JOURNAL OF VERBAL LEARNING AND VERBAL BEHAVIOR 20, 497–514 (1981)

Relational and Item-Specific Information in Memory

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This paper develops the argument that many factors affecting retention can be understood in the context of a distinction between relational and individual-item processing. Relational processing refers to the encoding of similarities among a class of events and individual-item processing refers to encoding of item-specific information. Both forms of information are assumed to be important in retention, and the empirical argument for the distinction rests in part upon the reported demonstration of superior recall when both types of information are encoded. The experiments also demonstrate that variables influencing the type of processing, such as orienting instructions and the type of material, produce differential effects upon certain dependent measures. Thus, the data indicate facilitation of recall from the combination of relational and item-specific information, and further suggest the viability of a distinction between them because of differential effects of the two forms of processing upon recognition, clustering, and the relative recall of typical and atypical category instances.

In our contemporary era of frameworks for memory research, two dominant ideas have emerged concerning the effects of psychological representation upon memory. On one hand, optimal memory performance is assumed to result from a memory trace containing general information common to a number of discrete events. The important input or encoding processes, according to this view, involve the abstraction of *relational* information shared by the elements or events present at input. The representation established by such encoding processes is assumed to be highly integrated and organized around the common features shared by the separate events. Thus, the description of the memory trace provided by the organizational approach emphasizes the importance of encoding relational information, information common to the input elements or events (e.g., Puff, 1979; Tulving & Donaldson, 1972).

An alternative which appears antithetical to the relational view emphasizes the importance of highly specific information representing each of the separate input events. The initial formulation of levels of processing (Craik & Lockhart, 1972) suggested that retention hinged upon the absolute amount of semantic information extracted from each separate event. Almost immediately, however, the levels-of-processing framework was modified by the addition of a concept of elaboration (Craik & Tulving, 1975). Elaboration is a process of relating semantic information from the target event to other aspects of the individual's knowledge. Although elaboration appears very similar to the concept of organization, elaborative processing presumably func-

This research was supported in part by a grant from the Graduate Council of the University of North Carolina at Greensboro. The comments of Frank Bellezza and Jan Rabinowitz on an earlier manuscript have substantially improved the quality of this paper. Appreciation is expressed to the following individuals for assistance in this research: Margarita Azmitia; Mark Elliott, Cathy Jasperse; Melanie Spence; Shellie Stallings; Michael Yount. We also thank Lib Nanney for her assistance with the materials and manuscript preparation. Reprint requests should be addressed to: R. Reed Hunt, Department of Psychology, University of North Carolina at Greensboro, Greensboro, N.C. 27412.

0022-5371/81/050497-18$02.00/0

tions to increase the distinctiveness of the memory trace, not to extract elements common to other input events (Lockhart, Craik, & Jacoby, 1976). Indeed, distinctiveness has become the dominant description of the memory trace within the levels-of-processing approach (Cermak & Craik, 1979). Distinctiveness is defined in a relative fashion, very much in accord with Tversky's (1977) theoretical description of similarity, where distinctiveness is an inverse function of the number of features in a trace shared by other to-be-remembered events. By converging on distinctiveness as a description of the memory representation, the levels-of-processing approach emphasizes the encoding of item-specific information. This position contrasts sharply with the relational emphasis of organizational theory.

The issue to be addressed in the present paper concerns the relative utility of these two perspectives. Is the most effective representation one embodying relational information shared by a number of events, or is retention better served by highly specific information denoting a single event? Can levels of processing be subsumed by the organizational approach? Alternatively, can organization simply be considered a variant of semantic processing? We shall argue that neither the organization nor levels-of-processing approaches should be reduced to the other; rather, a complete understanding of representational systems requires an integration of the two ideas.

Our proposal rests on assumptions concerning the type of information extracted at input and the subsequent use of this information in retrieval. At input, attention to features shared by all events in an episode produces a qualitatively different trace than does attention to features that are unique to each separate event. Moreover, we assume that these two types of information serve different functions in retrieval, an assumption consistent with positions within the organizational and levels-of-processing framework. Organizational theorists have assumed that relational information facilitates retrieval by allowing an effective search strategy (Bower, 1970; Tulving & Pearlstone, 1966). Item-specific information, as described by the distinctiveness hypothesis (Hunt & Elliott, 1980; Lockhart et al., 1976; Nelson, 1979) has been assumed important in delineating items in retrieval. Thus, item-specific information is assigned a discriminative function while the function of relational information is more nearly generative. In this vein, both relational and individual-item information would be useful for optimal memory.

Although plausible, these arguments are not entirely persuasive. First, the effects of organizational and individual-item tasks need not be assumed to differ. For example, detection of organizational structure must entail some semantic processing of individual items (Bellezza, Cheesman, & Reddy, 1977). Thus, depth of processing might be viewed as a necessary component of organizational processing. Alternatively, deep processing implies elaboration of semantic information. If a group of items are similar on some semantic dimension, activation of the semantic information representing each item would result in shared encodings among the items. On this view, organization would be a by-product of deep processing. On any of these considerations, the proposed distinction would be unnecessary. Given the indecisive nature of the logical arguments, empirical information becomes useful in considering the integration of these two ideas.

Two steps are necessary in an empirical argument for the distinction between relational and item-specific information. First, the combined effect of organizational and individual-item processing should exceed the performance produced by either task alone. This result alone, however, would not be conclusive because the two processes may simply result in more of the same type of information produced in a single process condition. In addition to demonstrating the effectiveness of the combined processes, an argument for a distinction between relational and item-specific information must also include demonstration of differential effects of the two types of processing. That is, variables such as the nature of the materials, context, and orienting tasks that influence the type of information activated at input should produce predictable differences on certain aspects of performance. Although few data are available from situations which bear directly on this issue, the results of several recent studies are consistent with distinctions between relational and item-specific information.

