Subjective organization and free recall: Performance of high, moderate, and low organizers*

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Carterette & Coleman (1963) report that, at least for high organizers, subjective organization appears to *follow* recall. Since such a relationship seriously brings into question the hypothesis that memory is largely dependent upon subjective organization, a replication and extension of Carterette and Coleman's experiment was undertaken. When Ss were divided into high, moderate, and low organizers, superior recall performance was clearly associated with greater organization. However, increases in organization for the low and moderate organizers were minimal, despite marked improvements in recall. Thus, the general problem raised by Carterette and Coleman about the adequacy of the organizational hypothesis to account for the free recall of lists of unrelated words was upheld.

Consistently high positive correlations between free recall and subjective organization have been an important theoretical cornerstone in the increasing volume of literature linking memory with organizational processes (e.g., Tulving, 1968). Thus, it has been frequently suggested that in learning "unrelated" lists of words, it is S's utilization of subjective organization that permits items to be added to his recall as trials increase, ultimately resulting in mastery of the list (e.g., Tulving, 1968). However, Carterette & Coleman (1963) have reported some correlational evidence that at least for Ss who are high organizers, most of their recall is accomplished before subjective organization appreciably begins. Although little attention has been focused on Carterette and Coleman's report, their results seriously bring into question the adequacy of the organizational hypothesis. The present experiment was conducted essentially as a replication of Carterette and Coleman's experiment because of the importance of their conclusions and the possibility of certain limitations in the original study. Thus, in the present study, (1) a larger number of Ss were tested; (2) a longer list and fewer trials were employed to reduce ceiling effects; (3) the Ss were divided into moderate organizers, as well as high and low organizers; and (4) instead of Tulving's (1962) unidirectional measure of subjective organization, a more sensitive bidirectional measure of organization was calculated.

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METHOD

The Ss were 51 native English-speaking volunteers from introductory psychology classes at the University of Hawaii (32 females and 19 males), who received extra course credit for their participation. The Ss were run in small groups of two to five individuals. No S had served in any prior free-recall experiment, and only a few had served in any verbal-learning experiment.

A list was composed of 20 words that were minimally associatively related to one another in terms of free-association norms. Of the 380 possible interitem associations among the words, there were only 2, and these were minor (1.6% and 0.2%). The words, followed by their normative (Kučera & Francis, 1967) word frequencies per million words, were: Eagle (5), Leaf (12), Earth (150), Plain (48), Holes (39), Table (198), Hold (169), Health (105), Complex (91), Brain (45), Variety (85), Trouble (134), Math (4), Things (34), Engineer (42), Fountain (18), Street (244), Ink (7), Corner (115), Dream (64). Twelve randomized orders of the 20 words were prepared such that no word appeared more than once in the same serial position and no word was succeeded or followed by another word more than once. The 12 orders were employed for 12 trials, consisting of alternating presentation-recall periods. An approximately equal number of Ss were started randomly in three different orders in the series of 12 orders. The words were presented on slides by means of a slide projector and an associated timing device for 1 sec each, with a 1-sec interval between exposures (when the slide changed). Recall was written, and each of the 12 recall periods was 80 sec. The Ss were given free-recall

