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ABSTRACT

The method of organization in free recall in the form of either clustering or subjective organization is explored in this study. This is just one of the possible forms of retrieval that may be employed. Other possibilities include serial recall, alphabetization, and imagery. To the extent that subjects employ such other strategies, correlations between organization indices and recall will be attenuated. This study explores this issue in two ways: first, about half the subjects (college students) were instructed to use a clustering strategy on a categorizable list. It was predicted that the correlation between clustering and recall would be higher for instructed than for non-instructed subjects. Secondly, subjects were asked to indicate the types of strategies they employed on a post learning questionnaire. It was predicted that subjects in the instructed group would report fewer strategies. The relationship of other individual difference variables to organization and recall has had little examination. Organization has been found to vary with internality-externality, intellectual ability, with chronological age, and with impulsivity/reflectivity in children. This study examined a number of such variables. (DEP)

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Correlates of Clustering and Retention in Free Recall

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Modern theories of free recall learning emphasize the role of organizational processes in retention. (35,34). While extensive experimentation on free recall has been conducted, very little work has focused on the relation of individual traits to performance and organization in free recall. In fact individual difference variables have been generally ignored by most verbal learners (12). This fact is unfortunate for several reasons. Individual differences on many aptitudes are produced by differences in the way subjects process information. By relating aptitude information to performance in verbal learning tasks such as free recall, insight could be gained into the cognitive processes that are necessary in such tasks. Conceivably such research could also lead to training programs to compensate for aptitude differences. From a methodological viewpoint, information about individual difference variables could be used to increase the power of verbal learning studies. Thus, one purpose of the present study was to explore the relationships between several individual difference variables and performance and clustering in free recall.

Organizational theories generally suggest that during free recall, Ss cluster or subjectively organize items into subsets during acquisition and retrieve the subsets during free recall. This organization may occur on a list which contains built-in experimenter-defined taxonomic categories, it is then called category clustering. The organization may also occur when an experimenter has striven to remove obvious categorical relationships between the items; it is then called subjective organization. Some theorists have held that category clustering and subjective organization reflect analogous processes operating in the two types of tasks. (33). Others have cautioned that the processes may be different (27). The present study had subjects perform with both types of lists in order to examine the relationship.

The development of clustering or subjective organization has been held to be necessary if learning more than a minimal number of items is to occur (24, 32, 33). If this is the case a strong correlation would be expected to exist between measures of recall and organization. But correlations have generally been moderate and it has been possible to increase organization measures without increasing recall and vice versa (1, 36). The moderate size of the correlations may reflect errors in the organization measures. The studies have often employed an immediate recall procedure (19, 20, 18, 29, 5). Immediate recall will be affected by both primary (STS) and secondary (LTS) memory processes (33, 17). Organizational processes presumably reflect long term storage processes; thus organizational indices based on immediate recall have built in errors. The present study contained both immediate and delayed measures in order to examine this issue.

Organization in free recall in the form of either clustering or subjective organization may be regarded as only one of several possible retrieval strategies subjects may employ. Other possible strategies include: serial recall; alphabetization, (11, 3, 4); imagery (24); and the new item priority strategy (7, 2). To the extent that subjects employ such other strategies, correlations between organization indices and recall will be attenuated. The present study explored this issue in two ways: first, about half the subjects were instructed to use a clustering strategy on the categorizable list. It was predicted that the correlation between clustering and recall would be higher for instructed

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than for non-instructed subjects. Secondly, subjects were asked to indicate the types of strategies they employed on a post-learning questionnaire. It was predicted that subjects in the instructed group would report fewer strategies.

Finally, previous work has concentrated on the relationship between measures of organizational ability and recall. There has been very little examination of the relationship of other individual difference variables to organization and recall. Organization has been found to vary with internality-externality (5), intellectual ability (21), with chronological age (21, 10), and with impulsivity/reflectivity in children (36). If organizational ability is shown to be importantly related to recall, investigation of the variables related to high organizational ability will be of considerable interest. The present study examined a number of such variables.

Method

Subjects: The participants were 107 male and female undergraduates taking General Psychology at the State University of New York, Cortland. Each subject volunteered and received course credit for participating.