Both Begg (1978) and Epstein, Phillips, and Johnson (1975) have shown that conceptually related word pairs are better remembered if an orienting task directs attention to differences rather than similarities between the words. Word pairs whose conceptual relationship is not obvious are better remembered if the orienting task draws attention to similarities between the items. One interpretation of these results is that highly related pairs induce encoding of the relational information, and further orientation to similarity is superfluous. An orienting task focusing upon the differences between the related words, however, produces item-specific information which, in conjunction with the relational information, facilitates recall. Unrelated word pairs encourage the processing of item-specific information and an orienting task focusing upon the similarities between the unrelated items produces useful relational information.

Bellezza et al. (1977) have clearly demonstrated that instructions to organize words produced better recall than a semantic individual-item task. Although Bellezza et al. explicitly argue that both individual-item and relational information are important, in no case did individual-item processing result in recall equivalent to organizational processing, suggesting perhaps that organization is preeminent. A potentially critical aspect of their experiment, however, was that the target words were unrelated. If encoding is directed in part by the relationship among the target events, individual item-processing of unrelated lists might be superfluous while relational processing is very important.

Einstein and Hunt (1980) have obtained data consistent with this hypothesis by requiring that conceptually categorized lists be processed through either a category sorting task, a pleasantness-rating task, or both. Performance was highest when both tasks were required, and recall following a single task did not differ between the two tasks. Thus, the item-specific task becomes important when the relational information is more obvious, as in a categorized list. Einstein and Hunt provide additional evidence for this position by showing higher recall of a conceptually categorized list following a pleasantness-rating task than a categorization task. For an ostensibly unrelated list, however, the categorization task produced better performance than the pleasantness-rating task.

Experiment 1

The purpose of the first experiment is to address an important issue related to the interpretation of Einstein and Hunt's (1980) data. In this earlier study, the superiority of the combined organizational and individual-item tasks was assumed to reflect the importance of both relational and individual-item information. Alternatively, the two tasks simply may have induced more processing than either task alone, thus allowing an interpretation based on quantitative considerations rather than one based on qualitatively different types of information. To directly address these alternative possibilities, repetition of the same orienting task was compared with two different orienting tasks. If the combined effect of categorization and pleasantness tasks is due simply to more processing, performance in the combined condition should not exceed that of a condition in which either task is performed twice. Moreover, both of these conditions should produce performance superior to that on either task alone. If, however, the categorization and pleasantness tasks produce functionally different types of information, the combined tasks should lead to higher recall than that on either task alone, regardless of the number of times the single task is performed.

In addition to orienting tasks, the relationship among list items was also varied to manipulate the perceptibility of the list structure. The lists were either conceptually categorized or less obviously related. The conceptually categorized list should lead to the encoding of relational information and additional relational processing through the categorization task should not be as beneficial as the addition of item-specific information from the pleasantness-rating task. With a less obviously related list the item-specific information should be readily encoded, and the categorization task will be more useful than the partially redundant pleasantness-rating task. In brief, the highly related list should benefit from individual-item processing and the less obviously related list should benefit from relational processing.

Following the recall test, a recognition test was administered. Based on the previously assumed two-process model of retrieval and the distinction between types of information, the effects of orienting tasks and list structure should differ between recognition and recall. Specifically, most two-process models assume that discriminative information is very important in recognition (e.g., Kintsch, 1970). Consequently, conditions favoring the encoding of individual-item information should produce highest recognition performance.

Method

Subjects. The 190 subjects were introductory psychology students fulfilling a course requirement. Eight of the 19 subjects in each condition were from Furman University and the others were from the University of North Carolina at Greensboro. Subjects were tested in groups of two to five.

Design and materials. All subjects were presented with one of two 36-item lists of nouns that differed in the saliency of their taxonomic structure. The words for the related list were selected from the Battig and Montague (1969) norms and included six items from each of six categories (animals, parts of the body, articles of clothing, musical instruments, insects, and fruits). The words were familiar and were frequent instances of their categories. The list of unrelated words also contained familiar nouns and was generated by the experimenters. The list did not have an obvious taxonomic structure but did contain six items from each of six broad categories (things that are green, liquids, things that make noise, things made of wood, things that fly, and things women wear). Prior use of this list indicated that subjects essentially perceived the words as unrelated.

The relational orienting task (CAT) required sorting of the items into taxonomic categories. The individual item orienting task (PR) required rating items for pleasantness. A third orienting task (CAT-PR) combined the relational and individual-item tasks. To control for the additional amount of processing in the group performing both relational and individual item-processing, two control conditions were added. Subjects in these groups repeated the same individual item (PR2) or relational (CAT2) task.

Procedure. An incidental learning situation was established by telling subjects that we were interested in their judgments of word attributes. All subjects were presented with a deck of 3×5 in. index cards, with one word typed in the center of each card. Subjects performing a single orienting task received a 36-card deck whereas subjects performing two orienting tasks were presented with 72 cards, in which each item was presented twice. The repeated items in the latter card decks were presented adjacently. One randomized presentation order was constructed for each list with the restrictions that an item from each category appears within each sixth of the list and that no two items from the same category were ever adjacent.

Subjects who performed the PR task rated each item for pleasantness on a 5-point scale. Subjects in the CAT processing conditions placed each item face down under its appropriate category label which was continuously available in this condition. Subjects in the CAT-PR condition first rated the item for pleasantness and then sorted the repeated item. Subjects in the CAT2 and PR2 conditions were asked to "think about the repeated item again" and to rate it or sort it independently of their prior decision. All subjects worked at their own rate.

Following the processing task, subjects read a short story for 1 minute and then received a 5-minute free recall test. A recognition test was administered 24 hours later to the eight subjects in each condition from Furman University. Separate recognition tests were constructed for the related and unrelated input list; both tests contained the 36 targets and 36 distractors which consisted of six frequent instances from each of the six input categories. Two test orders were used, each with an equal number of subjects. Recognition required an "old/new" response and a confidence rating for each item.

Results

The recall data were first analyzed for possible interactions with experimenter. Since no such interactions were found, these variables are ignored in presenting the results.

