

The relationship between typicality ratings and semantic characteristics as a function of intelligence level

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Typicality (TYP) ratings given by nonretarded (Uyeda & Mandler, 1980) and retarded (Winters & Hoats, in press) adults were compared with ratings given to eight semantic variables (Gilhooly & Logie, 1980; Toglia & Battig, 1978). The items' rated familiarity, ambiguity (U), and estimated age of acquisition were reliably related to the retarded group's TYP ratings, but not to the non-retarded group's TYP ratings. The items' categorizability, meaningfulness, and number of attributes were significantly related to TYP ratings by both groups. These variables have been found to be related to retrieval speed, which, in turn, is associated with the organization of categorical information. It was concluded that many of the semantic ratings given by nonretarded adults are reliable predictors of semantic judgments of retarded adults and that variables other than TYP ratings also affect retrieval speed in both populations.

There are several cogent reasons for investigating the verbal learning of mentally retarded persons. Some of them germane to our interests are to determine (1) how verbal information is organized in the memory of retarded persons, (2) how that organization compares with that of nonretarded persons of similar chronological age, and (3) which variables might be related to or affect that organization. Our purpose here is to compare, on the one hand, the organization of categorical information of retarded and nonretarded adults—as indicated by their ratings of the degree of representativeness (typicality) of exemplars—with, on the other hand, rated semantic characteristics of those words. We wish to determine not only the degree to which those ratings of semantic characteristics, as given by college students, are associated with the typicality ratings of these two groups, but also the extent to which factors associated with the semantic organization of the two groups may be similar.

According to Mervis and Rosch (1981) and Rosch (1975), natural categories contain a core meaning, that is, a best example or prototype. Those exemplars most representative of that core or prototype are judged by persons to be most typical of the category. Those sharing the most attributes have the highest family resemblance. As the similarity between the exemplars and prototype diminishes, the judged typicality decreases, with the degree of typicality being positively related to prototypi-

cality, or its core meaning. Over the course of intellectual development, persons gradually increase the number of exemplars they consider to be representative members of their respective categories. With mental growth, exemplars that had been less representative of a category (atypical) become more representative (typical) until adult criteria are used. According to Nelson and Nelson (1978), as persons learn more about a category, their criteria for assigning an object to that category vacillates between being generous to being conservative.

Mervis and Rosch (1981) found that children learn exemplars that are more representative of a category before they learn exemplars that are less representative of the category. They also concluded that, during mental development, the earlier atypical exemplars gradually become incorporated into the core of the category meaning. Bjorklund (1985) provided evidence that performance differences between typical and atypical items found in young persons are caused by their lack of knowledge concerning the category membership of the atypical items, indicating that children have not assigned the more atypical items to any specific category. These theorists have all come to similar conclusions: The inclusion of exemplars as typical category members is positively related to mental maturity and asymptotes at the upper level of mental development.

It has been established with nonretarded adults that rated typicality is related to performance on such verbal tasks as the reaction time to verify category membership (Mervis & Rosch, 1981), the amount of release from proactive inhibition (Keller & Kellas, 1978), and the production frequency of exemplars (Mervis, Catlin, &

The authors are grateful to Herman H. Spitz for his critical reading of the manuscript. Reprint requests should be sent to John J. Winters, Jr., E. R. Johnstone Training and Research Center, Bordentown, NJ 08505.

Rosch, 1976), as well as to other performance measures of nonretarded children (Bjorklund, 1985) and retarded individuals (Weil, McCauley, & Sperber, 1978). Consequently, it is important to examine which properties or variables are associated with or might affect those judgments not only in the mentally mature but also the mentally immature person, that is, a person at a stage at which adult criteria may not be used. An examination of how those properties are related to item representativeness in mentally retarded persons would give us some idea of which variables affect semantic retrieval at different levels of maturity and intelligence.

Joelson and Herrmann (1978) used Battig and Montague's (1969) 56 categories to factor-analyze 22 measures of category properties. Among those properties were measures of concreteness, meaningfulness, familiarity, and estimated age of acquisition. We will refer to these variables as CON, MNG, FAM, and AA, respectively. Each of these variables loaded significantly on at least one of the four factors.

The production frequency of properties, or number of attributes (NOA) that an item has, is also related to typicality ratings given by nonretarded adults (Ashcraft, 1978), as is an item's imagery (IMG) and familiarity (FAM) (Glass & Meany, 1978; McCloskey, 1980). The latter study found that the effect of typicality ratings on response time was reduced substantially when FAM was partialled out. Since then, Malt and Smith (1982) have determined that FAM and NOA ratings are positively related to typicality judgments.