Design and Procedure: The experiment was conducted with groups of 10 to 30. Subjects were assigned to one of two experimental conditions by randomly intermixing booklets for the conditions and distributing them in that random order. Approximately half the participants in any given session were in each condition. Upon entering an experimental session the participants were seated and given general directions for the study. The first task consisted of 3 sequential study-test trials on a 24 item list of unrelated nouns, each selected from a different category of the Battig and Montague (6) norms. The list items were listed on alternate pages of the booklet; recall pages containing 24 spaces for words were the interspersed pages. The words were listed in a new random order on each of the three study pages. Subjects received 30 seconds to study the list and were given 1.5 minutes to write their recall. Instructions told the subjects to study the words carefully, to recall in any order they wished, and that another task would follow the 3 study-test trials.

The second task consisted of 3 study-test trials on a list of 24 nouns, composed of 4 items in each of six categories taken from the Battig and Montague (6) norms. The six categories were: animals, fruits, musical instruments, crimes, diseases, and sports. Presentation and recall procedures were identical to the first task. On a random basis, approximately half the subjects were told the categorical nature of the list, what the six categories were, and to try to remember the words by categories. Instructions about the list provided the experimental variable.

After the 3 study-test trials on the categorizable list the subjects completed the following tasks in the indicated order. Timing for the task is given in parenthesis at the end of the description.

Task 3. The subjects identified the retrieval strategies that they had employed in learning each list by checking from among 7 listed strategies and an 'other' category. The listed strategies were: grouping on the basis of a common spect, grouping by first letters, using the words in sentences or stories, trying to remember words not remembered before, grouping words with the same sounds, listing the last words presented first, recalling in the rorder given. A separate questionnaire was completed for each list. (2 minutes).

Task 4. Task 4 consisted of the Uses-for-things test developed by Getzels and Jackson (16). Subjects are asked to list as many different uses as they can for each of five common objects, bricks, pencils, paper clips, toothpicks, and a sheet of paper.

The task measures creativity, divergent thinking, or ideational fluency. (The subjects were given 5 minutes, but each one minute interval was called off to permit pacing.)

Task 5. The internality-externality scale developed by Rotter (28) was the fourth task. The scale measures the degree to which individuals see themselves in control of their own lives (internal) or as being controlled by outside events (external). (8 minutes).

Task 6. The Wide Range Vocabulary Test (15) basically measures verbal ability. Scores on this test correlate reasonably well with measure of general intelligence. It might be considered a convergent-thinking ability test. (4 minutes).

Task 7. An experimenter-designed test of organizational ability made up task 7. The subjects were presented with seven words in each of eight categories. They were asked to select the four words within each category that best went together. Table 1 contains a copy of the test. During the test the number of elapsed seconds was written on the board every 5 seconds. Upon completing the task the subjects recorded the elapsed time on the bottom of the sheet. The test yielded two scores, number or problems out of eight correctly completed and the elapsed time.

Task 8. Task 8 consisted of a description of seven possible orientations students could take with respect to their roles as college students. The orientations had been developed in research conducted by Stanfield and Schumer (30). Descriptions of the orientations were written by the experimenters; subjects were asked to select the orientation that best fit them. Table 2 contains the role orientation scale. In another unpublished study, faculty members at SUNY, Cortland, rank ordered the seven orientations; mean ranks were computed for each orientation. Subjects in the present study were assigned the mean faculty rating for the item they picked. Thus the scale measures the degree to which students agree with average faculty values about student role orienations. (3 minutes)

Task 9. Subjects were asked to recall as many words as they could from the two lists they had studied. (Unlimited time) Subjects wrote their recall on a sheet containing 48 blank spaces.

Task 10. The subjects completed a short demographic questionnaire asking for sex, age, major, class year, position in family (eldest, youngest, middle), and size of city or origin (rural area, small village, small city, medium city, suburb or large city) and whether they preferred science or humanity courses.

Upon completing this questionnaire the subjects were thanked and dismissed.

Results

Informal interviews with participants in a previous free recall study led us to believe that there might be a difference in the preferred organizational strategies of individuals interested in science and students interested in the humanities. To explore this potentially intriguing difference we included this preference as a factor in our analyses. The recall and organization data for the three trials on the unrelated and categorized lists were subjected to a 2 (instructions or not) X 2 (science or humanities preference) X 3 (trials) (2 trials for the intertrial repetition data) X 2 (preference) analyses.

Recall: For the immediate recall of the unrelated lists, only the effect of trials was significant, recall increased significantly over trials, $F(2,204) = 309.57$, $p < .01$. On the delayed recall test, no differences between conditions were found. Table 3 presents both sets of means.