The recall data are presented in Table 1 as a function of orienting task and list structure. As shown in Table 1, related lists were better recalled than unrelated lists, $F(1,180) = 14.54$, $MS_e = 20.33$ (all effects reported as reliable reached at least the .05 level). Processing tasks also exerted a significant effect, $F(4,180) = 12.60$, $MS3 = 20.33$. More interesting, however, was the reliable interaction between orienting tasks and list structure, $F(4,180) = 66.03$, $MS_e = 20.33$. Newman–Keuls analysis indicated that the interaction was due in part to higher recall of unrelated lists following CAT and CAT2 processing than following PR and PR2 processing. Furthermore, related lists were better recalled following PR and PR2 processing than following CAT and CAT2 processing. As predicted, the effects of different types of processing depended upon the input materials.

A second prediction supported by the Newman–Keuls analysis was the superior recall of the CAT-PR processing condition. On both related and unrelated lists, the combined relational and individual-item tasks produced higher recall than any other condition. Moreover, repetition of a task did not facilitate recall. As can be seen in Table 1 and confirmed by the New-

TABLE 1

MEAN NUMBER OF ITEMS RECALLED AND MEAN CLUSTERING SCORES (IN PARENTHESES) AS A FUNCTION OF LIST STRUCTURE AND TYPE OF PROCESSING IN EXPERIMENT 1

	Type of processing				
List structure	CAT	CAT2	PR	PR2	CAT-PR
Related	15.0 (+.72)	15.0 (+.44)	17.3 (+.59)	17.8 (+.58)	22.5 (+.73)
Unrelated	16.8 (+.48)	15.6 (+.44)	11.9 (+.19)	11.6 (+.09)	19.2 (+.41)

man–Keuls analysis, performance following CAT2 orientation did not differ from that produced by CAT nor did performance following the PR2 task differ reliably from that of the PR task.

The clustering data also are presented in Table 1, and the analysis of these data provided further evidence for differences between individual item and relational processing. Our clustering measure was Roenker, Thompson, and Brown's (1971) adjusted ratio of clustering (ARC) score wherein 0 represents chance clustering and +1.00, perfect clustering. Subjects tended to cluster their output more when the list structure was salient, F (1,180) = 42.33, $MS3$ = .09; clustering was also affected by type of processing, F (4,180) = 5.38, MS_e = .09. Planned comparisons revealed that clustering was higher when subjects engaged in relational processing (CAT, CAT2, and CAT-PR conditions) compared to individual item processing (PR and PR2 conditions), F (1,180) = 15.56, MS_e = .09. However, the effects of processing tasks upon clustering interacted with list structure, F(4,180) = 3.41, MS_e = 3.41. Planned comparisons of the interaction, indicated that relational processing enhanced clustering to a greater extent with an unrelated, as compared to a related, list of words, F (1,180) = 7.59, MS_e = .09. With both related and unrelated word lists, there were no differences in clustering (all F's < 1) between the groups performing relational processing and those performing both relational and individual-item processing, indicating that the addition of an individual item task had no effect on clustering. Also, performing the same task twice had no effect on clustering, all F's (1,180) < 1.01, MS_e = .09, except in the relational processing groups with the related list of words, F (1,180) = 8.34, MS_e = .09. This unexpected result indicates lower clustering for those subjects that performed the relational task twice and possibly reflects the idiosyncratic recall of strategies of several subjects in this condition. In support of this interpretation, 4 of the 19 subjects in this group had negative or zero clustering scores, and if their data are omitted, the mean clustering score of the group is +.64. (Incidentally, recall is not significantly affected when these four subjects are eliminated from the analysis, F < 1.) In summary, the encoding of relational information was facilitated by organizational instructions and a salient list structure.

The recognition data are presented in Table 2 in terms of AG scores, hits, and false alarms. The AG score is a nonparametric signal detection measure (Pollack, Norman, & Galanter, 1964) and five subjects were excluded from this analysis because they did not properly indicate their confidence ratings. Analyses of the 75 remaining AG scores revealed that recognition performance was sensitive to list structure and type of processing, F (1,63) = 17.99, MS_e = .0048; F (4,63) = 10.90, MS_e = .0048, respectively. Recognition was greater for the unrelated word list relative to the related list of words, and individual-item processing (PR, PR2, and CAT-PR) significantly increased recognition scores relative to relational processing (CAT and CAT2), F (1,63) = 41.67, MS_e = .0048. This effect occurred with both the unrelated list, F (1,63) = 6.35, MS_e = .0048, and the related list, F (1,63) = 22.19, MS_e

TABLE 2
MEAN AG SCORES, HITS, AND FALSE ALARMS AS A FUNCTION OF LIST STRUCTURE AND PROCESSING CONDITIONS FOR DELAYED RECOGNITION

	Processing conditions				
List structure	CAT	CAT2	PR	PR2	CAT-PR
Related					
AG	.73	.75	.93	.88	.89
Hits	24.00	23.50	29.63	31.75	31.75
False alarms	9.75	11.88	4.63	5.88	7.38
Unrelated					
AG	.89	.85	.91	.94	.94
Hits	27.00	25.75	29.00	32.00	30.88
False alarms	2.38	2.25	2.50	3.00	2.75

= .0048. However, a significant interaction between list structure and processing tasks, $F(4,63) = 3.12$, $MS_e = .0048$, and a planned comparison, indicated that individual-item processing was more effective in increasing AG scores with the related list of words, $F(1,63) = 11.31$, $MS_e = .0048$. Furthermore, individual-item plus relational processing resulted in no higher recognition than individual-item processing alone with either related or unrelated word lists, all F's < 1. Also, with both types of lists and types of processing, there were no reliable effects of performing the same task twice, all F's < 2.16, $MS_e = .0048$.

Subsequent analyses of hits and false alarms revealed that high AG scores reflected high hits and low false alarm rates. Hits were higher and false alarms were lower with unrelated lists compared to related lists and with individual-item processing compared to relational processing. The only comparison that differed among the three dependent measures was that individual-item processing led to a lower number of false alarms than relational processing with the related list of words, $F(1,70) = 16.39$, $MS_e = 13.80$, but not with the unrelated list, $F(1,70) = 1.75$, $MS_e = 13.80$.

