Active and passive processing during primary rehearsal

JAMES S. NAIRNE
University of Texas at Arlington

Two incidental learning experiments examined the formation of interitem associations under task demands that encouraged different types of rehearsal in short-term memory. Subjects were assumed to engage in "passive" primary rehearsal when the task required them merely to keep information available in memory until the appearance of a decision word. "Active" primary rehearsal, on the other hand, required interactive processing of the stored material continuously throughout the rehearsal interval. The main question of interest asked whether active as opposed to passive rehearsal would typically lead to continued growth in interitem associative learning, even though no final memory test was anticipated. The results suggested that associative learning does not continue to develop as a simple by-product of attention, or temporal contiguity; rather, rehearsal will promote the formation of associations only while the subject continues to look for "relations" among co-rehearsed items. These data are discussed in terms of the distinction between primary and secondary rehearsal processes and from the perspective of the "working memory" model of Baddeley and Hitch (1974).

To most learning theorists, prolonged storage of a stimulus in short-term memory, or consciousness, is central to the formation of a durable, readily retrieved, memory trace. This is because rehearsal, the process controlling storage, allows the subject the opportunity to translate, recode, or elaborate the nominal stimulus into a form that can be easily remembered if later desired. Yet, research spanning the last decade has shown that such elaborative (or "secondary") rehearsal processes, which increase long-term memory for a rehearsed item, may occur only under a restricted set of task demands—for example, when the subject is studying material for a future test. Instead, subjects may often engage a maintenance (or "primary") rehearsal process that serves merely to maintain the immediate availability of information without increasing the long term durability of the memory trace (Craik & Lockhart, 1972).

On the surface, it may seem difficult to understand the functional significance of a rehearsal process that does little to aid long-term retention. However, as Bjork (1975) points out, there are a number of situations where it is profitable to maintain, rather than learn,
information over short intervals. Consider, for example, the “directed forgetting” experiments of Woodward, Bjork, and Jongeward (1973): Subjects were instructed to remember (R) or forget (F) items as they were presented in a series of lists. The critical variable was a blank delay, which ranged from 0 s to 12 s, between presentation of each item and the appearance of the R or F cue. In this context, because subjects are unable to predict the cue type during the delay, it is clearly better not to process an item elaboratively prior to the appearance of the R or F cue; the subject might soon be cued to forget what he or she is currently rehearsing. In later recall, subjects remembered more R than F words, but importantly, recall was unaffected by the length of the blank delay. In other words, total rehearsal time failed to predict final memory performance. This experiment presumably illustrates only one of a variety of situations where it is beneficial to engage a rehearsal process that adequately keeps information available for immediate use, but does not have a profound effect upon long-term recall.

Why does long-term recall not improve under primary rehearsal? One likely possibility is that subjects simply do not devote enough mental resources to the material during this type of rehearsal to promote effective learning (see Naveh-Benjamin & Jonides, 1984). Under such conditions, the allocation of attentional processing, although sufficient for mere maintenance, may be insufficient for the development of rich interitem associations that can serve as an effective basis for later recall. In many respects, primary rehearsal experiments have been designed to induce subjects to process material with minimal effort. This is certainly true in the Woodward et al. (1973) experiments, where it was necessary to wait through a blank interval before it was clear how to process a given list item. In addition, consider rehearsal performance in the modified Brown-Peterson paradigm used by Glenberg, Smith, and Green (1977) and by Rundus (1977). In this task, subjects are asked to repeat words aloud as distractor activity intervening between presentation and recall of a digit string. These short-term memory trials are then followed by a surprise recall test for the “distractor” words. From the subject’s viewpoint, because digit recall is the primary task requirement, little, if any, effortful processing ought to be directed toward repeating the “distractor” words; rather, it is the digit string that should receive the focus of the attentional resources. The consequence of such “attention-free” storage, however, is that later recall of the distractor words no longer benefits from rehearsal duration, as it does under secondary rehearsal.