For the categorized list, learners instructed about the organization recalled significantly more than learners not so instructed, $F(1,102) = 5.30$, $p < .05$. Recall also increased over trials, $F(2,204) = 352.65$, $p < .01$. On the delayed recall test, instructed subjects again appeared to recall more than non-instructed subjects, but the difference only approached significance, $F(1,102) = 3.71$, $p < .062$. Table 3 contains the means.

Organization: For the unrelated list the Bousfield and Bousfield (8) measure of intertrial repetition was used as the measure of recall organization. There were no significant effects between conditions. The means are presented in Table 4.

For the categorized list, the Z-score measure of category clustering (14) was used to index organization. Instructed subjects organized significantly more than did subjects not instructed, $F(1,102) = 63.96$, $p < .01$. Organization also increased significantly over trials, $F(2,204) = 73.75$, $p < .01$.

These results for the categorized list basically replicate previous results with respect to instructions, instructed subjects organized and recall more (10). This is important for the present study, since a failure to replicate previous results would raise questions about the validity of using the present data to explore correlational relationships between organization, recall and individual differences. These relationships are the major concern of this study. Such replication suggests that we can have some confidence that the present results reflect processes generally occurring in free recall studies of this type.

Correlations.

Unrelated list. Table 5 presents the correlations between the index of intertrial repetition and immediate and delayed recall for the unrelated list. In general the correlations between immediate and delayed recall are considerably stronger than between organization and recall. This suggests that intertrial repetition only partially taps the cognitive processes influencing recall. Most interesting in Table 5 is the fact that organization indices appear to be better predictors of delayed recall for individuals interested in science than for individuals interested in humanities. In fact the correlations are significant only for the individuals interested in science.

Table 6 presents the correlations between clustering indices, immediate recall, and delayed recall for the categorized list. As predicted the rs between organization and recall were higher for the instructed than for the non-instructed conditions. Most interesting was the fact that for the instructed groups, organization was a better predictor of delayed recall than was performance on the third recall trial. For the non-instructed groups, the reverse was true. These two facts suggest that instructions to organize did in fact lead subjects to encode using an organizational strategy. Such a finding supports the retrieval strategy hypothesis of the effect of organization. Under this hypothesis subjects can employ a variety of encoding strategies for learning and recalling a list of words. Organization indices only reflect the use of an organizational strategy, not the effects of the other strategies. By instructing subjects to use a particular strategy the relationship between organization indices and recall is increased. In line with this interpretation, we would expect that the number of strategies reported by subjects in the instructed condition would be fewer than those reported by subjects in the non-instructed condition. This in fact was the case, $t\ (102) = 20.8$, $p < .01$, instructed = 1.30, non-instructed = 1.78: but the significance test should be interpreted cautiously since as would also be expected the variance was greater in the non-instructed (.96) than in the instructed (.25) condition.

Also interesting was the fact that the correlations between category organization and recall were higher for the individuals who prefered humanities than for the

individuals who preferred sciences. As noted above the reverse was true for the unrelated list. This apparent discrepancy can be explained by differences in the two types of organization measures. The ITR measure used for the unrelated list measures consistency in the serial orders of recall, the z-index measures the degree to which recall conforms to experimenter determined taxonomic categories. The intertrial repetition measure will be large if subjects adopt a serial recall strategy, the z-index will be large if subjects use clustering as a strategy. It may be that individuals who prefer science are more likely to adopt a serial recall strategy while individuals who prefer humanities "naturally" adopt a clustering strategy. In other words the different subject matter areas may attract individuals who typically employ different cognitive processes in learning and remembering. Gordon Pask has also suggested this possibility (26). In this regard it should be noted that the correlations between intertrial repetition and the z-index were minor and non-significant. This suggests that subjective organization and clustering require different cognitive processes on the part of the subjects (27).

Tables 7, 8, 9, 10, 11 present the significant ($p < .05$) correlations among the individual differences and free recall variables for each condition and, combined over conditions.