Discussion

The results support both steps in the argument for the combined effect of two different types of information. First, the manipulations designed to induce encoding of both types of information produced higher recall than conditions in which only one type of encoding was encouraged. Performance following the combined orienting tasks exceeded performance following either alone. Incongruent combinations of list structure and orienting task, for example, CAT orienting task and unrelated list, led to higher recall than congruent combinations of task and list, for example, CAT orienting task and related list. This interaction is comprehensible on our presupposition that list structure encourages encoding of a particular kind of information. In addition, the first experiment produced two indices of differential effects of the two types of processing. First, the clustering analyses demonstrated that category clustering was a function solely of relational processing. Not only did relational tasks produce higher clustering than individual-item tasks, but the addition of an individual-item task to the relational task did not increase clustering above the level of the single relational task. This observation is even more interesting when considered in light of the less than perfect correlation between clustering and recall. For example, the PR2 condition produced better recall on related lists than CAT orientation, although the latter condition produced much higher clustering. As will be discussed following Experiment 4, the distinction between relational and individual-item processing provides a framework for understanding this dissociation between clustering and recall.

Two other points should be noted about the clustering data. First, the degree of clustering following individual-item processing was higher with related than unrelated lists. Considering the very low levels of clustering on the unrelated list, this pattern of results is consistent with the assumption that both list structure and orienting tasks affect the nature of encoding. Related lists encourage encoding of relational information, even following an individual-item task. With unrelated lists, very little clustering occurs following individual-item processing, supporting both the assumption that individual-item processing produces little encoding of relational information and raising a second point concerning the clustering data. Namely, the unrelated lists indeed were functionally unrelated.

The recognition data provide a second indication of independent effects of individual-item and relational processing. Unlike recall, recognition performance was primarily a function of variables influencing individual-item processing. Recognition accuracy was greater following individual-item processing than following relational processing. Also, individual-item processing had a much greater effect on recognition with the related list. Again, if the list structure is assumed to influence the type of encoding for each item, unrelated lists encourage the processing of item-specific information. As previously suggested, the primary function of item-specific information is to facilitate discriminative decisions at output. Assuming that the simple recognition test is primarily a discrimination problem, relational information, whose primary function is assumed to be generative, would be of less importance than item-specific information.

Finally, the experiment was designed to provide evidence concerning quantitative versus qualitative interpretations of the superior recall following the combined tasks. The data are clear on this issue. Performing a task twice produced the same recall as that following a single task, both of which were inferior to the combined tasks. This pattern suggests that the combined tasks result in superior memory because of the type of information encoded, not because of the number of opportunities to encode.

However, a reasonable objection has been offered to this conclusion on the grounds that the repeated tasks were performed on adjacent items. Given the vast literature on the importance of spaced repetitions, massed orienting tasks may not constitute functional repetition. On this view, spaced repetition of the single tasks might produce recall equivalent to that of the combined CAT-PR tasks, again assuming that the number of things done is the critical variable. Alternatively, our position is that spaced repetition of orienting tasks will improve performance only under conditions that encourage the encoding of both relational and item-specific information. To examine these alternatives, a second experiment was conducted in which the orienting tasks were spaced rather than massed.

Experiment 2

Method

Fifteen undergraduate volunteers were randomly assigned to each of six conditions. These six groups represented the orthogonal combination of three processing instructions with the two list structures (related and unrelated) used in Experiment 1. All three of the processing conditions in this experiment required that each subject perform two processing operations on each item. Subjects rated each item twice for pleasantness (PR2), categorized each item twice (CAT2), or performed both the pleasantness-rating and categorization tasks (CAT-PR). These orienting conditions were essentially identical to the PR2, CAT2, and CAT-PR conditions in Experiment 1 except that repeated items were not presented adjacently in the list order. Rather, the subjects went through the deck of 36 cards twice, performing a particular orienting task on each repetition. The same word order was maintained on each repetition so all lags were constant at 35 items. Subjects in the CAT2 and PR2 conditions performed the orienting tasks described in Experiment 1 and were asked to think about each repeated item and to rate or sort it independently of their first decision. Subjects performing the CAT-PR orienting activities first rated each item for pleasantness and then categorized the repeated items. All other procedures were identical to those in Experiment 1.

Results

The mean recall and clustering scores are presented in Table 3 as a function of orienting task and list structure. As is evident from Table 3, related lists were better recalled than unrelated lists, F (1,84) = 5.28, MS_e = 26.25. Memory was also affected by orienting tasks, F (2,84) = 4.50, MS_e = 26.25, and as can be seen in Table 3, the CAT-PR condition led to higher recall than either CAT2 or PR2.

More interesting for the purposes of this study, however, was the interaction be-

TABLE 3
MEAN RECALL AND CLUSTERING (IN PARENTHESES) AS A FUNCTION OF LIST STRUCTURE AND ORIENTING TASKS

List structure	Orienting tasks		
	CAT2	PR2	CAT-PR
Related	15.97 (+.65)	19.90 (+.69)	19.53 (+.72)
Unrelated	17.30 (+.63)	13.97 (+.16)	18.87 (+.60)

tween list structure and orienting task, $F(2,84) = 8.05$, $MS_e = 26.26$. As evidenced by individual comparisons, recall of related lists was higher following any individual-item processing (PR2, CAT-PR) than following relational processing (CAT2), $F(1,84) = 10.71$, $MS_e = 26.25$. The PR2 and CAT-PR performance did not differ reliably on related lists, $F(1,84) = 1.4$. With unrelated lists, relational processing (CAT2, CAT-PR) produced higher recall than individual-item processing (PR2), $F(1,84) = 12.91$, $MS_e = 26.25$, but no reliable difference was evident between CAT2 and CAT-PR, $F < 1$. In summary, the basic interaction between list structure and orienting task was replicated in Experiment 2, but the spacing of a repeated orienting task indeed produced recall equivalent to the combined relational–individual item tasks. Importantly, however, the facilitation from spaced tasks occurs only with the appropriate list structure.