Winters and Brzoska (1975) asked three groups of non-retarded children and adolescents and one group of retarded persons to supply names for 480 colored pictures. The percentage of items labeled in accordance with adult criteria was positively related to cognitive development. A comparison between labeling performance and the estimated AA given by Carroll and White's (1973a) college students revealed that, for the retarded, kindergarteners, fourth-graders, and sixth-graders, the relationship was reliable, thereby extending to a lower mental age Carroll and White's (1973a, 1973b) findings that the processing of information in semantic memory is related to the age at which words were estimated to have been acquired.

Measures of estimated AA and a consensus of an item's name (U as defined by Lachman, 1971; Lachman, Schaffer, & Hennrikus, 1974), both of which are related to the speed of retrieval of words from lexical store, were obtained from college students by Winters, Winter, and Burger (1978). In that study it was found that both measures (AA and U) were significantly related to labeling efficiency by kindergarteners (from the study of Winters & Brzoska, 1975), indicating that (1) the sequence in which words enter the lexicon during development is associated with the ages at which the words were estimated by college students to have entered the lexicon, and (2) those items that had the greatest consensus as to their names were, in fact, labeled appropriately by most of the subjects. Thus, evidence exists that the variables of esti-

mated AA and U are related to semantic judgments whether comparisons are made using labeling efficiency or retrieval speed.

Evidence concerning the relationship between the semantic processing of information and the properties of those words in mentally retarded persons is meager. In a study in which retarded persons named 48 pictures, the speed and accuracy of semantic retrieval were found to be reliably related to estimated AA (Winters & Cundari, 1979). The retrieval data were then compared with other properties, such as CON, IMG, CAT, MNG, FAM, and NOA, and found to be significantly related to all except NOA (Winters & Burger, 1980). However, NOA will be considered here as a variable because others have found a relationship between this property and typicality ratings (Ashcraft, 1978; Malt & Smith, 1982).

The one property that had not been compared with semantic processing tasks prior to the Winters and Burger (1980) study is an item's categorizability (CAT). An item's categorizability relies largely upon how well that item's attributes or features fit into a category, or the degree of family resemblance. Since degree of family resemblance is also what determines an item's typicality (Rosch & Mervis, 1975), CAT should be related to typicality judgments. In view of the general findings with non-retarded and/or retarded persons that the semantic properties of CON, IMG, CAT, MNG, FAM, NOA, U, and AA are related to semantic decision processes, these eight variables will be compared with the typicality ratings given by retarded (Winters & Hoats, in press) and non-retarded (Uyeda & Mandler, 1980) adults to determine the relationship among these nine variables for these two groups. Uyeda and Mandler obtained their ratings from college students; Winters and Hoats obtained their ratings from mentally retarded persons who had a mean chronological age of 25.05 years (4.96 years), a mean mental age of 9.71 years (1.36 years), and a mean IQ of 61 (9). Standard deviations are given in parentheses.

RESULTS AND DISCUSSION

The ratings for the semantic variables of CON, IMG, CAT, MNG, FAM, and NOA were from the Toglia and Battig (1978) college norms; the AA and U ratings were from the Gilhooly and Logie (1980) college norms. Those items given TYP ratings by college students in the Uyeda and Mandler (1980) list that were also in both sets of norms were used in one set of analyses (130 items); those items given TYP ratings in the Winters and Hoats (in press) list that were also in both sets of norms were used in the other set of analyses (73 items).

Correlations were performed comparing performance on the eight semantic variables and TYP ratings in each subject group. Table 1 contains those correlations for both groups. Comparisons among the nine variables for the retarded group are given in the upper half of the matrix; the same comparisons for the nonretarded group are given in the lower half of the matrix. Whenever the sign was

Table 1
Intercorrelations Among Eight Semantic Variables
and Typicality Ratings

	TYP	CON	IMG	CAT	MNG	FAM	NOA	U	AA
TYP		.18	.16	.37**	.29*	.26*	.26*	.28*	.29*
CON	.11		.57**	.49**	.32**	.31**	.07	.50**	.20
IMG	.11	.71**		.61**	.41**	.26*	.15	.34**	.13
CAT	.31**	.59**	.70**		.13	.11	.15	.35**	.13
MNG	.17*	.21*	.36**	.12		.62**	.63**	.04	.35**
FAM	.09	.24*	.34**	.10	.68**		.22	.19	.53**
NOA	.20*	.21*	.20*	.16	.61**	.33**		.16	.17
U	.15	.48**	.47**	.49**	.13	.10	.07		.17
AA	.11	.26**	.30**	.22*	.38**	.51**	.12	.04	

* $p < .05$. ** $p < .01$.

minus and in the appropriate direction—lower U, AA, and Uyeda and Mandler's (1980) TYP ratings should be negatively related to Toglia and Battig's (1978) higher semantic ratings—they are reported as positive so that comparisons are consistent and interpretations of the results less complicated.

