Category Use: Learning and Understanding Categories

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Categories are crucial for a large number of cognitive activities, such as classification, inference, problem solving, and explanation. They provide an important means for allowing us to benefit from past experiences. Because of this importance and involvement across a wide variety of intelligent activities, category learning has long been a central research topic in cognitive science, cognitive psychology, and machine learning.

Most of the research on category learning has focused on classification learning, how to assign items to categories. Although classification is an important part of category learning, it is clearly not the only part. In addition, this near-exclusive focus may be limiting our understanding in at least three ways. First, we learn categories in many different ways and how we go about learning categories is likely to have a large influence on what we learn. Thus, a full understanding of category learning requires examining multiple ways of category learning. Second, the focus on classification has led to finding a strong influence of feature diagnosticity, those features that distinguish the categories being learned. Although diagnosticity is an important influence on category representation, we clearly know much more about categories than what distinguishes them. However, given that many items consist of a large number of features and relations that might not be very diagnostic of the category, how do we determine what information to include or not to include in a category representation? Third, in many cases our knowledge of categories does not rely solely on observable features and relations, but on deeper underlying similarities of why the category members go together. It is not clear how classification learning promotes the learning of this type of category understanding.

Recently, there has been a variety of research examining the different ways people learn and use categories (for reviews see Markman & Ross, 2002; Solomon, Medin, & Lynch, 1999), which addresses these limitations of the focus on classification. First, studies have investigated how different ways of category learning might influence the representation (e.g., Anderson, Ross, & Chin-Parker, 2002; Yamauchi & Markman, 1998, 2000). Second, work has examined how nondiagnostic information relevant to other uses of categories might be learned when the focus is not on classification (Chin-Parker & Ross, 2002a, b; Ross, 1997, 1999). Third, research has begun to investigate the understanding that derives from using categories in different ways. Some of my work has examined category learning during problem solving with three different types of tasks—decoding formulas applied to coded messages, mathematical equations, and letter-string transformations (e.g., Ross, 1997, 1999; Ross & Warren, 2002). The results suggest that not only can such learning lead to additional (nondiagnostic) information in the category representation, but it also allows the learning of abstract relations that may help learners to understand the underlying coherence among category members. For example, in the decoding task, learners are able to classify later coded messages on the number relations learned during decoding, even when the relations are fairly abstract (such as the difference between two numbers being less than zero).

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