Analysis of the clustering scores revealed an effect of list structure, $F(1,84) = 25.74$, $MS_e = .09$, and as can be seen in Table 3, related lists produced higher clustering than unrelated lists. Furthermore, orienting tasks interacted with list structure in producing clustering, $F(2,84) = 12.50$, $MS_e = .09$. Clustering in unrelated lists was reliably higher following CAT2 and CAT-PR tasks than following the PR2 task, $F(1,84) = 21.9$, $MS_e = .09$, and the CAT and CAT-PR conditions did not differ, $F < 1$. These results replicate those found in Experiment 1 with adjacent repetitions. In Experiment 1, pleasantness rating also led to lower clustering with the related lists; however, in the present experiment clustering with related lists was unaffected by processing instructions (all F's < 1). Rather, clustering was uniformly high with this list, suggesting that the high recall of the PR2 condition was mediated by strong organizational processing in addition to individual-item processing.

Discussion

The pattern of the recall data is clear: spaced repetition of an orienting task facilitates performance on an incongruent list. Unrelated lists are best recalled following CAT2 and CAT-PR tasks while related lists are better recalled following PR2 and CAT-PR. Thus, spaced repetition of a single task does produce performance equivalent to that of two separate tasks but only on incongruent lists. Again, these data are most readily interpreted as reflecting qualitatively different types of information rather than in terms of the number of orienting tasks performed. Spacing the repetitions provides additional opportunity to notice and encode information arising from list structure as well as the information extracted by the orienting task. When the information provided by list structure is different from that provided by the orienting task, performance can benefit from the combination of individual-item and relational information.

The clustering scores provide some additional evidence for this interpretation. Specifically, the spaced PR2 condition of Experiment 2 produced much higher clustering in recall of related lists than either PR or massed PR2 of Experiment 1. This increase in clustering is consistent with the assumption that list structure information is more likely to be detected with spaced repetition.

Thus, the massed repetition in Experiment 1 did underestimate the potential advantage of repeating a single task, but the data of Experiment 2 clearly suggest the critical factor is the opportunity to encode different types of information. The number of tasks performed is not as important as the type of information extracted. Taken together, the results of Experiments 1 and 2 are highly consistent with our proposed distinction between individual-item and relational information, especially the assumption that the combined tasks are beneficial because different types of information are extracted.

Experiment 3

The additional experiments to be reported here are designed to apply the individual item-relational distinction to recall of typical and atypical category instances. Experiments 3 and 4 capitalize upon Glass and Meany's (1978) structural analysis of category typicality. Glass and Meany argue that the psychological representation of typical category instances differs in two ways from atypical category members. First, the information representing category membership is more immediate for typical instances, but as known members of the category, atypical instances are represented by category information shared with typical instances. Atypical instances, however, are generally less well known. Thus, categorical information notwithstanding, less specific information about the atypical instance is available. By analogy with the Smith, Shoben, and Rips (1974) feature model, the defining features of atypical instances are available but less immediate than for typical instances. The characteristic features of typical instances, however, are far richer than those of atypical instances. When combined with the distinction between relational and item-specific processing, this structural analysis has interesting implications for recall.

Specifically, relational and individual-item processing should differentially affect the relative recall of typical and atypical items. Relational orientation should reduce differences in recall of typical and atypical items. Categorical information is readily activated for the typical items, and the relational processing task serves to activate the same information for the atypical items. An individual-item task, however, should provide an advantage for typical instances. Since the atypical items are assumed to be impoverished in item-specific information, a task which focuses attention on individual items rather than relationships among items should lead to higher recall of typical than atypical instances.

These predictions were examined in the third experiment through the simple expedient of crossing orienting tasks and typicality. The lists consisted of both typical and atypical category instances. The orienting activities included a categorical classification task, a pleasantness-rating task, and an orthographic task. The primary concern in this experiment was the effect of categorization and pleasantness-rating tasks on the relative recall of typical and atypical items. On the reasoning outlined above, the category classification task was expected to result in little difference between the recall of typical and atypical items. The pleasantness task, however, was expected to produce better recall of typical than atypical items.

Method

Subjects and design. The subjects were 36 undergraduate volunteers who were randomly assigned to one of three conditions based on three different orienting tasks: Category Judgment (CAT), Pleasantness Rating (PR), and orthographic Judgment (ORTH). Within each type of orienting task, subjects were required to process both typical and atypical words. Thus, the design was a simple 3 (Orienting Task)$\times$2 (Typicality) factorial.

Materials. Two separate lists were constructed from Battig and Montague's (1969) category norms. Each list contained 24 items consisting of six instances from four categories. Of the six instances of each category, three were high-frequency exemplars (Rank ≤ 5) and three were low-frequency exemplars (Rank >30). The 48 words were then subjected to a typicality rating by a group of 50 subjects. These subjects were given each word paired with its superordinate and asked to rate how typical the word was of the category superordinate on a 7-point scale, where 1 = very typical and 7 = very atypical. The high-frequency instances received an average typicality rating of 2.31, and the low-frequency instances were rated 5.68 on the typicality scale. The eight categories used were furniture, birds, vehicles, sports, buildings, fruit, tools, and fish.

Each list thus contained three typical and three atypical instances from each of four categories. The words were presented on slides, printed in uppercase letters to eliminate any effects of orthographic irregularity (Hunt & Elliott, 1980). Each list occurred in two different orders, with each list and each order represented equally in each of the orienting conditions.

Procedure. Subjects initially were instructed as to the performance of their particular orienting task under the guise that this was the primary purpose of the experiment. In the CAT condition, subjects wrote the category superordinate for each word as it appeared. Several examples were given prior to list presentation to facilitate appropriate levels of category generality. In virtually all cases, the orienting responses were consistent with the preexperimental groupings. Furthermore, a subsequent analysis of the results ignoring categories from which one or more of the responses was not consistent with the preexperimental groupings did not change the conclusions. Subjects in the PR condition were instructed to rate each word for pleasantness on a 5-point scale. In the ORTH condition, subjects were required to write the middle letter of each word.

Each word was exposed for 3 seconds, followed by an additional 2 seconds for recording the response prior to presentation of the next word. After presentation of the entire list, a surprise free recall test was administered with a 3-minute time limit.