In an earlier paper (Nairne, 1983), I proposed that the specific mechanics of this passive “attention-free” rehearsal process might be
understood within the "working memory" framework described by Baddeley and Hitch (1974). In particular, I suggested that primary rehearsal could be identified with the activation of an articulatory storage loop, whose purpose was to protect the work of a limited-capacity central executive. The articulatory storage loop, once initiated, served as an efficient mechanism for keeping information immediately available, but with a minimum of attention or processing effort. The loop's function was suggested to be completely short-term; that is to say, information maintained in the loop was not processed in a fashion that led to the formation of interitem associations or other aids in long-term recall (although residence in the loop might lead the subject to encode "intrattem" attributes that could mediate later recognition performance). For the Glenberg-Rundus task, maintenance of the distractor words was felt to be under the control of the loop, whereas the digit strings received the focus of attention via the central executive. Such a strategy acted to reduce distractor interference on digit recall, but did little to aid subsequent long-term recall of the distractor words.

The experiments reported in the present article were designed to test some implications of this perspective on rehearsal. Because primary rehearsal is typically characterized as a "nonassociative" storage process (see Woodward et al., 1973), the retention index in these experiments was the formation of interitem associations between concurrently rehearsed members of a word pair. According to Nairne (1983), activation of the articulatory storage loop, and consequently nonassociative primary rehearsal, ought to be particularly likely in situations where the subject expects a period of uninterrupted information storage. In Experiment 1, subjects were asked to repeat pairs of words aloud, through blank delays of various length, prior to making a rhyme or semantic decision about the words making up the pair. Because no interactive processing of the material was required during the delay (other than that required for mere maintenance), it was expected that the formation of associations between pair members would not depend upon the amount of time that the pairs were maintained in memory. In addition, if storage during the delay were controlled by a single loop, then the nature of the final decision (rhyme versus semantic) would be predicted to have little impact upon how the learning is affected by the delay. Experiment 2, in contrast, was designed to manipulate the amount of interactive processing required during rehearsal. In this case, the intention was to vary the likelihood that subjects could initiate the loop as a mechanism for storage and, thereby, affect how associative learning develops over time.
EXPERIMENT 1

In Experiment 1, on each of a series of trials, subjects were presented with a pair of words (e.g., cart-town) to be maintained for a blank interval prior to the appearance of a third word. In one condition (rhyme), this third word, or target, rhymed with one of the two members of the rehearsal pair; for a second condition (semantic), the target was close in meaning to one of the two members of the rehearsal pair. The subject’s task was simply to press one key if the target word rhymed (or was close in meaning) to the left member of the pair (cart) or a different key if the target was related to the right member of the pair (town). The critical variable was the blank interval separating the appearance of the word pair and target word. It was necessary for subjects to repeat each word pair aloud for either a short (2 s) or a long (12 s) interval before the rhyme or semantic judgment could be made. After a series of these trials, a surprise pair-recognition test was given to assess the development of interitem associations; subjects attempted to choose intact rehearsal pairs from mismatched pairs containing words that had been rehearsed, but never together. The following empirical questions were asked: First, would subjects remember which words received paired presentations? Second, would that memory change as a function of the time the items were maintained together (i.e., the length of the blank delay)? Third, would the type of rehearsal depend upon whether the subject needed to make a rhyme or a semantic judgment?

METHOD

Subjects

Subjects were 32 undergraduates from an introductory psychology course at the University of Texas who participated for pay or credit.

Materials and apparatus

All stimulus materials were presented on a Televideo 950 CRT and were controlled by a Northstar Horizon microcomputer. The critical word-pair items were four-letter, single-syllable, high-frequency nouns. Words were randomly paired, with the exception that any obvious word-word associations were not permitted. Less control was exercised over the target words; they were often multisyllabic and from three to seven letters long.

Procedure and design

Subjects were told that the purpose of the experiment was to study how long it takes people to make judgments about words. Sixty-four judgment
(i.e., rehearsal) trials were presented in two separate 32-trial blocks. For one block, subjects decided whether the target word rhymed with the left or right member of the rehearsal pair; for the other block, the task was to decide which member of the word pair closely resembled the target word semantically. Within a block, “left” and “right” correct decisions were distributed equally, and randomly, across the 32 trials. Each subject participated in both the rhyme and semantic conditions; task order was counterbalanced across subjects. The other important variable, also manipulated within-subject, was the length of the blank delay (either short or long) separating the initial appearance of the word pair and the onset of the target word. Each block of 32 trials contained 16 short trials and 16 long trials; the particular order was random within a block. Delay was also counterbalanced such that each pair, across subjects, was rehearsed (a) in preparation for either a rhyme or a semantic decision and (b) for either a short or a long interval.

