Does Causal Discovery Result in Category Formation and Set the Basic Level?

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Keywords: Categorization; causal reasoning.

Introduction

The most common explanation for category formation is cognitive economy: categories exist to capture unusual levels of similarity among objects or events (Rosch et al., 1976), and basic level categories, which have a privileged status, owe their characteristic processing advantages to their exceptional degree of 1) inter-category dissimilarity and 2) intra-category similarity given their large size (Rosch et al., 1976). The present study explores an alternative goal of category formation: people form categories to best capture causal relations. This alternative goal suggests that categories are formed to convey information that learners need rather than to passively mirror the environment's presumed physical structure. It also suggests that features might emerge to support the prediction of particular outcomes instead of existing a priori, independently of the formation of categories. One study has shown that people who have different purposes in using the same objects form different basic-level categories of these objects (Cheng & Saiki, 1994). However, little converging support exists, and the nature of the processes that drive function-specific category learning is unclear.

The Study

The goal of the present study is to replicate this finding and to examine whether causal discovery per se, or more generally associative learning, drives category formation for functional kinds. Participants received the same information on all features of the stimuli but their causal goals and the attainability of these goals were both varied.

Method

Ninety-six participants were asked to find out how to cause either 2 general or 6 specific categories of birds to grow using flowering plants (where the 6 are subcategories of the 2). Participants received the same information about which particular birds and plants increased on various occasions. Half of the participants were assigned to a situation that allowed causal inference (participants actively intervened to increase flower populations by sowing their seeds), and the other half were assigned to a situation that did not allow causal inference (participants merely observed coinciding bird and flower population growth in the wild). Participants' causal conclusions were probed as a manipulation check.

After the learning phase, participants engaged in a transfer task: they estimated the probability of an increase in bird populations that were sometimes identified generally (e.g. condor) and other times specifically (e.g. bush condor) when certain novel flower populations increased. The flowers' features were novel along either a specific or a general perceptual dimension that was associated with change in bird populations during the learning phase. After the transfer task, participants engaged in a speeded verification task in which they judged the truth of a flower-bird association. Both specific and general bird labels were used for all participants. Finally, participants engaged in a similarity-rating task. They rated the similarity of flowers in pairs.

Results and Discussion

Participants' transfer data were analyzed to find the level at which participants represented the perceptual dimensions relevant to their causal goal. The data, in addition to indicating this level of abstraction, provide evidence for participants' formation of categories. An important function of categories is to allow inferences about unobserved properties when an instance is categorized based on its observed properties. Finding that participants transferred unobservable causal properties (e.g. affects condors) associated with particular perceptual features (e.g. red) to flowers with novel values on these perceptual features (e.g. brown) signals that participants have indeed formed categories (warm-colored flowers) with respect to their causal goal (increasing the condor population). Participants' similarity ratings and speeded verification accuracy and response times were analyzed to discover whether participants with different goals (i.e. specific or general) had conferred basic-level advantages to different categories. The degree to which these differences occurred in conditions that did or did not license causal inference sheds light on whether causal discovery was essential to setting the basic level.

References

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