Results

The recall data are presented in Table 4 as a function of orienting task and typicality. As can be seen in Table 4, the standard levels-of-processing effect was obtained with the orienting tasks. The two semantic tasks, CAT and PR, produced much higher recall than the ORTH task, $F\ (2,33) = 24.63$, $MS_e = 4.38$. Newman–Keuls analysis revealed no reliable difference between CAT and PR but both of these conditions exceeded performance in the ORTH condition. The main effect of typicality also was reliable, $F\ (1,33) = 14.12$, $MS_e = 2.17$, with typical words better recalled than atypical words.

The most interesting result, however, concerns the interaction between orienting tasks and typicality, $F\ (2,33) = 5.21$, MS_e 11.32. Inspection of Table 4 suggests that the interaction was primarily due to higher recall of typical than atypical items in the PR and ORTH conditions but no difference in recall of the two types of items in the CAT condition. Newman–Keuls analysis confirmed this interpretation in that typicality had no reliable effect following CAT orientation, but typical items were better recalled than atypical items following the PR and ORTH tasks.

In addition to the recall data, category clustering was analyzed using again the ARC score. As can be seen in Table 4, the effect of orienting condition upon clustering was reliable, $F\ (1,33) = 6.20$, $MS_e = .10$. Subsequent Newman–Keuls analysis revealed reliably high clustering in the CAT and PR conditions than in the ORTH condition. The difference in clustering between CAT and PR was marginally significant ($.10 > P > .05$).

TABLE 4
AVERAGE CORRECT RECALL AND MEAN CLUSTERING SCORES AS A FUNCTION OF ORIENTING TASKS AND TYPICALITY IN EXPERIMENT 3

	Orienting tasks		
	CAT	PR	ORTH
Typicality			
Typical	8.25	9.75	5.42
Atypical	8.08	7.50	3.92
Clustering	+.56	+.38	+.16

Discussion

The most interesting outcome of the third experiment was the interaction between orienting tasks and typicality. Relational orientation resulted in no difference between recall of typical and atypical words. Pleasantness ratings and orthographic tasks produced reliably superior recall of typical words. The typicality effect following the nonsemantic task is another instance of the interaction between memory processes and structure (Hunt, Elliott, & Spence, 1979). The orthographic task results in some minimal activation of the word's representation, and the differential amount of individual-item information confers an advantage on typical items.

Differential effects of the tasks also were evident in the clustering analyses. Not surprisingly, categorization resulted in high levels of categorical clustering. Pleasantness rating produced somewhat lower clustering and orthographic orientation substantially reduced the amount of clustering. Further discussion of these data will follow presentation of the fourth experiment which was designed to partially replicate and extend the results of Experiments 1, 2, and 3.

Experiment 4

In the fourth experiment, semantic relational and individual-item orienting tasks were orthogonally combined, as in Experiments 1 and 2. The lists again consisted of both typical and atypical category instances. The purpose of the experiment was to simultaneously replicate the primary findings of Experiments 1 and 2, superior recall following the combined tasks, and Experiment 3, the interaction of orienting tasks and typicality.

Method

Subjects and design. The subjects were 48 introductory psychology students who were randomly assigned to one of four conditions. The conditions were based on orienting activities and included CAT-PR, PR, CAT, and an intentional control. The control condition was added to provide a basis for assessing intentional memory performance as a function of category typicality. The design of the experiment then includes four orienting conditions, CAT, PR, CAT-PR, and Intentional, and a within-list manipulation of typicality.

Materials. The word lists were selected in the same fashion as those of Experiment 3, but were expanded to 36 items. Two separate lists were prepared consisting of six instances from six categories. Each category was represented by three typical and three atypical instances. Typicality was defined in the same fashion as in Experiment 3.

Procedure. The procedure was the same as that of Experiment 1. The orienting tasks were performed under incidental memory instructions at the subject's own pace. In the CAT-PR condition, both tasks were performed on a word before going on to the next item. Category superordinates were available to the CAT-PR and CAT conditions to expedite sorting. The intentional group was given standard free recall instructions.

The words were individually typed on 3 × 5-in. cards. Two orders of each list were prepared with the restriction that no more than three typical or atypical words, three category members, or three words beginning with the same first letter occur contiguously. An equal number of subjects in each condition received a particular list and order.

Following the orienting tasks a surprise free recall test was administered. This test, of course, was expected in the intentional condition. A 3-minute time limit was placed on recall.

Results

The recall data of Experiment 4 are presented in Table 5 as a function of orienting tasks and typicality. Focusing first upon total recall, there was no reliable main effect of orienting tasks, $F(3,44) = 2.37$, MS_e

= 10.01. However, planned comparisons revealed that the CAT-PR group produced reliably higher recall than the PR and the intentional groups, F's (1,44) $\geq$ 6.39, MS_e = 10.57. Also, the CAT, PR, and intentional groups did not differ, F's (1,44) $\leq$ 2.13, MS_e = 10.57. These results are basically in agreement with those of Experiments 1 and 2 except for surprisingly high recall in the CAT condition. Recall in the CAT group was not significantly different from the CAT-PR condition. As will be discussed shortly, this particular result was an artifact of one list order used in Experiment 4.

Although there was no main effect of typicality, F (1,44) = 1.83, typicality interacted with orienting tasks, F (3,44) = 4.95, MS_e = 5.48. Planned comparisons of the typicality effect for each of the four processing conditions revealed that typical items were better recalled than atypical items following individual-item (PR) processing, F (1,44) 5.14, MS_e = 5.48. There were no reliable differences between typical and atypical item recall in the CAT-PR, F (1,44) = 1.95, and intentional, F (1,44) = 2.74, conditions. However, recall was higher for atypical than typical items in the CAT condition, F (1,44) = 6.84, MS_e = 5.48.