Trials began with the appearance of a row of asterisks and a short auditory beep. The asterisks served as a “ready” signal and remained on the screen for 3 s. Next, the word pair was presented for 1 s. The words of the pair appeared adjacent to one another, separated by a hyphen. Subjects were instructed to begin repeating the pair aloud as soon as it appeared. After 1 s, the pair was removed and the blank rehearsal period began. Depending upon the trial type, the screen remained blank for either a “short” (1 s) or “long” (11 s) interval before appearance of the target word. Because overt rehearsal of the word pair began with initial exposure to the pair, rehearsal continued for a total of 2 s on a short trial and 12 s on a long trial. When the target word appeared, overt rehearsal ceased and subjects keyed in their response as quickly as possible. Once again, the subject’s task was to press one key if the target rhymed (or was close in meaning) to the “left” member of the pair or a different key if the target rhymed (or was close in meaning) to the “right” member of the pair. The target word remained on until subjects keyed in their response. Two seconds later, the next trial began. General task instructions were read to subjects immediately prior to each block; speed with accuracy was stressed. Finally, each block began with a short set of practice trials.

Immediately following the final judgment trial, subjects were asked to count backwards from 100 to 0 to remove residual trial effects from short-term memory. Counting was followed by administration of the surprise pair- recognition test. The test was forced-choice: Subjects had to choose which of two presented pairs was the “intact” pair from the earlier judgment trials. Specifically, on each trial the subject was presented with two word pairs located on opposite sides of the terminal screen. One of these test pairs contained words that had been rehearsed together on the same judgment trial (i.e., an “intact” pair); the other pair contained words that had been rehearsed under exactly the same conditions but not together. Thus, the words of each pair had been rehearsed (a) for the same length of time and (b) prior to the same kind of judgment (rhyme or semantic) task. Each pair also had one word that related to a target word and one word that did not. The
Table 1. Mean recognition scores in Experiment 1

<table>
<thead>
<tr>
<th>Condition</th>
<th>Rehearsal interval</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Short</td>
</tr>
<tr>
<td>Rhyme</td>
<td>0.8</td>
</tr>
<tr>
<td>Semantic</td>
<td>1.3</td>
</tr>
</tbody>
</table>

Note. Values represent recognition responses weighted by the confidence ratings (e.g., +3 for a correct “sure” response and −3 for an incorrect “sure” response).

Table 2. Percentage correct recognition in Experiment 1

<table>
<thead>
<tr>
<th>Condition</th>
<th>Rehearsal interval</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Short</td>
</tr>
<tr>
<td>Rhyme</td>
<td>67</td>
</tr>
<tr>
<td>Semantic</td>
<td>75</td>
</tr>
</tbody>
</table>

structure of the test was explained to each subject in detail. It was pointed out that one could not perform with success by attending to the individual words; to make a correct choice, subjects were required to remember which words had been paired together (see Nairne, 1983, for the use of a similar test structure).

Subjects responded in two ways: First, they pressed a key signaling whether the left or right pair was the “intact” rehearsal pair. Next, they pressed a key to indicate how confident they were in their decision on a scale from 1 (guess) to 3 (sure). Subjects were given as much time as they needed to answer. The test contained 32 trials; each of the four trial types (semantic—short or long interval; rhyme—short or long interval) was represented equally and was distributed randomly.

RESULTS AND DISCUSSION

The recognition responses were weighted by the confidence ratings (e.g., +3 for a correct “sure” response, and −3 for an incorrect “sure” response) to create a potential 6-point scale for a given item. The mean ratings for the various items are shown in Table 1. An overall analysis of variance (ANOVA) on the data revealed a highly significant main effect of task type (rhyme versus semantic judgment), $F(1, 31) = 21.91, MS_e = 0.537, p < .001$, no effect of rehearsal interval, $F(1, 31) = 1.34, MS_e = 0.452$, and no interaction of rehearsal interval with task type $F(1, 31) < 1$. A similar pattern of results is found for the raw percentages of correct choices, as shown in Table 2.
The results are clear-cut: First, mean performance in each condition is above the chance level of 50%. In the rhyme condition, specifically, 29 of the 32 subjects recognized more than half of the pairs correctly, \( p < .01 \) by a sign test. Clearly, the subjects remembered which words were paired together in the experiment, despite the incidental nature of the task. Second, the rehearsal mechanism that was engaged to maintain the word pairs in memory prior to the appearance of the target word did nothing to promote the development of interitem associations as a function of storage time. Subjects, regardless of task type, were as likely to respond correctly to a pair rehearsed for 2 s as to a pair rehearsed for 12 s. This finding allows one to reject any simple proposal that equates the formation of interitem associations with the duration of storage in short-term memory (e.g., Raaijmakers & Shiffrin, 1981). Contiguity, or the number of item-item pairings, by itself, does not predict final pair recognition performance (see also, Glenberg & Bradley, 1979). Third, although the semantic versus rhyme judgment affected performance overall, task type apparently did not influence the likelihood that subjects would engage in primary rehearsal as the mechanism of storage throughout the blank interval. For both types of judgment task, pair recognition did not improve with increasing durations of storage. If, as Nairne (1983) suggested, subjects utilize a single articulatory storage loop as the vehicle for storage, then no interaction of task type with rehearsal interval should have been anticipated.

