

CROSS-CATEGORY DIFFERENCES IN THE AVAILABILITY OF PERCEPTUAL AND SEMANTIC INFORMATION

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INTRODUCTION

When people make decisions about the category membership of pairs of pictured objects (respond "yes," if both objects are members of the same category), providing them with a category label in advance, that is, a prime, allows the formation of an internal representation of the category that facilitates decisions for both semantic and color categories (Duncan and Kellas, 1978; Guether and Klatsky, 1977; Rosch, 1975a, b). The representations of color categories are theorized to provide more concrete physical information than those of semantic categories as evidenced by the fact that the prime still facilitates response to color categories under physical identity instructions (respond "yes," only if the two pictures are physically identical), while the prime has no effect on decision times for semantic categories under these same instructions. On the other hand, the internal representations of semantic categories are theorized to contain more abstract conceptual information (Rosch, 1973, 1975a, b). This distinction can be viewed as a difference in the degree to which items within each of the two types of categories are related on a perceptual dimension, with members of color categories related primarily on the basis of perceptual similarity, while members of semantic categories are related primarily on a semantic or conceptual basis.

Some recent research suggests that semantic categories can be divided along a continuum into those categories containing members that are more visually homogeneous, hereafter called "perceptual" categories, and those which contain members judged to be more visually heterogeneous, hereafter referred to as "non-perceptual" categories (Sperber, *et al.*, 1982, 1984). One could argue that this distinction between perceptual and nonperceptual categories would also result in differences in the internal representations of such categories, with the representation of a perceptual category embodying more perceptual information, while that of a nonperceptual category embodies more abstract semantic or conceptual information.

The present experiment examined expected differences between perceptual and nonperceptual categories when pictures of category members were classified under physical identity instructions. It was expected that the facilitative effects of a category label prime on physically identical pairs would be obtained only for the perceptual categories, because of the hypothesized availability of visual features in the representation generated by the prime that could be used to facilitate the match. This is similar to the result that Rosch (1975b) found with color categories. No effect of priming would be expected for the nonperceptual categories due to the lack of visual information contained in the internal representation. In

addition, response latencies to same-category pairs (pairs of members from the same category, which would be a "no" response) were expected to be slower for perceptual than for nonperceptual categories due to what Seymour (1976) has called pictorial confusability; that is, it was expected that the greater visual similarity between items in perceptual category pairs would make it more difficult for subjects to decide that these items were not physically identical compared to decisions on the same-category pairs for nonperceptual categories.

METHOD

Twenty adult, college-student volunteers, 8 males, and 12 females, made physical identity decisions (respond "yes," only if the two pictures are identical; respond "no" to all other picture pairs) on three types of picture pairs: physically identical (e.g., bus-bus), same-category (e.g., bus-motorcycle), and different-category (e.g., bus-apple). The stimuli consisted of photographic slides of pairs of pictures selected from eight semantic categories. Half of the categories had been judged to be perceptual categories (those categories in which members were judged to be perceptually homogeneous) and half to be nonperceptual categories (those in which the members were more visually heterogeneous). The basis for such a distinction and the choice of particular categories were based on previous subjects' judged perceptions of visual similarity of category instances and on category-instance verification data (Sperber, *et al.*, 1984). Four instances were chosen from each of the eight categories selected for the present experiment. All instances were high typical exemplars of their respective categories, as rated in Rosch's (1975a) and Sperber, *et al.* (1984) typicality norms. The picture stimuli were color-photographed copies of pictures from the Basic Word Making Cards (Word Making Productions, Inc., P.O., Box 15038, Salt Lake City, Utah 84115).

Two separate stimuli lists were constructed, one from the perceptual category items, the other from the nonperceptual category items. Each list consisted of 64 physically identical, 32 same-category, and 32 different-category pairs. Half of the subjects made decisions on picture pairs from perceptual categories, such as insect and vehicle, while the remaining subjects made judgements on items from nonperceptual categories, such as sports equipment and furniture.

The apparatus consisted of a Kodak Carousel (Model C) slide projector equipped with a tachistoscopic lens, a voice-operated relay connected to a Hunter Model 120-C Klockounter for recording subjects' response latencies, and supportive programming equipment. The Klockounter was interfaced with the voice-operated relay and tachistoscopic lens such that the onset of the stimulus slide started the timing cycle and the subject's verbal response stopped the Klockounter.

Each subject was tested individually. Half of the subjects were presented with the perceptual category list and half with the nonperceptual category list. Subjects were instructed that they would be shown pairs of pictures and were to respond "yes" as rapidly as possible, if the two pictures were physically identical, and "no," if they were not (i.e., for same-category and different-category pairs). Half of the trials in each list were primed. Each primed trial began with the oral presentation of a category name (which was always a superordinate of at least one of the two pictures) followed approximately 2 seconds later by the presentation of the stimulus pair. For each unprimed trial, the procedure was the same except that the word "ready" was used instead of a category name. The subject was not informed of any possible relationship of the prime to the stimulus pair or of any

TABLE 1. Mean response times in msec.