Further analysis indicated that the reversed typicality effect in the CAT group, the high recall in the CAT condition and the lack of a significant typicality effect in the CAT-PR condition were due to an artifact of list structure. A four-way interaction involving List Order × List × Typicality × Orienting Tasks, F (3,32) = 3.27, MS_e = 3.90, was reliable. This interaction was due to the effects of one order of one list upon atypical items in the relational processing conditions (CAT and CAT-PR). In this list, three atypical members of one category appeared in contiguous positions and recall of these items was perfect by subjects in the CAT condition who received this list. When this particular list order was eliminated and the data were reanalyzed, there were no list order interactions. Further, there was no difference between typical ($\bar{X}$ = 7.78) and atypical ($\bar{X}$ = 8.89) item recall in the CAT condition, F (1,24) = 1.51, there was a marginally significant (.10 > P > .05) typicality effect in the CAT-PR condition, F (1,24) = 3.88, MS_e = 3.67, and recall was reliably higher in the combined individual-item and relational processing condition than in the CAT group, F (1,24) = 4.88, MS_e = 5.83. It should be noted that all other effects in this analysis were identical to those presented earlier. In summary, these effects are entirely consistent with our major argument that individual-item processing enhances the typicality effect and that relational processing does not differentially affect the recall of typical and atypical instances.

To examine organizational processing, ARC scores were calculated and are presented in Table 5. The analysis of clustering scores was collapsed over the typicality variable since both typical and atypical instances are members of the same category. As expected, clustering was higher following relational processing and the CAT-PR and CAT did not differ. Clustering was lower in the PR and intentional conditions and these groups did not differ.

Discussion

The interesting result from both Experiments 3 and 4 was the interaction between orienting tasks and typicality. Generally, recall of typical items exceeded atypical items following individual-item processing.

TABLE 5

MEAN RECALL AND CLUSTERING FOR TYPICAL AND ATYPICAL ITEMS AS A FUNCTION OF ORIENTING TASKS IN EXPERIMENT 4

	Orienting tasks			
	CAT-PR	CAT	PR	Intentional
Typicality				
Typical	10.83	7.83	8.92	9.08
Atypical	9.50	10.33	6.75	7.50
Clustering	+.62	+.71	+.34	+.41

Relational processing, however, eliminated the typicality effect in both experiments.

This pattern of results can be understood by combining Glass and Meany's (1978) structural analysis of typicality with the proposed distinction between relational and individual-item processing. Glass and Meany suggest two primary differences between typical and atypical items. First, atypical category instances are generally less meaningful. Less item-specific information is available for atypical items. Relational information, on the other hand, is assumed to be available if the person knows that the atypical instance is a category member. Unlike typical instances, however, category membership is in some sense less obvious for the atypical than for typical items. If attention is primarily directed to category membership, the orienting task activates relational information for both typical and atypical items, and little difference exists in memory performance. If, however, the orienting task directs attention to item-specific information, the atypical items suffer due to the relative impoverishment in item-specific information and the low probability of tangential activation of relational information. These simple recall data thus extend Glass and Meany's structural analysis to the recall task and further recommend the viability of a distinction between relational and individual-item processing.

Differential effects of relational and individual-item processing were also evident in the clustering analyses of Experiments 3 and 4. Relational processing produced higher levels of category clustering in both experiments than did semantic individual-item processing. Of particular interest, however, is the dissociation of clustering and recall. In both Experiments 3 and 4, the higher clustering scores of relational tasks were accompanied by no reliable recall differences between relational and individual-item tasks. Furthermore, the combined relational–individual-item condition of Experiment 4 produced higher recall than the relational condition, yet the two conditions did not differ reliably on the clustering measures. The point here is that relational and individual-item-processing have different effects upon output clustering while, at least in some cases, producing the same level of recall. A similar pattern of results has been reported by Einstein and Hunt (1980).

This dissociation of clustering and recall can be understood by assuming that relational and individual-item processing direct encoding of qualitatively different types of information, both of which are important in recall. Thus, the combined tasks produce higher recall than either alone. Assuming that clustering serves as an index of relational information, higher clustering scores would be expected following relational processing than following individual-item processing. Both types of information are important to recall, and clustering is an index only of relational information.

Before leaving the specific discussion of these experiments, a point of apparent inconsistency should be clarified. In the first two experiments, relational tasks were shown to be less efficient with highly related lists than were individual-item tasks. The explanation of this result was that highly related lists would engage relational processing, and the relational orienting task would then be superfluous. In the third and fourth experiments, however, performance on categorized lists was equivalent following relational and individual-item processing. This apparent discrepancy between the four experiments is due to the presence of atypical items in Experiments 3 and 4. The categorical information for atypical items is assumed to be less obvious, and hence, relational processing will facilitate recall of atypical instances. Recall of typical items, however, is quite consistent across experiments. As in the related lists of Experiment 1 and 2, the individual-item orienting task in Experiments 3 and 4 produced higher recall of typical items than the relational orienting task.

General Discussion

Two general empirical conclusions emerge from these experiments: individual-item and relational processing combine to produce optimal recall; and yet the two types of processing differentially affect other dependent measures. The first point is evident in the superior recall following the combined orienting task in Experiments 1 and 4. Further evidence on this point comes from the interaction of list structure and orienting task in Experiments 1 and 2; relational orientation produced the best performance on unrelated lists, and individual-item processing led to highest recall of related lists. Differential effects of the two types of processing were clearly seen in measures of clustering, recognition, and recall as a function of typicality. Relational processing, under the control of orienting tasks or related list structure, produced higher levels of clustering while individual-item processing, induced by orienting tasks or unrelated list structure, produced highest recognition performance in Experiment 1. Recall of typical and atypical category instances also was differentially affected by the type of processing. Relational processing produced equivalent recall of the typical and atypical instances while typical items were better recalled than atypical items following individual-item processing.

A satisfactory understanding of the entire pattern of data seems to require an explanation based on qualitatively different memory traces. Certainly the results of Experiments 1 and 2 cast doubt on simple quantitative explanations, which might appeal to the sheer number of activities performed. Rather the results are highly consistent with a distinction between relational and individual-item information, the former referring to features shared by all elements of a to-be-remembered event and the latter denoting features unique to each event. Once encoded, the functions of relational and item-specific information differ in retrieval. We suggest that relational information serves primarily a generative function. That is simply to say that relational information denotes a general class of which each of the separate events are members. Note that we are not making a strong claim for the serial generation of discrete events given relational information. Rather, the function of relational information may be more generally to delimit the class of events from which specific to-be-remembered information will be drawn. The subsequent discrimination among the objects or events within the class is then facilitated by specific information concerning each object or event.

