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A Comparison of Context Effects for Typicality and Category Membership Ratings

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Introduction

In the last few years, the demonstration of context effects on people's judgments of category typicality (Barsalou, 1987; Roth & Shoben, 1983) has posed a major challenge to both classical feature and prototype theories of category representation. In these recent studies, the degree to which an item is considered to be a good example of a category depends on the context in which it is presented. This result has been taken to imply that category structure depends on situational factors and is, therefore, not the stable phenomenon which feature theories and prototype theories claim (Roth & Shoben, 1983). One possible conclusion which may be drawn from these apparent changes in category structure is that category representations are themselves unstable (Barsalou, 1987). Context effects have, however, provided support for exemplar-based accounts of category representation (Medin & Schaffer, 1978). According to these theories, category membership or goodness-of-example is determined by comparing items to category members in memory that are retrieved in response to the context. Because different contexts lead to the retrieval of different exemplars, an item that is encountered in different contexts will receive different goodness-of-example ratings.

However, some investigators have questioned whether goodness-of-example measures do indeed assess gradedness in category structure (Armstrong, Gleitman, & Gleitman, 1983; Barr & Caplan, 1985, 1987; Lakoff, 1987). According to these authors, gradients in typicality judgments do not necessarily reflect gradients in category structure or membership. They argue that it is easy to generate examples in which items are clearly members of categories, but are poor examples of the category. Thus, a penguin might be identified as clearly a member of the category Bird, but as a poor example of the category. If this is true, then context effects may only reflect differences in exemplar typicality, rather than differences in the degree to which an exemplar is viewed as a category member. For example, a change in context (e.g., from Montreal to the Antarctic) might change a penguin from a poor example of a bird to a

good example. In both cases, though, it remains clearly a bird. Therefore, context effects, as assessed by goodness-of-example ratings, may not reflect true changes in category structure.

In this experiment, we compared the context effects obtained for goodness-of-example ratings with those obtained for category membership ratings. If contexts truly change the structure of a category, then context effects should be equally apparent for both types of ratings. However, if they affect only an item's perceived typicality, but not its category membership, then context effects should be more apparent in goodness-of-example judgments than in category membership judgments.

We presented category members to subjects in two widely varying contexts. For instance, "ferry" and "raft" were each presented in the following sentence frames: 1) "The boys spent Saturday exploring the stream on the", and 2) "The cars had to reach the island by". The dependent measure we examined was the proportion of subjects who assigned higher ratings to exemplar A than to exemplar B in one context, and who reversed the direction of these ratings in the second context, such that exemplar B was assigned a higher rating than exemplar A. The existence of a reversal minimally implies a re-ordering of items along a scale - and, hence, a restructuring of the category.

Method

Subjects

Thirty-one adults served as subjects. All were between the ages of 18 and 45 years, had completed at least one quarter or semester of college, and were native English speakers. They were paid for their participation.

Apparatus and stimuli

Stimulus presentation and response recording were handled by a Macintosh microcomputer. Ten categories were used: Birds, Dogs, Flowers, Animals, Furniture, Boats, Vehicles, Weapons, Tools, and Toys. For each category, two exemplars were chosen. Three sentence contexts were presented with each of the exemplars in each category. One of the contexts, "They saw the", was used as a neutral context, but will not be discussed further. Each of the other two contexts was written to encourage the subjects to view one of the exemplars as a typical category member. Therefore, for each category, each exemplar was presented once with a congruent context, once with an incongruent context, and once with a neutral context. The order in which the 60 category-context-exemplar

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combinations were presented was randomized differently for each of the two types of judgment.

On each trial, the following information was presented on the computer screen. The seven-point rating scale was presented at the top. In the category membership condition, the "7" was labeled "clearly a member" and the "1" was labeled "clearly not a member", after Barr & Caplan (1987). In the goodness-of-example condition, the "7" was labeled "very good example", and the "1" was labeled "very poor example (or not a category member)", adapted from Rosch (1975). Below the scale, subjects saw a context sentence ending in a category word. Below the sentence, subjects saw instructions to consider how well a particular exemplar matched their idea or image of what the category word had referred to in the previous sentence. At the bottom of the screen, a sentence requested them to rate the category word. In the category membership condition, they were asked to rate how clearly the item was a member of the category. In the goodness-of-example condition, they were asked to rate how good an example the item was of the category.

