A Little Knowledge Goes a Long Way in Category Learning

Audrey S. Kaplan (AKAPLAN@S.PSYCH.UIUC.EDU)
Gregory L. Murphy (GMURPHY@S.PSYCH.UIUC.EDU)
Beckman Institute, University of Illinois
405 N. Mathews Ave., Urbana, IL 61801 USA

When people learn a new category, they are influenced by their prior knowledge about the domain that the new category is in. By "prior knowledge" we mean to refer to knowledge about a broad domain, such as animals or vehicles, that exists before a new category is learned. This knowledge is the sort that connects features of a category and provides some sort of explanation of why the category has the properties it does (see Murphy & Medin, 1985, for a review). For example, people have some idea about how animals fly that provides a possible explanation for why something that has wings can live high on a cliff--the wings explain flying that in turn explains why this habitat is possible. Previous research has shown that such knowledge can greatly speed learning when it is correct (Murphy & Allopenna, 1994).

One limitation of prior research on the role of prior knowledge in category learning has been that the knowledge related all or most of the features in the exemplars. However, in the real world, it is often the case that prior knowledge provides explanations for only a small subset of the features present in a category member. So, we may know that wings allow a bird to fly, but we may not know why a robin has a red breast. The present experiment asks whether prior knowledge can aid category learning even when most of the features of the individual exemplars are not relevant to prior knowledge.

Method and Results

Twenty-four subjects participated in a category learning task. The categories used in this experiment consisted of six exemplars, each of which was characterized by binary feature values on five dimensions. For example, if the dimension was "number of doors," the possible features were "two doors" and "four doors." If the dimension was "type of seat covers," the features were "cloth" and "vinyl." These characteristic features were chosen to be unrelated to prior knowledge. That is, there's no reason why a vehicle with two doors would be more likely to have cloth than vinyl seat covers. Each exemplar also had one unique idiosyncratic feature. The prior knowledge was embodied in these features. For example, the features "Made in Africa," "Drives in jungles," and "Used on safari" were derived from a Tropical vehicle theme while the idiosyncratic features "Made in Norway," "Drives on glaciers," and "Used in mountain climbing" were derived from an Arctic vehicle theme. Because each exemplar contained only one such knowledge related feature, the themes could only be noticed by integrating over several exemplars.

Two category conditions, Intact Theme (IT) and Mixed Theme (MT) were used. Both used the same characteristic features. In the IT categories, all of the idiosyncratic features within a category were derived from one theme (e.g., Tropical vehicles), and all of the idiosyncratic features in the other category were derived from a contrasting theme (e.g., Arctic vehicles). In the MT categories, half of the idiosyncratic features within each category were derived from each of the two themes. Thus, if such minimal amounts of knowledge-related information can aid category learning, the IT categories should be learned faster than the MT ones. The results supported this hypothesis. IT categories were learned in fewer blocks (mean = 4.1) than MT categories (mean = 9.7), $t(22) = 3.98$, $p < .001$.

In subsequent experiments, we replicated this result and tracked the use of domain knowledge over the course of learning trials. We found that the advantage of the theme for the IT condition was apparent even after the first block of learning.

Conclusion

This experiment showed that prior knowledge could facilitate category learning even when the individual category members were only weakly related to prior knowledge. People were able to identify the theme across fragments in several exemplars and use this knowledge to speed learning. Thus, it is not crucial that one's prior knowledge is related to all or even many of the features of some new category as long as there is some small, critical mass of information that connects the new items to prior knowledge.

References

Murphy, G. L., & Allopenna, P. D. (1994). The locus of knowledge effects in concept learning. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 20*, 904-919.

Murphy, G. L., & Medin, D. L. (1985). The role of theories in conceptual coherence. *Psychological Review, 92*, 289-316.