Category	Picture Pair					
	Physically Identical		Same		Different	
	Primed	Unprimed	Primed	Unprimed	Primed	Unprimed
Perceptual	643 (66) ^a	670 (68)	708 (64)	680 (60)	673 (67)	676 (59)
Nonperceptual	625 (51)	623 (55)	637 (60)	630 (63)	642 (57)	645 (60)

^a Standard Deviations

possible benefit to be gained from the prime. There were approximately 10 seconds between each trial, at which time the subject's response latency to the preceding trial was recorded.

RESULTS

Mean response latencies for physically identical, same-category, and different-category trials were analyzed separately using a 2 x 2 analysis of variance. Category type was a between-subjects factor, while priming was a within-subjects factor. The mean response times for all conditions are presented in Table 1. Looking first at the results for the physically-identical pairs, primed stimuli ($\bar{x}$ = 634 msec) were responded to faster than unprimed stimuli ($\bar{x}$ = 646 msec; F = 12.97, df = 1,18, P < .003). This main effect of priming was, however, qualified by a significant Category Type x Prime interaction (F = 17.90, df = 1,18, P < .001). Additional analyses of this interaction revealed that a significant facilitation effect of the prime was found only for the perceptual categories (F = 28.14, df = 1,9, P < .001).

Turning next to the same-category pairs, significant main effects of Category Type (F = 4.89, df = 1,18, P < .04) and Priming (F = 17.84, df = 1,18, P < .001). were obtained. Perceptual categories were responded to significantly slower than nonperceptual categories ($\bar{x}$ = 694 msec and 634 msec, respectively). Primed stimuli were responded to significantly slower than unprimed stimuli ($\bar{x}$ = 673 msec and 655 msec, respectively). Both of these main effects were qualified by a significant Category Type x Prime interaction (F = 6.62, df = 1,18, P < .02). Analyses of this interaction revealed that the priming effect for the nonperceptual categories was not significant. However, for the perceptual categories, primed stimuli pairs were responded to significantly slower than unprimed pairs (F = 22.71, df = 1,9, P < .002).

No significant main effects or interactions were obtained for the different-category pairs.

DISCUSSION

The present experiment provided additional support for the utility of the distinction made between perceptual and nonperceptual categories and the corresponding differences in the availability of concrete visual information in the internal representation generated to a category prime. As predicted, a category

label prime significantly aided physical identity decisions on physically identical pairs from perceptual categories, while it provided no help for decisions on pairs from nonperceptual categories.

Rosch (1975a, b) has argued that the internal representation that is formed from a category label prime of a semantic category does not provide perceptual or physical information that can be used in making decisions about physically identical pairs of members from that category. This is in contrast to the representations found with color categories under the same conditions, which do provide perceptual information that a subject can and does use to aid their decision making. The present experiment provides evidence that while Rosch's conclusion may be true for some semantic categories, it is not true for all semantic categories. Categories that have a high degree of visual similarity among their members behave much like Rosch's "perceptual" color categories; that is, the category label primes of perceptual categories in the present experiment did allow subjects to form an internal representation that contained sufficient perceptual or visual information to aid subjects decisions on physically identical pairs under the physical identity instructions. The internal representation formed from the prime of a perceptual category might serve to accentuate the visual features that instances of a perceptual category share in common. This accentuation allowed subjects to decide that the two stimuli in a pair were encoded. This was not the case for the nonperceptual semantic categories, in which evidence in accordance with Rosch's conclusions (1975a, b) was obtained. The internal representations of the nonperceptual categories in the present experiment apparently do not provide perceptual information that can be used, when making physical identity decisions on physically identical pairs, since no priming effect was obtained with pairs from these categories.

Another expected result from this experiment was derived from Seymour's concept of pictorial confusability. Seymour has suggested that the more the two pictures in a same-category pair are visually similar to one another, the more difficult it will be to decide that they are not physically identical and to give a "no" response. In the present experiment, it was predicted that the items in the same-category pairs of perceptual categories would be perceived as being more visually similar to one another resulting in the pictorial confusability suggested by Seymour. On the other hand, it was expected that no such effect would be found with the nonperceptual categories due to the relative lack of visual similarity within the same-category pairs. The results clearly supported the expected findings. The same-category pairs of perceptual categories were responded to significantly slower than the nonperceptual category pairs. A category prime presented before the stimulus pair had no effect on the nonperceptual categories, but it did significantly interfere with decisions on pairs from perceptual categories. The information made available by the internal representation formed to the prime of a perceptual category made it even more difficult for subjects to decide that the stimulus pair items were not physically identical.

The internal representation formed from the category label prime of a perceptual category apparently contains information that is not contained in the representation formed to the category prime of a nonperceptual category. As suggested earlier, this information is believed to involve the visual features that typical members of a perceptual category share in common. The internal representations formed with nonperceptual categories contain no information that af-

fects either the positive decisions to physically identical pairs nor the negative decisions to same-category pairs. In conclusion, there appear to be differences in the internal representations of perceptual and nonperceptual semantic categories similar to the differences Rosch found between color and semantic categories. Such differences need to be recognized in future research involving semantic categories.

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