These correlations raise questions about the results suggested by previous investigators: Bartel et al (5) had found that internality-externality was related to category organization, this did not seem to be the case in the present study, the only significant correlation was obtained in the instructed-humanities groups with a correlation between internality-externality and category organization on the third trial. Sex was correlated with recall in the correlations combined over groups, but did not seem to be consistently related to recall across groups, the rs were signfficant only for the non-instructed science group. For the overall correlations, the number of strategies reported for the unrelated and categorized list correlated positively with category organization, a fact suggesting that subjects who report more strategies cluster less. Such a finding would be consistent with the arguments about degree of clustering and consistency of subjects' recall strategies presented above. However, the correlation should be interpreted with caution since the category organization number of strategies correlations are non-significant when examined group by group. The overall correlation may merely reflect the decrease in the number of strategies reported by the subjects given instructions about organization. Verbal ability was related to recall but not to organization in the overall correlations, this would suggest that high verbal subjects employ non-organization based retrieval processes, however again the correlations are not consistent when examined group by group and therefore must be interpreted cautiously.

In most educational learning situations we are interested in promoting delayed retention of learned material. From this perspective it is possible to conceptualize the present data in a predictive mold, that of predicting delayed recall scores from organization and individual difference data. To examine the ability to predict delayed recall in each group, multiple-regressions were computed with each group. Because of the small number of subjects in the instructed humanities group it is not possible to include all the variables in the regression for that group. Only the most promising variables were selected. Table 12 presents the multiple R^2s and the standard beta weights. Perhaps the most impressive aspect of these analyses are the high multiple R^2s obtained. This suggests that in a relatively controlled learning task it is possible to obtain control of a substantial portion of variance. However, attenuation of the R^2s due to the small sample size must be considered. In addition there appeared a slight tendency for more variables to be significantly related to delayed recall of the category list for the science oriented people than for the hymanities oriented people. The reverse appeared true for the unrelated list. Obviously a similar pattern

was noted for the correlations with delayed recall of the category list and unrelated lists. While at best only a tendency, these results suggest the possibility that science-oriented and humanities-oriented individuals approach the subjective organization and category clustering free recall tasks differently. This possibility was noted above in the examination of the correlations of delayed recall and organization and was also reflected in some informal interviews of subjects in a previous study (21). Pask and Scott have reported similar results (26). The possibility of differences in the cognitive processes of individuals in different majores is intriguing enough to justify future research in this area.

REFERENCES

1. Andre, T. Clustering in the free recall of sentences, Psychological Reports, 1973, 32, 971-974.
2. Andre, T. The Priority in Recall of New Items Effect: A Strategy model, Journal of General Psychology, 1975, in press.
3. Andre, T., Anderson, R. C., & Watts, G. H. Organizational strategy and retroactive inhibition in free recall, American Journal of Psychology, 1975, in press.
4. Andre, T., Anderson, R. C. & Watts, G. H. Item-specific interference and list discrimination in free recall, Journal of General Psychology, 1976, in press.
5. Bartel, H., Ducette, J., & Wolk, S. Category clustering in free recall and locus of control. Journal of General Psychology, 1972, 87, 251-257.
6. Battig, W. F., & Mantague, W. B. Category norms for verbal items in 56 categories: A replication and extension of the Connecticut Category Norms. Journal of Experimental Psychology, 1969, 80 (3, Pt.2).
7. Battig, W. F., Allen, M., & Jensen, A. R. Priority of free recall of newly learned items, Journal of Verbal Learning and Verbal Behavior, 1965, 4, 175-179.
8. Bousfield, A. K., & Bousfield, W. A. Measurement of clustering and of sequential constancies in repeated free recall. Psychological Reports, 1966, 19, 935-942.
9. Bousfield, W. A. The occurrence of clustering in the recall of randomly arranged associates. Journal of General Psychology, 1953, 49, 229-240.
10. Bower, G. H., Clark, M. C., Lesgold, A. M., & Winzenz, D. Heirarchical retrieval schemes in recall of categorized word lists, Journal of Verbal Learning and Verbal Behavior, 1969, 8, 323-343.
11. Cole, M., Frankel, F., & Sharp, D. Development of free recall learning in children. Developmental Psychology, 1971, 4, 109-123.
12. Earhart, M. The facilitation of memorization by alphabetic instructions, Canadian Journal of Psychology, 1967, 21, 15-24.
13. Estes, W. K., Learning theory and intelligence. American Psychologist, 1974, 29, 740-749.
14. Frankel, F., & Cole, M. Measures of category clustering in free recall. Psychological Bulletin, 1971, 76, 39-44.
15. French, J., Ekstrom, R. B., & Price, L. A. Kit of Reference Tests for Cognitive Factors. Princeton, New Jersey: Educational Testing Service, 1963.
16. Getzels, J. W., & Jackson, P. W. Creativity and Intelligence. New York: John Wiley & Sons, 1962.
17. Glanzer, M. & Cunitz, A. Two storage mechanisms in free recall, Journal of Verbal Learning and Verbal Behavior, 1966, 5, 351-360.
18. Gorfein, D. S., & Blair, C. Factors affecting multiple trial free recall. Journal of Educational Psychology, 1971, 62, 17-24.
19. Gorfein, D. S., Blair, C., & Rowland, C. The generality of free recall: 1. Subjective organization as an ability factor. Psychonomic Science, 1968, 11, 279-280.
20. Gorfein, D. S., Blair, C., & O'Neill, C. R. A reanalysis of "The generality of free recall: 1. Subjective organization as an ability factor." Psychonomic Science, 1969, 17, 110.