Certainly the most striking feature of the present data is the substantial main effect of judgment type on the probability of correct pair recognition. Subjects were more likely to recognize a pair correctly in the semantic task condition. In a sense this finding can be interpreted simply as a standard “levels of processing” result; that is, the semantic judgment required a deeper level of processing than the rhyme judgment (Craik & Lockhart, 1972). Yet, in the present case, it should be emphasized that neither the rhyme nor the semantic task required the establishment of associations between the members of the word pairs. To perform correctly, the subject had to compare each rehearsal item separately with the target word—the judgment was not made about the pair, but rather about the individual members of the pair. Thus, in addition to addressing the main effect of judgment type, one could question why any evidence of associative learning was obtained in this task. One possibility is that the formation of associations was restricted to the initial stages of the rehearsal process. Specifically, associations may have resulted from the short-term contiguous processing that was necessary to encode that a given two words needed to be rehearsed aloud together. Or, put differently, associations
may have been formed as a consequence of the processing that was required to set up the rehearsal loop (Nairne, 1983). Once rehearsal in the loop was initiated, however, no further associative processing occurred. Furthermore, if a semantic decision was required, it is possible that subjects tended to encode the items semantically, rather than acoustically, during the initial pair exposure; i.e., subjects may have chosen to encode the pair more deeply if a relatively difficult semantic decision was anticipated. Because such an encoding process is presumably controlled by central executive processes (rather than by the articulatory loop), greater interitem elaborations may have been produced as a result. But such reasoning is speculative, and the main effect of judgment type remains largely unexplained.

**EXPERIMENT 2**

The results of Experiment 1 indicate that subjects were using a primary rehearsal process, perhaps an articulatory loop, to store the word pairs in memory prior to the appearance of the target word. This reasoning is based on the critical finding that pair recognition was unaffected by the length of the rehearsal interval. Utilization of a mechanism like the articulatory loop was a plausible strategy in this context because little, if any, attention needed to be directed toward the pairs during the blank delay; in effect, the rehearsal was passive in that only pure maintenance was required. The purpose of Experiment 2 was to manipulate whether interactive processing of the maintained word pairs was required during the delay. If subjects are required to attend actively to the pair items throughout the storage period (e.g., form visual images, etc.), then one might expect final pair recognition to improve as storage time increases even though subjects are not anticipating a final memory test. In this case, one could argue that associative learning simply requires that some above-threshold level of cognitive resources be devoted to the rehearsal task. Such a finding would also be consistent with the idea that primary rehearsal, as indexed by the growth of interitem associations, can be identified with a looping mechanism that is engaged only when the subject anticipates a period of uninterrupted information storage.

As in Experiment 1, subjects rehearsed pairs of words for various intervals prior to making a rhyme judgment; they decided whether a target word rhymed with either member of a rehearsed pair. Subjects differed, however, in how they were instructed to process the words in preparation for their decision. The "active" rehearsal subjects were told that the purpose of the experiment was to examine how activation
of an item’s permanent (i.e., semantic) memory location affected rhyme reaction time. One group (relational) was told that the formation of images linking the pair items together during repetition was an ideal way of activating these “semantic storage locations.” This cover story was designed to promote relational processing of the pairs throughout the blank delay. A second group of subjects (separate) was told that the formation of separate images for each member of the pair was the best way of exciting semantic memory locations. These instructions were intended to promote “deep,” but not necessarily relational, processing of the pair items during rehearsal. A final group (rote) was told nothing about a hypothetical relationship between semantic memory and rhyme reaction time; they were instructed simply to repeat the pair items aloud until appearance of the target word.