Procedure

Subjects were tested individually. They were instructed that they would be making two different kinds of judgments about a set of category words. The first type of judgment was explained to them, and they were asked to rate members of two practice categories without any presentation of context. Then, they were shown a printed facsimile of what the screen would look like on each trial, and were asked to rate the exemplar given, keeping the sentence context in mind. Next, computer-presented trials began. The first three trials were practice trials. Following these trials, subjects completed the 60 experimental trials for the first type of judgment.

During the second half of the session, subjects were given instructions for the type of judgment which they had not made during the first half, and the distinction between the two types of judgment was pointed out to them. The procedure for the second half of the session was virtually identical to that of the first, with the exception that the nature of the rating scale was varied as described above.

The order in which the two types of judgment were made was counterbalanced across subjects. All of the categories, contexts, and exemplars used were identical for the two kinds of rating.

Results and Discussion

For each category, we calculated the proportion of subjects who demonstrated reversals in their ratings. A reversal was defined as a difference between the ratings of the two exemplars in one context which was in the opposite direction to the difference between them in the other context. When the difference equalled zero for either context, that subject's response was not counted as a reversal. The proportion of reversals was much higher for goodness-of-example ratings (mean = .77) than for category membership ratings (mean = .37), $F(1, 9) = 110.39$, $p < .0001$.

Clearly, reversals of exemplar ratings with context were more likely to occur for ratings of goodness-of-example than for ratings of category membership. This finding suggests that previous investigators may have overestimated the magnitude of context effects, and that conclusions that category structure is unstable may not have been fully warranted.

Even in category membership ratings, however, reversals of exemplar ratings did occur. How might such reversals be explained? One possibility is that, even for category membership judgments, context effects reflect a re-structuring of the category with context (Roth & Shoben, 1983), and a corresponding change in category representation. Another possibility, however, is that although the extension of a category may change with context, its representation does not. We have recently (Barr & Caplan, 1985, 1987) presented a theory of category representation which can explain how a category's representation can remain unchanged while its extension changes. According to our account, a category is represented by features, each of which may be considered to be *intrinsic* or *extrinsic*. Intrinsic features are true of an object considered in isolation (for example, most individuals would represent the feature "has four legs" to be an intrinsic feature of dogs). Extrinsic features are relations which hold between an object and some other entity (for example, most individuals would represent the feature "chases cats" as an extrinsic feature of dogs). Members of categories which are primarily represented by intrinsic features are likely to remain category members across changes in context, because intrinsic features are tightly bound to entities. On the other hand, members of categories which are primarily represented by extrinsic features may change their membership with context. Under some contexts, the appropriate conditions may hold for the

extrinsic feature to be true of an object. In these cases, the object will be considered a category member. Under other contexts, however, the appropriate conditions will not hold. In these circumstances, the object will no longer be considered a category member. For example, suppose that "used to create" were the complete representation of the category Tool. A piece of driftwood lying on a beach, therefore, would not satisfy the appropriate relationship to be a tool. However, if it were used by someone to scrape a picture in the sand, it would become a tool. It is important to note that regardless of whether a category's representation relies more heavily on intrinsic or on extrinsic features, the underlying representation of the category (i.e., the properties which determine category membership) remains the same in all contexts. However, the set of items which are considered to be category members should change more for extrinsically represented than for intrinsically represented categories.

The data we collected in this study provide some support for this model. The 10 categories that were used vary in the degree to which their meanings depend on relational (i.e., extrinsic) information, according to the ratings of a previous group of 15 subjects. Therefore, we were able to calculate the correlation between previous subjects' mean ratings of "relationalness" and the proportion of subjects who demonstrated reversals for this set of categories. Using the more stringent measure of category restructuring (category membership ratings), we obtained a significant correlation between the degree to which a category's meaning relies on relational information and the proportion of reversals obtained, $r = .67$, $p < .05$. A similar correlation for goodness-of-example ratings failed to reach significance at the $p < .05$ level.

These data suggest that context effects are more likely to occur for extrinsically represented than for intrinsically represented categories. One should, however, be cautious in interpreting these results. Because the contexts used varied among categories, it is possible that we had inadvertently selected the more powerful contexts for the more relational categories. Nevertheless, these results are consistent with our model's predictions.

In conclusion, this study demonstrated that context effects are less likely to occur for category membership judgments than for category typicality judgments, suggesting that previous estimates of the frequency or magnitude of context effects may have been exaggerated. In addition,

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the residual context effects shown when the more stringent measure of category membership was used can be explained to a considerable extent by a theory that assumes that category representation remains constant across contexts. It remains to be demonstrated then, that context effects do indeed challenge the traditional view that category representation is invariant across contexts.

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