21. Hopkins, W. M. & Andre, T. Extrinsic and intrinsic cuing in free recall paper presented at Annual Meeting, Chicago, 1974. American Educational Research Association.
22. Hultsch, D. F. Adult age differences in free classification and free recall. Developmental Psychology, 1971, 4, 338-342.
23. Jensen, A. Social class, race and genetics, implications for education. American Educational Research Journal, 1968, 5, 1-42.
24. Miller, G. A. The magical number seven, plus or minus two: Some limits on our capacity for processing information. Psychological Review. 1956, 63, 81-97.
25. Paivio, A., Muille, J. C. & Rogers, T. B. Noun imagery and meaningfulness in free and serial recall, Journal of Experimental Psychology, 1969, 79, 509-514.
26. Pask, G., & Scott, B. C. E. CASTE: A system for exhibiting learning strategies and regulating uncertainties. International Journal of Man-Machine Studies, 1973, 5, 17-52.
27. Postman, L. A. pragmatic view of organization. In E. Tulving & W. Donaldson (Eds.), Organization of Memory. New York: Academic Press, Inc., 1972.
28. Rotter, J. B. Generalized expectancies for internal versus external locus of control of reinforcement. Psychological Monographs, 1966, 80 (1, Whole No. 609).
29. Shapiro, S. I., & Bell, J. A. Subjective organization and free recall: Performance of high, moderate, and low organizers. Psychonomic Science, 1970, 21, 71-72.
30. Stanfield, R. E., & Schumer, H. Changing role concepts of college students. University of Massachusetts: Final Report, Project No. 5-0902, Contr. No. OE6-10-014, August, 1967.
31. Tulving, E. Subjective organization in free recall of "unrelated words." Psychological Review, 1962, 69, 344-354.
32. Tulving, E. Intratrial and Intertrial retention: Notes toward a theory of free-recall verbal learning. Psychological Review, 1964, 71, 219-237.
33. Tulving, E. Theoretical issues in free recall. In T. R. Dixon and D. L. Horton (Eds.), Verbal Behavior and General Behavior Theory. Englewood Cliffs, New Jersey: Prentice-Hall, 1968.
34. Tulving, E. & Donaldson, W. Organization of Memory. New York: Academic Press, Inc. 1972.
35. Tulving, E., & Madigan, S. A. Memory and verbal learning. Annual Review of Psychology, 1970, 21, 437-484.
36. Weiner, A. Development of free recall in reflective and impulsive children. State University of New York at Cortland, unpublished paper, 1974.

Table 1

Organizational Ability Task

Below there are eight categories of words, with seven items in each category. Four of the items in each category "go together," have something in common, and form a sub-category. Place a mark next to each of the four words that make up this sub-category. You may erase or cross-out if you change your mind about a choice. There is nothing tricky about this.

VERY IMPORTANT--Every five seconds, the number of seconds that have elapsed will be written on the board. Put the appropriate numbers, when you begin and end, in the space provided.

