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Deep versus Surface Features in Categorization and Similarity Judgment

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Introduction

A traditional account for categorization is that similarity is the main basis of categorizing objects. A recent approach emphasizes the role of deeper features and the variability of examples as additional factors in categorization rather than mere similarity. Rips (1989), for example, showed that a 3-inch round object was judged to be more similar to a quarter than to a pizza but was categorized as a pizza rather than a quarter. This dissociation was attributed as the effect of variability. That is, the size of pizzas varies more (variable object) than the size of quarters (fixed object) and this mysterious round object with a 3-inch diameter would be more likely to belong to a more variable category. In similarity judgment what matters is the distance from the mean. In two experiments we show that the dissociation between categorization and similarity can occur for reasons other than variability. In particular, we attempt to show background causal knowledge is integral to categorization.

Experiment 1

Experiment 1 tests whether feature weighting differs depending on the task. That is, deeper features have heavier weights in categorization than in similarity judgments, and this difference in feature weighting can lead to the dissociation between categorization and similarity. In our study, deeper features are operationalized to be those which cause surface features. For instance, bird DNA is believed to cause other features of birds, such as "have wings," and "have a beak." Participants received a target object along with two options, all of which consisting of three features. One option (A→D→E) shared the initial causal feature with the target (A→B→C) and the other option (F→B→C) shared the two effect features with the target. Participants judged either which option should be categorized with the target or which option is more similar to the target. When asked to judge similarity, participants' responses were split in half between the two options. However, when asked to categorize, 75% of the participants categorized the target (A→B→C) with Option A→D→E, the option that matches on one deep feature but mismatches on two surface features. That is, when categorizing objects, sharing a deeper feature mattered much more than when judging similarity.

Experiment 2

Experiment 2 further examines the dissociation obtained in Rips (1989). Smith and Sloman (1994) argued that instead of variability, the sparseness of descriptions used in Rips (1989) triggered a rule-based categorization rather than a similarity-based categorization. To test this interpretation, they used sparse descriptions (e.g., a round object 3-inch in diameter) as in Rips (1989) as well as rich descriptions, each with an additional feature that was characteristic of the fixed category (e.g., a round object 3-inch in diameter and is silver-colored). They found that with the rich descriptions, categorization indeed tracked similarity. We argue that the effect found in Smith and Sloman (1994) is due to the fact that the additional features in the rich descriptions were generally not possible for the variable objects used in these studies. For instance, the additional feature used to create a rich description for an object involving a quarter and a pizza was "silver-colored" which is impossible for a pizza. Experiment 2 measured participants' judgments on how possible a feature is within a category. We found that this measure predicted categorization of rich descriptions better than similarity. The relative impossibility of the additional features was the most important correlate in the likelihood that targets were categorized with objects.

General Discussion

Overall the two experiments show that categorization is based on deeper features. Experiment 1 shows that features that cause other features serve as the basis for categorization more than for similarity. Experiment 2 shows that even with rich descriptions the possibility of features determined categorization more than similarity did. We speculate that the possibility of features is determined by the causal background knowledge that people have. For instance, our theories or causal knowledge about pizzas indicate why it is not quite possible for pizzas to be silver-colored. As such, judgments of possibility may be considered the effect of deeper features which play a more important role in categorization than surface similarities. The results presented here support the hypothesis that background knowledge is more integral to categorization than to similarity.

References

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