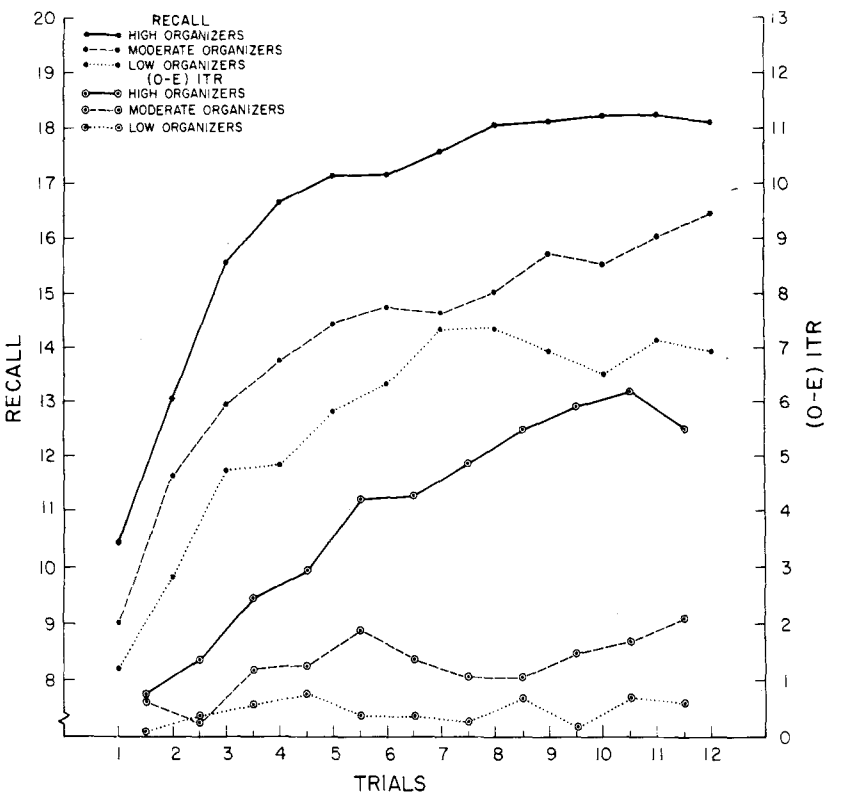

Fig. 1. Mean recall (left ordinate) and (O – E)ITR scores (right ordinate). (Note: (O – E)ITR scores are based on successive trial pairs and are plotted at the midpoints between trials.)

Table 1
Correlations Between Recall and (O-E) ITR Scores for Early, Middle, and Late Trials for Low, Moderate, and High Organizers

	Trials 1-4	Trials 5-8	Trials 9-12	All Trials
Low Organizers (N = 17)	+0.07	+0.58*	+0.16	+0.47
Moderate Organizers (N = 17)	+0.25	+0.32	+0.38	+0.32
High Organizers (N = 17)	+0.51*	+0.65**	+0.72**	+0.70**
All Ss (N = 51)	+0.47**	+0.71**	+0.73**	+0.72**

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

instructions, which stressed that only the number of words recalled was important and not the order of their recall.

RESULTS AND DISCUSSION

Intrusions and duplicate responses were omitted in calculating all measures. Figure 1 summarizes the recall and subjective organization scores for high, moderate, and low organizers. Recall is plotted relative to the left ordinate and subjective organization is plotted relative to the right ordinate. The measure of subjective organization employed was bidirectional observed minus expected intertrial repetitions, (O – E)ITRs (Gorfein, Blair, & Rowland, 1968), which was calculated for successive trial pairs. The (O – E)ITR data are plotted, therefore, at the midpoints between trials in Fig. 1. The division into high, moderate, and low groups of organizers is based on ranking all 51 Ss by their overall organization scores and regarding the 17 Ss with the highest scores as the high organizers, the 17 Ss with the lowest scores as the low organizers, and the remaining 17 Ss designated as moderate organizers. Figure 1 clearly indicates that recall is superior where more organization is evident. However, the amount of organization shows only a very progressive and substantial increase for the group of high organizers. The group of moderate organizers exhibits a rather modest increase in organization over trials, and the low organizers show little in the way of a systematic increase.

Table 1 presents Pearson product-moment correlations between recall and organization scores for each of the three groups over all trials and over blocks of four trials. To obtain the blocked-trial correlations, the (O – E)ITR scores for Trial Pairs 4-5 and 8-9 were not included. With one exception, significant correlations were obtained only for the group of high organizers, and these correlations appear to increase systematically from early to late trials. The one remaining significant correlation was for Trial Block 5-8 for the group of low organizers.

The pattern of correlations obtained is not a very good match to the pattern obtained by Carterette & Coleman (1963). Their results generally indicate that the correlations for blocks of trials are greater for low organizers than for high organizers. In fact, on the initial and terminal trial blocks the correlations were mildly negative for high organizers. Precisely these results contributed to Carterette and Coleman's conclusion that at least for some Ss recall appears to precede organization. The negative correlations for the last two trial blocks (Trials 9-12 and Trials 13-16) for Carterette and Coleman's high organizers may reflect some ceiling effects. The remaining discrepancies between the present study and that of Carterette and Coleman may reside in the small number of Ss (N = 8 per group) they employed. The stability of the correlations may also have suffered in being calculated for blocks of trials where fewer data points were involved. Further, it should be noted that Carterette and Coleman's Ss were generally superior in recall and organization to the Ss in Tulving's (1962) experiment, which Carterette and Coleman sought to replicate. Also, the correlations for all Ss across trials in Tulving's experiment for Trials 1-8 was +0.45, while the correlation for these trials in Carterette and Coleman's experiment was +0.86.

Despite some of the correlational differences between the present study and that of Carterette and Coleman, their general conclusion is well taken. That is, in some cases there appears to be a substantial amount of recall, although it is accompanied by relatively little organization. More specifically, the groups of moderate and low organizers eventually recall most of the list, but their organization scores are minimal and show little in the way of systematic increases. A similar observation is apparent from the performance curves presented by Carterette and Coleman. That is, even for their low organizers, there is a substantial amount of recall, in fact, not much less than that of the high organizers. Moreover, most of the organization, even for the low group, does not begin to develop appreciably until recall is rather high (i.e., approximately 14 out of 16 items recalled).[1]

A similar question can be raised about how recall can increase over trials when the lists are composed of items of low meaningfulness, despite little evidence of a correlated increase in subjective organization. Such results, for example, have been obtained in a second unpublished experiment by Carterette and Coleman, by Abramczyk & Bousfield (1969), and by Gorfein, Blair, & O'Neil (1969).