COUNTRIES	VESSELS	COLORS	FURNITURE
___France	___raft	___blue	___sofa
___Russia	___destroyer	___orange	___table
___Italy	___submarine	___aqua	___divan
___Germany	___cruiser	___yellow	___davenport
___Nigeria	___sloop	___turquoise	___loveseat
___China	___yacht	___red	___bed
___Spain	___battleship	___green	___dresser

ANIMALS	WEAPONS	ALCOHOLIC BEVERAGES	PARTS OF THE BODY
___mule	___gun	___wine	___nose
___horse	___bomb	___beer	___neck
___camel	___cannon	___Scotch	___ears
___cow	___pistol	___bourbon	___legs
___sheep	___rifle	___gin	___tongue
___pig	___ax	___ale	___lips
___elephant	___shotgun	___rum	___chest

TIME FINISHED _____

Table 2. Role Orientation Scale

Students have different orientations or expectations about their college experiences. Different students expect to get different things out of college. Listed below are seven possible orientations a student may take to his college career. Please select the orienation that best characterizes you. Pick the orientation that best describes your belief and expectations of your college career. Please be frank and as honest as you can be. Place a check mark or a cross on the line before the description that best fits you.

_____My orientation is academic with respect to the humanities and the sciences. I have a deep concern for acquiring the knowledge, concepts, and principles from the courses I will take in college. I try very hard to learn as much as I can from the courses I take.

_____I am really not sure why I'm going to college. I have a lot of different goals in mind. I always expected to go to college, and my parents always expected me to go. Almost everyone in my social group goes on to college. My parents are important to me, and I work to have them be proud of me.

_____I think that the most important goal I have for myself at college is to develop myself socially. By this I mean that it is important to meet and learn about different kinds of people. A person should learn to get along with people in college. I think it is necessary to learn to relate to and help other people. I expect to involve myself in groups that will allow me to pursue these kinds of goals.

_____While learning is important in college, I think that this is not the whole story. A person should have fun in college. It is important to enjoy the social and collegiate life available in college. One should take pleasure in the experience of being in college, by making friends, having dates, going to parties or games and so on.

_____I think it's important to take part in the general intellectual life of the college, not necessarily within the formal course structure. I like to get together with people and discuss art and/or ideas that have real meaning. I don't like to follow the crowd, but like to think and feel things out on my own and through discussions with friends. I want to find my own path even if it is different from others.

_____One thing I want to get from college is to learn those skills and the knowledge that I will need to succeed in my chosen occupation. I want college to give me what I need to know that will be applicable to what I want to do. I really don't like courses that are irrelevant to my own goals. I want to get my degree so I'll be qualified for a good job.

_____I think it's important to take part in the extracurricular activities and groups in college. You can have a lot of fun and learn a lot working on and organizing some of the groups on campus. I certainly won't neglect my academic work, but I intend to work for the formal student organizations on campus. Maybe someday I can be an officer of one of these groups. Working for these groups and being a leader in one of them will give me a lot of experience that is fun and also will stand me in good stead in later life.

Table 3. Mean Words Recalled for the Unrelated and Categorizable Lists.

Unrelated List	N	Trial 1	Trial 2	Trial 3	Delayed Recall
Instructed-Science	30	8.1	11.1	14.1	10.3
Instructed-Humanities	17	8.6	11.8	14.5	11.3
Non-Instructed-Science	37	8.0	11.4	14.2	10.2
Non-Instructed-Humanities	22	8.0	11.4	13.7	9.0
Related List					
Instructed-Science	30	9.6	14.2	16.5	16.1
Instructed-Humanities	17	9.6	14.5	17.8	16.9
Non-Instructed-Science	37	8.9	13.3	15.5	15.0
Non-Instructed-Humanities	22	9.1	12.8	16.1	15.0

Table 4. Mean ITR and Z Indices of Organization and Number of Strategies For the Unrelated and Categorizable Lists

Intertrial Repetition

Unrelated List	Trial 1-2	Trial 2-3	Number of Strategies
instructed-science	.921	.753	1.30
instructed-humanities	.290	.658	1.35
non-instructed-science	.654	1.229	2.02
non-instructed-humanities	.796	.936	1.54

Z-indices

Categorizable List	Trial 1	Trial 2	Trial 3	
instructed-science	3.88	5.41	6.55	1.26
instructed-humanities	3.39	5.77	6.78	1.35
non-instructed-science	1.83	2.96	4.38	2.02
non-instructed-humanities	1.75	2.69	3.76	1.72

Table 5. Intercorrelations of Intertrial Repetition, Recall on Trial 3 and Delayed Recall for the Unrelated List

	Trial 3 Recall	Delayed Recall
Instructed		
ITR	.246*	.144
Trial 3		.624*
Non-Instructed		
ITR	.304*	.44*
Trial 3		.547*
Science		
ITR	.320*	.421*
Trial 3		.628*
Humanities		
ITR	.163	.006
Trial 3		.513*

