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Cross-category structure in semantic memory

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In Experiment I, subjects made similarity judgments about all 56 category terms listed in the Battig and Montague (1969) norms. These judgments were then subjected to a hierarchical clustering analysis. Experiment II demonstrated that the relations among the category labels are very similar to the relations among the high dominance exemplars of these categories. Experiment III showed that the distances between the category terms in the hierarchical clustering analysis could predict RTs in a same-different paradigm.

Recent studies have used the Battig and Montague (1969) category norms in an attempt to delineate the semantic structure of particular domains (e.g., Rips, Shoben, & Smith, 1973). These norms present, for each of 56 categories, a dominance ordering of the different instances of that category, where the dominance of an instance is the number of subjects who listed it as an exemplar of that category. Thus these norms provide possible information about within-category structure, but say nothing about between-category structure. Yet the similarity relations between various categories can be of critical concern in semantic memory research. To illustrate, consider the same-different task introduced by Schaeffer and Wallace (1970). A subject is presented a word pair and is instructed to respond "same" if both words are drawn from the identical category (e.g., *hawk, dove*), and "different" otherwise (e.g., *hawk, salmon*). Researchers have been interested in the time needed to respond "different" as a function of the similarity of the two words; but to measure this similarity accurately, it is often important to know something about the similarity of the two categories that the words were drawn from (birds and fish, in the above example).

The main purpose of the present paper is to provide measures of between-category similarity for all 56 categories used in the Battig and Montague (1969) norms. Toward this end, we performed a hierarchical clustering analysis of these categories, and then validated our analyses by means of two follow-up experiments. The similarity judgments used as input to the clustering analysis were obtained by asking subjects to sort the 56 category names into groups on the basis of common meaning, a procedure recently used by Miller (1967, 1969).

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EXPERIMENT I

Method

Materials and procedure. Computer printouts listed the 56 categories in the Battig and Montague (1969) norms. Each printout presented a different random ordering of these categories. Alongside of each category on the printout was its category number. Each subject was given a computer printout, directed to examine the list of categories, and to decide which categories, if any, shared some meaning. The subject then recorded by category number those groups of categories which were perceived to share a common meaning. Each category was only permitted to be used in one group. A category which held nothing in common with other categories was to be listed separately, i.e., a "group" containing one item.

Subjects. One hundred and twenty-three subjects participated in the experiment, with 100 of them fulfilling a course requirement.

Analysis. A similarity matrix was derived for all 56 categories by summing the number of subjects who grouped a certain category with each of the remaining categories. Thus, the similarity matrix consisted of 1540 cells. The matrix was then subjected to a clustering analysis with Johnson's (1967) hierarchical clustering routine.

Results

The results of the clustering analysis (diameter method) are shown in Figure 1. Examination of the figure shows that subjects tended to group categories in one of the six major branches. The branches can be labeled with names suggested by categories in a branch, e.g., the third branch from the top deals with a biological taxonomy of living things, while the fifth branch from the top involves matters of concern to scientists. Inspection of the results in Figure 1 further indicated that the clustering solution was consistent with theories assuming hierarchical structure in semantic memory (e.g., Collins & Quillian, 1969), in that Johnson's clustering statistic was significant at the .05 level or better for 85% of all recovered clusters. Clearly the null hypothesis of random sorting across subjects can be discarded.