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Prior Theory Effects on Learned Categorical Perception

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Categorical perception (CP) effects for the domains of color and phonemes are well known, but recent research suggests that there may be a learned analog of this phenomenon for other domains for which there is no innately prepared categorical response (see Livingston, Andrews, & Harnad, submitted, for thorough review). In learned CP, the process of acquiring the ability to make a new categorical distinction results in a warping of the psychological similarity space for the members of the newly learned categories. The effect of this warping is either to compress the region of space containing members of the same category, thereby rendering them more similar to one another, or to expand some regions of the similarity space so as to increase the distinctiveness of instances from different categories, or both. The compression effect seems to predominate in most cases studied thus far but the studies done to date have not explored the role of contextual factors in the CP phenomenon. Considerable work now suggests that one class of contextual factors, the prior theoretical knowledge brought to a new domain by a category learner, may play a particularly large role in the character and course of the learning process (e.g., Livingston & Andrews, 1995; Spalding & Murphy, 1996; Wisniewski & Medin, 1994). Our purpose in this series of studies was to explore the effect of prior theoretical knowledge on the learned CP phenomenon. Specifically, we suggest that the existence of a well defined and overlearned prior theoretical distinction may provide structured representations to which items in the new domain can be aligned (Markman and Gentner 1993). Importing previously established distinctions could serve to enhance the separation of items at the category boundary, in comparison with what happens for people learning the distinction without benefit of relevant prior theories.

To explore this possibility we conducted a series of experiments using pictures of the genitalia of day-old chickens. These stimuli are unfamiliar to most people, but constitute a natural kind. Although people don't know about chicken genitalia in particular, they do have rich theories about male-female genital differences more generally, which makes it possible to manipulate this variable by telling some people that the pictures were of male and female day-old chicks (the theory group) and some that they were pictures of the larynxes of different species of monkeys (few people have theories about monkey larynxes). Two groups of subjects learned the category distinction in a standard concept-learning paradigm under these two descriptions and then judged the similarity of all possible pairs of stimuli in the learning set. Two corresponding baseline groups make the similarity judgments without learning the categories. (Data from two additional groups are not discussed here.) Analyses of variance reveal no effect of prior theory group on the learning curves. We observe compression effects for within-category pairs, but the hypothesized separation effect did not occur. In a second study we replicated this and added an additional, very atypical, instance to the training set for each category, hypothesizing that this might create greater focus on boundary conditions and thereby produce a separation effect. Compression was observed in both learning groups; as hypothesized, only the theory group showed a separation effect. A third replication removed the atypical items as a check on their importance to the effect (additional conditions not discussed here were also added). We again failed to confirm the separation effect though compression still occurs. MDS analyses and follow-up regression analyses for all three studies reveal that those who have learned the category distinction attend to different attributes of the stimuli than those in the baseline groups, but members of the genital and larynx theory groups differ very little in the stimulus attributes to which they attend. It thus appears that for concrete perceptible objects like these, whether prior theories have an effect on the pattern of learned CP effects depends on the set of confusable alternatives that make up the categories. Prior theory effects may be more likely for less definitive, more abstract, and/or verbally presented categories like those studied in previous research on this topic.

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