*$r < 0$, $p < .05$

Table 6. Intercorrelations of Z-indices, Recall on Trial 3, and Delayed Recall for the Categorized List

	Trial 3 Recall	Delayed Recall
Instructed		
Z	.576	.522
Trial 3 Recall		.451
Non-Instructed		
Z	.511	.417
Trial 3 Recall		.641
Science		
Z	.484	.416
Trial 3 Recall		.404
Humanities		
Z	.671	.548
Trial 3 Recall		.816

Table 7. Significant Intercorrelations of Individual Differences, Organization and Recall Variables for the Instructed-Science Group

GROUP II SCIENCE INSTRUCTED (N = 30)

	USES	IE	SEX	CITSZ	BIRORD	AGE	VAT	CATEGT	CATTIM	NMSTR1	NMSTR2	ROLE	Z1	Z2	Z3	ITR 1	ITR 2	TOTL1	DELL1	DELL2	TOTL2
USES	1								-41												
IE		1						39		39											
SEX			1							42								40	38		
CITSZ				1																	
BIRORD					1														41		
AGE						1			-44		45										
VAT							1							-46		41		37	55	47	38
CATEGT								1							-46						
CATTIM									1												
NMSTR1										1	42						36				
NMSTR2											1										
ROLE												1	37								
Z1													1								
Z2														1		-46		-43			-57
Z3															1					-41	-59
ITR 1																1	39				
ITR 2																	1	43			
TOTL1																		1	68	65	59
DELL1																			1	69	41
DELL2																				1	76
TOTL2																					1

$p < .05$

See next page for coding (decimals omitted to save space).

Table 7 (continued)

CODE

USES - Uses for things test.

IE - Rotter internality-externality score

SEX - 1 = male, 2 = female

CITSZ - City Size: 2 = large city, 7 = rural area

BIRORD - Birth Order; 1 = eldest, 3 = youngest

AGE - chronological age in years

VAT - Wide Range Vocabulary Test Score

CATEGT - Number correct on organizational ability task

CATTIM - Time taken to complete organizational ability task

NMSTR1 - Number of strategies reported on the unrelated list

NMSTR2 - Number of strategies reported on the categorizable list

ROLE - Score on the Role Orientation scale

Z1, 2, 3 - Z-indices for Trial 1, 2, 3 on the categorizable list

ITR 1, 2 - Intertrial indices for Trials 1-2, and 2-3 for the unrelated list

TOTL1 - Total items recall for the three trials of the unrelated list

DELL1 - Delayed recall of the unrelated list

DELL2 - Delayed recall of the categorized list

TOTL2 - Total items recall for the three trials of the categorized list.

Table 8. Significant Intercorrelations of Individual Differences, Organization, and Recall Variables for Instructed-Humanities Group.

GROUP 12 INSTRUCTED HUMANITIES (N = 17)

	USES	IE	SEX	CITSZ	BIRORD	AGE	VAT	CATEGT	CATTIM	NMSTR1	NMSTR2	ROLE	Z1	Z2	Z3	ITR 1	ITR 2	TOTL1	DELL1	DELL2	TOTL2
USES	1		51																		61
IE		1					66				-58	-58			56	58					
SEX			1																		
CITSZ				1																	
BIRORD					1																
AGE						1															
VAT							1				-48					-43					
CATEGT								1	50					-58	-81					65	
CATTIM									1	-49											
NMSTR1										1											
NMSTR2											1										
ROLE												1			-55						
Z1													1				-51				
Z2														1	63					-51	-49
Z3															1					-54	-66
ITR 1																1			58		
ITR 2																	1				
TOTL1																		1	91	76	57
DELL1																			1	78	53
DELL2																				1	75
TOTL2																					1

$p < .05$

See Table 7 for Coding (decimals omitted to save space).

Table 9. Significant Intercorrelations of Individual Differences, Organization, and Recall Variables for the Non-Instructed-Science Group.

