Markow, 1995), it is well known that the presence of labels can be helpful to young learners' categorization by drawing attention to shared features, relations, or actions. For example, applying the same label to different objects can make the similarities of these objects more salient to learners (Balaban & Waxman, 1997; Booth & Waxman, 2002b; Fulkerson & Waxman, 2007; Waxman, 1999; Waxman & Markow, 1995; Welder & Graham, 2006; cf. Nazi & Gopnik, 2001; Oakes & Rakison, 2003). Moreover, young children expect that items that share a label should also share some perceptual features and that, conversely, items that look similar should share a label (Gershkoff-Stowe & Smith, 2004; Jones, Smith, & Landau, 1991; Waxman & Markow, 1995; Yamauchi & Markman, 2000; Yoshida & Smith, 2003; cf. Buresh & Woodward, 2007). Furthermore, the presence of a novel label in a match-to-sample task promotes categorical choices in 3- to 5-year-olds, as opposed to thematic choices (Markman & Hutchinson, 1988). These and related studies consistently support the idea that labels specify category membership even for young children (Gelman, 2003; Gelman & Coley, 1990; Gelman & Markman, 1986, 1987; Waxman, 2003; Yamauchi & Markman, 2000). On this view, "exactly what makes a dog a dog, or a lamb a lamb, may be unknown (and unknowable; Gelman, 2003), but a category label can serve as a placeholder that a reason exists" (Jaswal & Markman, 2007, p. 96). In short, labels may function as "invitations to form categories" (Waxman & Markow, 1995).

In most of the work documenting the effects of labels in categorization, labels were applied to perceptually congruent categories. To isolate the role of labels more clearly, and to show that labels can reveal deeper underlying conceptual similarities, it is important to look at cases where labels do not work in concert with perceptual information during categorization. Relevant work has shown that applying one label to two narrow perceptual categories helps infants and preschoolers to form a single broad category (Landau & Shipley, 2001; Plunkett et al., 2008), and applying two labels randomly to members of two perceptual categories disrupts category formation entirely (Plunkett et al., 2008). A more stringent test of the potency of labels would be given by a stimulus that is perceptually equidistant from two other stimuli belonging to different categories (and, thus, is perceptually "neutral"); applying the same label to this stimulus and to one of the foils would show whether labeling could affect the placement of category boundaries in the absence of perceptual support (cf. Carmichael, Hogan, & Walter, 1932). In addition, one could ask whether a single basic-level label, applied to stimuli that are perceptually dissimilar to each other, could lead to the creation of a unified (albeit perceptually incongruent) category. Empirical evidence from such tests, however, remains a topic of debate.

Early studies of children's inductive inferences about natural kinds (i.e., animals, insects, plants, and other kinds of entities found in nature; Gelman & Markman, 1986, 1987) showed that labels were used more reliably as markers of category membership than perceptual similarity when the two types of information conflicted, thereby supporting the hypothesis that labels point to a rich underlying category structure. In one such study, 4-year-olds saw two objects (e.g., a tropical fish and a dolphin) and

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