METHOD

Subjects and apparatus

Subjects were 36 undergraduates from an introductory psychology course at the University of Texas who participated for course credit. The stimulus materials were similar to the ones used in the previous experiment, except that care was taken to ensure that all words were highly concrete (that is, images could easily be generated). The apparatus from the previous experiment was used.

Procedure and design

The general characteristics of the rhyme judgment task differed in no significant way from the trial structure of Experiment 1. Subjects rehearsed pairs of words aloud for a short (2 s), medium (6 s), or long (12 s) interval prior to the appearance of a single target word. However, instead of making a decision about which member of the pair rhymed with the target word, subjects merely had to decide whether the target word rhymed with either member of the pair (i.e., they made a yes/no judgment). Subjects received 48 experimental trials with 16 trials from each of the three rehearsal intervals. Each word pair, across subjects, was rehearsed at each of the three rehearsal intervals. The session began with a short block of practice trials.

The critical between-subject manipulation was the instructions that subjects received. These instructions varied in how the subjects were told to process the members of the word pairs in preparation for the rhyme judgment. For the two groups requiring “active” rehearsal, a cover story was created explaining how activation of semantic memory might affect one’s ability to make rhyme judgments. They were not told specifically that semantic memory would help rhyme reaction time; they were told simply that the purpose of the experiment was to find out if a relationship existed. For the relational group, subjects were told that the creation of an image linking the two word-pair items together was an effective means of activating se-
Table 3. Mean recognition scores in Experiment 2

<table>
<thead>
<tr>
<th>Condition</th>
<th>Rehearsal interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Short</td>
</tr>
<tr>
<td>Rote</td>
<td>1.3</td>
</tr>
<tr>
<td>Separate</td>
<td>0.9</td>
</tr>
<tr>
<td>Relational</td>
<td>0.9</td>
</tr>
</tbody>
</table>

*Note.* Values represent recognition responses weighted by the confidence ratings (e.g., +3 for a correct “sure” response and −3 for an incorrect “sure” response).

mantic memory. So, every time the pair was repeated aloud during the blank delay, these subjects were to form an interactive image combining the members of the pair. It should be noted that these subjects were also asked to form a different image linking the two words for every repetition, and an appropriate example was given. Subjects in the separate group were given similar instructions except that they were informed that the formation of separate images for each of the pair items was effective in activating semantic memory. Similarly, these subjects were asked to create a different image for every repetition of the pair and were given an appropriate example. Finally, subjects in the rote group were told nothing about a relationship between semantic memory and reaction time; they were asked just to repeat the pairs aloud until the appearance of the target word.

After the judgment trials and counting backwards, subjects were given a pair-recognition test to assess associative learning. In all respects, this test resembled the one used in Experiment 1: Subjects attempted to select which of two word pairs contained words that had been rehearsed together on the same judgment trial. After selection of the pair, subjects indicated their confidence on a 3-point scale. Words from each of the three rehearsal intervals were represented equally on the test. All subjects received the same final test.

RESULTS AND DISCUSSION

Table 3 shows the mean recognition scores which, as in Experiment 1, were calculated by weighting the recognition responses by the confidence ratings (−3 to +3). The overall ANOVA revealed significant effects of instruction group, $F(2, 33) = 4.48, MS_e = 0.811, p < .03$, rehearsal interval, $F(2, 66) = 3.45, MS_e = 0.477, p < .05$, and the interaction of group with interval, $F(4, 66) = 3.74, MS_e = 0.477, p < .01$. Separate planned ANOVAs confirmed a highly reliable main effect of rehearsal interval for the relational group, $F(2, 22) = 8.53$, and no effect of interval for subjects receiving the separate rehearsal instructions, $F(2, 22) = 1.87$, or the rote instructions, $F(2, 22) < 1$. 

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The mean percentage correct recognition data, without confidence weighting, are shown in Table 4. Once again, there was a significant main effect of interval for the relational subjects, $F(2, 22) = 4.00$, and no interval effect for the separate group, $F(2, 22) = 1.85$, or the rote instructions group, $F(2, 22) < 1$. Clearly, as expected, the formation of images linking the pair items together was the effective learning mechanism throughout the blank delay. These data therefore confirm that the interval manipulation was sensitive enough to detect changes in pair memory as a function of storage time.