GROUP 21 NON-INSTRUCTED SCIENCE (N = 37)

	USES	IE	SEX	CITSZ	BIRORD	AGE	VAT	CATEGT	CATTIM	NMSTR1	NMSTR2	ROLE	Z1	Z2	Z3	ITR 1	ITR 2	TOTL1	DELL1	DELL2	TOTL2
USES	1						34													32	37
IE		1							39												
SEX			1												-48			37	36	45	48
CITSZ				1																	
BIRORD					1											-36					
AGE						1															
VAT							1														
CATEGT								1			-37										
CATTIM									1												
NMSTR1										1	69										
NMSTR2											1								-35		
ROLE												1				38		37			33
Z1													1	32							
Z2														1	55						-36
Z3															1		-38			-40	-38
ITR 1																1		37		40	
ITR 2																	1	37	53		34
TOTL1																		1	60	59	73
DELL1																			1	47	39
DELL2																				1	75
TOTL2																					1

$p < .05$

See Table 7 for coding (decimals omitted to save space).

Table 10. Significant Intercorrelations of Individual Differences, Organization, and Recall Variables for the Non-Instructed Humanities.

GROUP 22 NON-INSTRUCTED HUMANITIES (N = 22)

	USES	IE	SEX	CITSZ	BIRORD	AGE	VAT	CATEGT	CATTIM	NMSTR1	NMSTR2	ROLE	Z1	Z2	Z3	ITR 1	ITR 2	TOTL1	DELL1	DELL2	TOTL2
USES	1	49																			
IE		1																			
SEX			1						-45												
CITSZ				1																	
BIRORD					1																
AGE						1							65								
VAT							1														
CATEGT								1								-55					
CATTIM									1							-43					
NMSTR1										1	86										
NMSTR2											1										
ROLE												1	-42								
Z1													1	50							
Z2														1	78						-57
Z3															1					-48	-53
ITR 1																1					
ITR 2																	1				
TOTL1																		1	68		
DELL1																			1		
DELL2																				1	66
TOTL2																					1

$p < .05$

See Table 7 for coding (decimals omitted to save space).

Table 11. Significant Intercorrelations of Individual Difference, Organization and Recall Variables for all groups combined.

	USES	IE	SEX	CITSZ	BIRORD	AGE	VAT	CATEGT	CATTIM	NMSTR1	NMSTR2	ROLE	Z1	Z2	Z3	ITR 1	ITR 2	TOTL1	DELL1	DELL2	TOTL2
USES	1								-20												
IE		1							-21												
SEX			1															34	32	27	25
CITSZ				1				26		20											
BIRORD					1																
AGE						1															
VAT							1											20	31		24
CATEGT								1							-26						
CATTIM									1												
NMSTR1										1	72		27	24							
NMSTR2											1		27	32	31						
ROLE												1								20	
Z1													1	51	42						-20
Z2														1	69			-22	-23	-35	-50
Z3															1			-20	-21	-46	-49
ITR 1																1		29		19	
ITR 2																	1	31	28		
TOTL1																		1	68	52	58
DELL1																			1	55	42
DELL2																				1	74
TOTL2																					1

$P < .05$

See Table 7 for Coding (decimals omitted to save space).

Table 12. Standard Beta Weights and Multiple R^2s for the Regression Analyses

Variable	Instructed Science		Instructed Humanities		Noninstructed Science		NonInstructed Humanities	
	DELL1	DELL2	DELL1	DELL2	DELL1	DELL2	DELL1	DELL2
Z3	-.16	-.71	-.87	.13	.39	-.46	.52	-1.08
Z2	.24	.25	-.07	-.55	-.27	.16	-.58	.50
Z1	.55	.25	.70	.38	.29	.03	-.84	.14
ITR 1	-.44	.32	.47	-.21	.30	.23	.01	.12
ITR 2	.39	-.31	.18	.42	.68	.34	.46	-.93
CATEGT	.09	-.28	-.36	-.52	-.01	-.18	.18	.37
CATTIH	-.09	-.10	-.22	.66	.05	.21	.61	.16
NHSTR1	.03	.10	-.37	.27	-.37	-.28	.21	-.23
NHSTR2	-.23	-.33	.18	-.21	-.13	.10	-.10	-.40
VAT	.73	.77	-.06	.24	.05	-.01	1.01	-.34
USES	.13	-.23	.28	.81	.04	.25	.02	.44
IE	-.20	.04	.13	-.69	.06	.16	.05	-.51
SEX	.39	.10	.07	-.14	.43	.28	.60	-.11
CITSZ	-.31	-.39			.13	.14	.53	.06
AGE	-.02	.15			.13	.20	.40	.31
ROLE	.12	.00			-.45	.15	-.43	.50
BIRORD	.17	.07			.20	.07	.20	.57
R^2	.81	.70	.90	.77	.80	.67	.77	.87