Another way to illustrate the problem is to note the rather common finding that the amount of subjective organization typically found in free-recall studies tends to be relatively low when one considers the amount of such organization theoretically possible and when the actual organization is contrasted with chance expectancies (e.g., Tulving, 1962). Such considerations, in conjunction with the results of the present experiment and Carterette and Coleman's, raise perplexing questions about the adequacy of the organizational hypothesis to account for the free recall of unrelated lists of words.

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NOTE

1. Note added in proof: Similar correlational discrepancies have been reported by M. W. Laurance (Age differences in performance and subjective organization in the free-recall learning of pictorial material. Canadian Journal of Psychology, 1966, 20, 388-399).

The relationship between self-reported pulse rates and exam scores

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Introductory psychology students took their own pulses during a normal lecture class and during four exams. There was no systematic relationship between absolute pulse rate and exam scores. However, consistently high correlations were found between pulse-rate change scores and test performance: The greater the increase in pulse rate, the lower the exam score.

Until recently the investigation of the relationship of pulse rate to performance on exams was limited to the following two approaches: (1) administering a test to individual Ss in a laboratory situation so that pulse rates could be continuously measured (e.g., Waite, 1942; Judson & Gelber, 1965) or (2) obtaining pulse rates immediately before and immediately after a real-life test situation (e.g., Talbert, 1944). Shortcomings inherent in both of the above methods are obvious.

Southard & Katahn (1967) have recently demonstrated that there is an extremely high correlation between self-reported and mechanically recorded pulse rates. Following from their suggestion, the current authors investigated self-reported pulse rate during normal class periods and during examination periods and related these data to test performance.

Table 1
Correlations Between Pulse Rate Increase over Resting Level and Performance on Introductory Psychology Tests

	Males (N = 99)		
	Start	Mid	End
EXAM 1	+.022	−.143	.095
EXAM 2	−.511*	−.529*	−.341*
EXAM 3	−.598*	−.559*	.508*
EXAM 4	-.508*	−.446*	−.387*
	Females (N = 80)		
	Start	Mid	End
EXAM 1	-.116	−.075	+.005
EXAM 2	.393*	- .143	-.350*
EXAM 3	-.464*	.217*	-.538*
EXAM 4	−.198	.153	-.237*

*$p < .05$

METHOD

The 179 Ss (99 males and 80 females) were students in the first author's introductory psychology class.

During a lecture on the autonomic nervous system, Ss were taught to take their own pulses from the radial artery. At the following lecture, with no prior notice, a form was passed out on which each S was to indicate his pulse at the beginning, middle, and end of the period. The E initiated the measurement sequence 5, 30, and 55 min after the start of class by saying, "Find your pulse—ready—go"; after 15 sec E would say "stop," and Ss would record their pulse rates. The same data collection procedure was followed during the four exams given in the course.

The test-performance measure used was number of questions correct on 50-item multiple-choice exams. The class distribution for all four tests was approximately normal.

RESULTS

Basically, correlations were run separately for males and females and separately for the beginning, middle, and end of each of four exam periods, between pulse rate and test performance.

The first of the two stages of the data analysis failed to reveal any significant correlations. That is, no systematic relationship was found between Ss' *absolute* pulse rate and their test scores for any of the exams.

The second stage of the analysis involved an investigation of the relationship of *relative* pulse rate to test scores. The pulse measure used was pulse rate during an exam minus pulse rate for the same part of the period, i.e., beginning, middle, or end, taken during the normal lecture class. Table 1 summarizes the results. The overall finding was that for both males and females, for Exams 2, 3, and 4, the greater the increase in pulse rate over the self-report obtained during the basal day, the poorer the test performance. This relationship was found to be stronger for the males (nine out of nine correlations were significant) than for the females (six out of nine were significant). One additional finding was that neither males nor females showed any systematic relationship between their relative pulse rate and their test scores on Exam 1.

DISCUSSION

This study is thought to be of interest both because of the specific relationship reported here and because of the demonstration that pulse rate, a commonly used measure of anxiety, can be studied in real-life group situations with no equipment.

The interpretation of the significant negative correlation between increase in pulse rate and test scores is beyond the scope of this preliminary study. One possible explanation is that Ss who were unprepared for the exams looked at the exam, became anxious in anticipation of failing, and therefore displayed a large increase in pulse rate. A second possible explanation is that test anxiety, as manifested in a large increase in pulse rate, interferred with maximal test performance. The fact that this relationship did not appear until the second exam suggests that the latter explanation may better account for this correlational finding.

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