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The construction of categorization judgments: Using subjective confidence and response latency to test a distributed model

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ABSTRACT

The classification of objects to natural categories exhibits cross-person consensus and within-person consistency, but also some degree of between-person variability and within-person instability. What is more, the variability in categorization is also not entirely random but discloses systematic patterns. In this study, we applied the Self-Consistency Model (SCM, Koriat, 2012) to category membership decisions, examining the possibility that confidence judgments and decision latency track the stable and variable components of categorization responses. The model assumes that category membership decisions are constructed on the fly depending on a small set of clues that are sampled from a commonly shared population of pertinent clues. The decision and confidence are based on the balance of evidence in favor of a positive or a negative response. The results confirmed several predictions derived from SCM. For each participant, consensual responses to items were more confident than non-consensual responses, and for each item, participants who made the consensual response tended to be more confident than those who made the nonconsensual response. The difference in confidence between consensual and nonconsensual responses increased with the proportion of participants who made the majority response for the item. A similar pattern was observed for response speed. The pattern of results obtained for cross-person consensus was replicated by the results for response consistency when the responses were classified in terms of within-person agreement across repeated presentations. These results accord with the sampling assumption of SCM, that confidence and response speed should be higher when the decision is consistent with what follows from the entire population of clues than when it deviates from it. Results also suggested that the context for classification can bias the sample of clues underlying the decision, and that confidence judgments mirror the effects of context on categorization decisions. The model and results offer a principled account of the stable and variable contributions to categorization behavior within a decision-making framework.

1. Introduction

1.1. Theoretical views

Dividing the world into classes of things is a fundamental cognitive ability that allows people to treat distinct entities as equivalent in some way. The classical view of categorization holds that all instances of a concept share common fundamental features that are individually necessary and jointly sufficient for determining which instances are members of the concept. This view implies that categorization is rule-based. Extensive empirical research, however, has yielded several findings that challenge this view. Specifically, results indicate difficulties in specifying a set of defining attributes for natural concepts (Ashcraft,

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1978; Hampton, 2009; Rosch & Mervis, 1975), gradedness in category membership (Barr & Caplan, 1987; Hampton & Gardiner, 1983; McCloskey & Glucksberg, 1978; Oden, 1977; Rosch, 1973; Rosch & Mervis, 1975), cross-person and within-person inconsistency in categorization (Barr & Caplan, 1987; Estes, 2003; Hampton, 1979, 1998, 2009; McCloskey & Glucksberg, 1978), and contextual influences on categorization judgments (Anderson & Ortony, 1975; Barsalou, 1987, 1989; Hampton, 2011; Medin, Lynch, Coley, & Atran, 1997; Roth & Shoben, 1983; see Murphy, 2002). The theories that have been proposed to accommodate these findings, such as the prototype view (Rosch & Mervis, 1975) and the exemplar view (Brooks, 1978; Hintzman, 1986; Medin & Schaffer, 1978; Nosofsky, 1988, 1991) assume that categories are defined in terms of family similarity rather than in terms of a set of criterial features. These views embody a probabilistic conception according to which category membership is graded rather than all or none. Hybrid models that include both rule-based and similarity-based categorization have also been proposed (see Smith & Sloman, 1994).

1.2. The present study

The aim of this study is to gain insight into the process underlying human categorization by examining confidence judgments in one's decision about the membership of an object in a certain category, and the time it takes to reach that decision. A model will be proposed, and predictions from the model will be tested. The model is clearly "fuzzy". However, it focuses on the process by which people make category decisions, and this process would seem to entail a variety of cognitive operations that do not follow any simple principle.

Our point of departure is the observation that the classification of objects to categories displays two seemingly inconsistent characteristics. On the one hand, there is a great deal of cross-person consensus and within-person consistency in the assignment of objects to natural categories (McCloskey & Glucksberg, 1978). This observation is, of course, basic to the idea that categorization is rule-based. On the other hand, categorization also exhibits some degree of within-person instability and cross-person variability. This observation, which suggests that the assignment of objects to categories is not clear-cut, has provided the motivation for the probabilistic views of categorization. The theoretical challenge is to offer a principled account for both the stable and variable contributions to categorization behavior.

In fact, the results documenting variability in categorization behavior also exhibit some order in this variability. For example, the typicality results reported by Rosch and Mervis (1975; see also Hampton & Gardiner, 1983) indicate a very reliable ranking of typicality across participants. In addition, participants disclose some awareness of the differences in degree of membership because they can rate the membership of exemplars on a continuous scale (Barr & Caplan, 1987). Typicality also predicts within-person consistency in categorization (Hampton, 1988, 1995), and correlates with cross-participants consensus in categorization decisions (Barr & Caplan, 1987; McCloskey & Glucksberg, 1978). Typicality was also found to predict response time in categorization: Categorization sentences of typical items were verified more quickly than sentences describing less typical items (McCloskey & Glucksberg, 1979; Rips, Shoben, & Smith, 1973; Rosch, 1973). Of particular relevance to the present investigation is the observation that within-person consistency and between-person consensus are correlated: Items that are in disagreement between participants also exhibit inconsistency in categorization across repeated presentations (McCloskey & Glucksberg, 1978). Thus, not only is there some stability in categorization, but the instability observed also follows a relatively stable pattern. Our proposal is that confidence judgments and decision latency can help track the stable and variable components of categorization responses in a manner that provides some information about the process underlying category membership decisions.

1.3. Category membership decisions: a process analysis

The model to be presented below is based on the assumption that category membership decisions are generally constructed on the fly depending on the clues and considerations that are accessible at the time of the judgment (see Barsalou, 1987). A similar assumption underlies the attitude-as-construction view, which assumes that attitudinal judgments are formed on the spot. Therefore, they can vary depending on the person's current goals and mood, and depending on the context in which the judgment is made (Bless, Mackie, & Schwarz, 1992; Schwarz, 2007, 2008; Schwarz & Strack, 1991; Tourangeau, 1992). A similar view has been proposed with regard to personal preferences (Lichtenstein & Slovic, 2006; Slovic, 1995): Preferences are generally constructed in the process of elicitation rather than retrieved ready-made from memory. This view was motivated by observations indicating that preferences can vary with the task, the context, and the goals of the respondents (see Bettman, Luce, & Payne, 1998; Shafir, Simonson, & Tversky, 1993; Warren, McGraw, & Van Boven, 2011).

We propose that category membership decisions are also constructed on the spot. Assume that a person is asked to decide whether a particular object belongs to a particular category, for example, whether olives belong to the fruit category. How does one choose between *yes* and *no*? Introspection and an informal think-aloud study suggest that a variety of clues and considerations come to mind in an associative manner. One might visualize a small olive and compare it to an apple, feeling uneasy to reach a *yes* decision. But then may think of other fruits such as a prune, even a green prune. One might try to recall whether olives are sold in the fruit section of a supermarket, or else one might think about the context in which olives are served or consumed (e.g., not in a fruit salad). Each such clue may tip the balance in favor of *yes* or *no* response. Some of the clues and considerations may involve similarity to a prototype, as postulated by Rosch and her associates, whereas others may concern the deep "essence" of a fruit (Medin, 1989). Others still may involve semantic or episodic associations that are irrelevant to the decision but can still bias the decision in one direction or the other.