The correlations of major interest are in the top line of Table 1, where the typicality judgments of the 73 items used with the retarded subjects are compared with college students' ratings of the same words on eight semantic variables, and in the first column of Table 1, where the typicality judgments of the 130 items used with the college students are compared with the same eight semantic variables. For the retarded group, six of the eight variables were significantly related to their typicality ratings, whereas only three were significantly related to the typicality ratings for the nonretarded group. Typicality ratings correlated reliably with FAM, U, and AA in the retarded but not in the nonretarded group. There is somewhat less commonality between these semantic and typicality ratings for the brighter individuals.

However, the finding that an item's NOA and CAT are related to the typicality ratings of both groups further supports the contention of the theorists that the attributes and family resemblance of these items are related to typicality ratings (e.g., Colling & Loftus, 1975; Mervis & Rosch, 1981; McCloskey & Glucksberg, 1979). Similarly, an item's meaningfulness (MNG)—the number of associations it forms with other words—reflects the commonality and overlap in features it has with other members of a group or category. The propensity to establish these three sets of commonalities is apparently unrelated to intelligence.

Two stepwise multiple-regression analyses were performed to determine which semantic variables are most associated with the typicality ratings of each group when the associations of the remaining variables are accounted for. In one analysis, the eight semantic variables were treated as independent variables, and the typicality ratings given by Uyeda and Mandler's (1980) nonretarded adult subjects was the dependent variable. In the other analysis, the same variables served as independent variables, but the typicality ratings given by Winters and

Hoats's (in press) retarded adult subjects served as the dependent variable.

There were several semantic variables that loaded significantly on the dependent variable of each group. In both analyses, the CAT measure was the first to enter the regression equation and was the most important variable evaluated (e.g., F_s to enter = 19.84 and 10.21, $p < .001$, for the nonretarded and retarded groups, respectively), accounting for about 14% of the variance in each group. In both analyses, other semantic variables entered the equation at significant levels (e.g., MNG, IMG, and AA), but the single variable that was significant throughout both sets of analyses, regardless of the sequence with which variables entered the equation, was the items' CAT.

The remaining 56 correlations in Table 1 are based on the ratings of college students only. As noted, the items used to derive the correlations in the upper half of the matrix were not all the same as those used to derive correlations in the lower half of the matrix, although there were a number of items that were the same in both sets. Nevertheless, the correlations are very similar. The relationship among those semantic variables that were also reported by Toglia and Battig (1978), which included CON vs. IMG vs. CAT vs. MNG vs. FAM vs. NOA, were all lower here. For the six variables, the mean values of Uyeda and Mandler's (1980) and Winters and Hoat's (in press) stimuli are between .5 and 4 standard deviations above the means obtained by Toglia and Battig. Also, the standard deviations of the means are half as large in Toglia and Battig's study as in the other two studies. This higher mean level, along with the more restricted variance, was most likely caused by the exemplars selected in the Uyeda and Mandler and Winters and Hoats studies, viz., picturable concrete objects, which led to a higher level and reduced distribution of values, thereby attenuating the correlations and, most likely, the association between the typicality and semantic variable ratings.

Several conclusions can be drawn from these results. The first is that many of the semantic processing procedures and judgments of retarded persons (Winters & Burger, 1980; Winters & Hoats, in press) are related to those of nonretarded adults. In a previous study, response latencies were significantly related to estimated AA and U values derived from one set of nonretarded norms (Winters et al., 1978); here, typicality judgments were significantly related to these same two variables when derived from another set of nonretarded norms (Gilhooly & Logie, 1980). These two independent sets of results indicate that the semantic-based responses of retarded individuals are associated with the stimuli's degree of ambiguity (U) and estimated sequence of inclusion into the language.

A second conclusion is that the three variables (CAT, MNG, and NOA) that were significantly related to the typicality judgments of both groups are those that, according to the cited theorists, should be related to the items' representativeness of a category. Items that have the

greatest number of attributes or properties, that are most easily categorized (high family resemblance), and that have the most associations with other items were judged as being most representative of their categories by both groups. Thus, not only are many judgments that are made by nonretarded adults in semantic variables related to typicality ratings of groups differing in intelligence level, but they are also associated with the semantic processing and retrieval of categorical information. Further evidence of this position must be obtained in order to substantiate it.

The finding that the semantic variable CAT had the highest and most consistent relationship with typicality ratings for both groups, and loaded significantly on typicality ratings throughout for both groups in the regression analysis, further attests to the importance of this variable as a predictor of verbal performance. It was previously found to be significantly related to the retrieval speed of retarded persons (Winters & Burger, 1980). This variable, and possibly others, such as an item's MNG, NOA, FAM, AA, and U, should be considered as contributors to the variance when information is retrieved from semantic memory. These results substantiate Malt and Smith's (1982) statement that "Perhaps the safest conclusion is that more than one factor can influence typicality ratings" (p. 73). We found that several factors are related to those ratings of adult populations varying in intelligence.

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(Manuscript received for publication February 4, 1985.)