On this view, retrieval becomes a process of increasingly finer discriminations. Both relational and item-specific information guide the reconstruction of target information by delimiting the to-be-remembered material from other aspects of the individual's knowledge. In this sense, relational and individual-item processing serve to increase the distinctiveness of the memory trace, but the two forms of processing fulfill this function in different ways. Relational processing emphasizes similarities among events while individual-item processing emphasizes differences among the events. In turn, the relational information may then serve to outline the class of events from which the specific information is to be drawn. Other than assuming a random search, it is inconceivable that retrieval would proceed successfully in the absence of such information. Even an unrelated list processed individually is related to some degree through instructions to recall all items on the list. Recall of specific information, however, improves with additional information. Relational processing provides a basis for reconstruction, but verbatim recall typically requires more precise discrimination which is based on item-specific information.

The conceptual distinction between relational and item-specific information actually has considerable precedent in discussions of both memory structure and memory which refer to classes of events. In an early description of cognitive structure, Ausubel (1965) distinguished between primary signs, which refers to particular objects, and generic signs, which refer to classes of events. Most contemporary models of semantic memory continue to capture the same distinction in some fashion. For example, relational and specific knowledge is implicit in the hierarchical representation of most associative models. Collins and Quillian's (1969) early model, which has influenced subsequent theories, proposed nodes to represent concepts and properties to represent specific information associated with concepts. Feature theories of semantic memory (e.g., Smith et al., 1974) describe the distinction between relational and item-specific information as defining features, shared by all members of a category, and characteristic features, specific to individual category instances.

Positions very similar to our conceptualization of the processing of individual-item and relational information have been articulated first by Bellezza (Bellezza et al., 1977; Bellezza, Richards, & Geiselman, 1976) and later by Ritchey (1980; Ritchey & Beal, 1980). Ritchey argues that a distinction between within-item and between-item information is useful in understanding the picture superiority effect in free recall, but he hesitates to conclude that the combined effect will exceed either alone. Bellezza's view is very close to our own, both individual-item and relational information are assumed to be important and serve different functions in retrieval. Although Bellezza's research seems to emphasize organizational factors while our work argues for the relative contribution of both types of information, the two conceptualizations are highly consistent. Finally, Mandler (1979; 1980a, 1980b) also has discussed a similar conceptual distinction in terms of within-item integration and between-item elaboration. On some descriptions (Mandler, 1980b), however, this distinction differs from ours in that within-item integration refers to perceptual integration of the target, information which distinguishes the target from all other items in the knowledge base. Between-item elaboration seems to encompass both our relational and individual-item information in that target is related to other information in semantic memory which may or may not represent target events. Mandler's distinction is quite similar to Humphreys' (1976, 1978) position, both suggesting a distinction between information uniquely specifying an event and information elaborating that event but shared by other events. This distinction is certainly compatible with, but also different from, our view of relational and individual-item information.

Useful application of the concepts of relational and individual-item information requires an appreciation for the relative nature of the concepts. Individual-item and relational processing must be identified relative to the input context. For example, information specifying *greenness* might serve a relational function when encoded in the context of FROG, DOLLAR, and PEA, but the same encoding might serve an item-specific function in the context of PEA, CORN, and TOMATO. Thus, the distinction between relational and item-specific information can only be drawn relative to the input context. Moreover, the effect of relational and item-specific information will be determined by the characteristics of the memory test. For example, what type of information will be accepted as correct (Morris, Bransford, and Franks, 1977)? If general information is acceptable, relational processing may be sufficient (e.g., *animals* is accepted in response to, "What did you see at the zoo?"). Alternatively, acceptable responses may require more specific information than is provided by relational processing (e.g., "Yes, but what animals?"). Thus, the potential effectiveness of relational and item-specific information must be judged in light of the information required at test.

Another major factor determining the relative effectiveness of either type of information will be the nature of the memory test. To this point our discussion has focused upon free recall for which we claim that both item-specific and relational information are important. Much the same analysis might apply to cued recall. The function of a cue at input may be similar to that of an orienting task, biasing a particular form of encoding (e.g., Hunt & Ellis, 1974). At output, however, the analysis becomes a bit more complex. The effectiveness of stored relational or item-specific information would be relative to the output cue, such that optimal performance would result from the activation of both relational and item-specific information through the interaction of the cue and the stored information. Although little direct evidence is available, Gardiner, Craik, and Birtwistle (1972) have shown that a change from a general cue at input (e.g., *animal*) to a specific cue at output (e.g., *stripes*) facilitates recall performance. This result is consistent with the assumptions that both item-specific and relational information are important and that the cue and stored information interact to determine type of information upon which recall is constructed.

The effects of item-specific and relational information may also vary in recognition. Although the results of Experiment 1 indicated that only individual-item processing affected recognition, the effect of item-specific and relational information will depend upon the alternatives in the recognition test. If the recognition decision can be made on the basis of general information, relational processing should produce recognition equivalent to that of individual-item processing. In summary, the fruitful application of the distinction between individual-item and relational processing will be critically dependent upon evaluation of the input and test environments.

With these considerations, this distinction should prove useful in generating new problems as well as in understanding existing issues. Certain orienting task effects have been susceptible to this analysis both in the present experiments and in Begg (1978), Bellezza et al. (1977), Einstein and Hunt (1980), Epstein et al. (1975). Ritchey (1980) and Ritchey and Beal (1980) have applied a similar analysis with some success to the picture superiority effect in memory. Our understanding of forgetting might benefit from the distinction. McDaniel and Masson (1977) have some preliminary evidence that relational information decays less rapidly than item-specific information. Perhaps the continuing attempts to understand gist versus verbatim memory for sentences and prose (e.g., Anderson and Paulson, 1977) would profit from application of this distinction. Good prose and coherent conversation maintain a continuity that would encourage relational processing. Subsequent recall of these materials would necessarily be reconstructed from general information and verbatim performance should be minimal. It is interesting to note that information that does not fit the dominant theme, and hence may induce more individual-item processing, is recalled verbatim (e.g., Keenan, MacWhinney, & Mayhew, 1977). These examples—and several others could be given—suggest that application of the distinction between individual-item and relational processing may be valuable and fruitful.

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(Received August 7, 1980)