The finding of critical interest in Experiment 2, however, is the similar pair-recognition levels for the separate and rote rehearsal groups. This comparison is important because subjects receiving the separate rehearsal instructions presumably devoted a greater amount of cognitive resources to the pair items throughout the rehearsal interval than did subjects in the rote instruction group. Because there is no reason to suspect that only subjects in the relational group followed task instructions, these data indicate that it is possible to maintain items concurrently at deep, semantic levels of processing and not continue to form interitem associations; associative learning is not a necessary by-product of continued contiguity or deep levels of processing. As a result, if one attributes the typical null effect of storage duration during primary rehearsal (at least for recall) to a failure to interassociate rehearsal items, then the present data suggest that such nonassociative processing is not simply the result of the subject’s forming low-level (e.g., phonological) codes (see Glenberg & Adams, 1978); these data also reduce the likelihood that one can attribute the null effect of interval to the low amounts of cognitive resources that are usually devoted to material in primary rehearsal tasks (see Naveh-Benjamin & Jonides, 1984). Instead, the critical determinant of associative learning in this context appears to be relational processing. It was necessary for the subjects explicitly to relate the items together for associative learning to grow throughout the interval. Finally, because the separate rehearsal instructions required interactive processing of the pair items throughout rehearsal, it seems
unlikely that they could have used the kind of passive articulatory loop described by Nairne (1983) or Baddeley and Hitch (1974) to control storage. Storage for these subjects should have been controlled by nonarticulatory central executive processes, yet final pair memory showed no improvement overall or as a function of interval.

GENERAL DISCUSSION

These experiments were designed to examine the formation of associations under task demands that required subjects either to engage in passive maintenance or in active interactions with word pairs throughout a blank storage period. In Experiment 1, where only passive maintenance was required, the results indicated that subjects kept the pairs in a short-term holding pattern that prevented the continued development of associations during storage. Moreover, because the nature of the final decision did not influence how learning changed over interval (both the rhyme and semantic conditions produced null effects of interval), it was argued that subjects may often use a single process to control storage during blank maintenance periods. One suggested possibility was that subjects engage a process similar to Baddeley and Hitch's (1974) articulatory loop.

However, the results of Experiment 2 indicate that rehearsal in contexts where utilization of the loop is unlikely, is not, by necessity, associative. Thus, primary rehearsal, as indexed by the formation of interitem associations, cannot be identified uniquely with operation of the loop or with low levels of devoted cognitive resources (see also Hanley & Thomas, 1984). Primary rehearsal seems to be a control process characterized by the failure of the subject to encode or produce relations among co-rehearsed items, and simply increasing attention or effort is not sufficient to change the nature of this storage process (see also, Bradley & Glenberg, 1983). This does not mean, however, that no learning occurs during primary rehearsal. As Geiselman and Bjork (1980) argued, primary rehearsal may lead the subject to encode intratitem contextual features that can, in some instances, mediate performance on a recognition test but not on a recall test (e.g., Woodward et al., 1973). In that case, the subject may be learning about the item itself, or enhancing its familiarity, rather than learning how the item relates to other information in the rehearsal set.

The current experiments suggest that the continued formation of associations among co-rehearsed items, under incidental learning conditions, may depend upon the subject's engaging in relational processing throughout the maintenance interval. In other words, the
subject may have to be induced, specifically, to process the pair items in an interactive manner to avoid the null effect of interval; associations will not continue to form as a simple by-product of contiguity. This conclusion appears to hold regardless of the level of processing of the individual items during the delay. The present experiments do not provide much insight, however, into the variety of different techniques that may induce such relational processing. It seems unlikely that the formation of interactive images is the only way of achieving this end. For example, it was shown (Nairne, 1983, Experiment 4) that when subjects were uncertain about whether a given pair would have to be repeated aloud, later pair memory improved as a function of actual pair repetitions. In this case, each pair repetition may have required the subject to encode the pair as "two words that needed to be said aloud together"; that is, the processing at each repetition may have resembled the processing seen only at the beginning of a rehearsal interval. Thus, the simple act of programming an overt repetition of two words may be "relational," in the sense of forming an incidental association between the to-be-repeated items.

Note

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References


