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ABSTRACT

This research was directed at determining whether the new item priority (NIP) effect in free recall was a result of an experimental artifact produced by the joint action of the serial position effect and the randomization of items over trials, or a consequence of a strategy of recalling newer items before older ones. In the experiment, subjects free recalled lists with either no randomization, total randomization, or randomization within the primacy, recency, or middle portions of the list. The NIP effect occurred with equal strength across all conditions, and increased over trials. Contrary to previous data, an interpolated delay between study and test did not destroy the NIP effect. It was concluded that the artifact hypothesis was untenable and that a strategy hypothesis best explained the data. (Author/PB)

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# IS THE NEW ITEM PRIORITY EFFECT AN EXPERIMENTAL ARTIFACT?

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# IS THE NEW ITEM PRIORITY EFFECT AN EXPERIMENTAL ARTIFACT?



BY

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THESIS

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# INTRODUCTION

The existence of a new item priority (NIP) effect in multitrial free recall learning has produced a minor controversy. The phenomenon is that previously unrecalled "new" items occur earlier in recall than previously remembered items. This NIP effect is well confirmed. (Battig, Allen, and Jensen, 1965; Battig, 1965; Postman and Keppel, 1968; Shuell and Keppel, 1968; Baddeley, 1968; Roberts, 1969); but the mechanisms which produce it are in question. The NIP effect is surprising because it appears to violate Marbe's law that the order of emission of items is directly related to the strength of the items. This principle has been shown to hold for single trial free recall (Bousfield, Cohen, and Silva, 1956). Two major theoretical accounts of the NIP effect have been put forth.

Battig, et al (1965), who discovered the effect, suggested that Ss follow a strategy of paying special attention to previously unrecalled items and of recalling these items quickly before they are forgotten. The Ss then recall the well learned list items. According to Battig, et al (1965) the NIP effect was independent of the serial position recency effect. Battig and his coauthors did not make explicit the covert mechanisms which could produce the effect. Further papers (Battig, 1965; Battig and Slaybaugh, 1969) restated this strategy hypothesis, but also failed to clarify the theoretical mechanisms which would allow such a strategy to be used.

If the probability of an item being recalled is plotted against its position during list presentation, the familiar serial position curve is obtained. The serial position curve is a U-shaped function; the elevated first portion of the curve is called the primacy area while the raised latter portion is designated by the recency area. Items from the recency curve tend to be recalled first in Ss recall protocols. Several recent investigations have attributed the NIP effect to an experimental artifact produced by the serial position phenomenon (Baddeley, 1968; Postman and Keppel, 1968; Shuell and Keppel, 1968). These investigators argued that the migration of unremembered items from the middle-of-the-list to the favored recency positions of the list produced the NIP effect. Since lists are presented in a different random order on each trial unrecalled middle-of-the-list items would rotate into the recency area. They would then tend to be recalled before previously remembered items no longer in the recency area. Shuell and Keppel (1968) reasoned that if the NIP effect were due to recency then destruction of the recency effect should lead to destruction of NIP. In their study two groups of Ss free recall learned two lists of words for four trials. On one list a 30 second delay was interposed between presentation and recall; on the other list recall was immediate. Glanzer and Cunitz (1966) had shown that a short delay would eliminate the recency effect. As Shuell and Keppel had predicted an NIP effect was found for immediate, but not delayed recall. Baddeley (1968) has replicated their results.

Supporters of the strategy hypothesis have attempted to demonstrate a NIP effect that was independent of recency. Mandler and Griffith (1969) employed a variation of the free recall procedure that added one new word to the beginning, middle, or end of the list per trial. Regardless of the input position, Ss recalled the newly presented item in the first half of recall. The authors argued that this result supported the NIP strategy hypothesis but did consider the possibility of Van Restoroff effects. The newness of the added item would make it unique and unique or conspicuous items are recalled first (Waugh, 1969).

In a study directed at the criticisms of Postman and Keppel (1968) and Shuell and Keppel (1968), Battig and Slaybaugh (1969) attempted to control for recency factors. Subjects learned an 18 item list. On each trial (except the first) the words that occupied the first two and the last two list positions were items that the S had previously recalled. The standard recall rank of each item recalled on each trial was computed by dividing the difference between an item's recall rank and the median recall rank by the standard deviation of recall ranks for that trial. Then the authors computed the mean standard recall ranks of newly-learned items (NL), previously correct items (PC), items presented in the last two serial positions (L2) and items presented in the first two serials positions (F2). Because of the experimental procedure, L2 items and F2 items were always previously correct items. The data for the first half of and the second half of trials to criterion were analyzed separately. Newly learned items had the greatest mean recall rank in the second half of trials to criterion indicating priority, but had a negative recall rank in the first half. The L2 items had a large positive recall rank in both halves of trials to criterion. Battig and Slaybough argued that their data supported the NIP strategy hypothesis and that the strength of the NIP effect increased over trials.

Their data did not justify this conclusion. If the two halves of recall are averaged together, then the order of mean standard recall ranks from highest to lowest (most prior to least prior) is: L2 > NL > F2 > PC. F2 and PC items are both approximately equal to 0. Battig and Slaybough controlled the last two list positions, but with an 18 item list the recency area is closer to 5 positions long (Murdock, 1962). The investigators did not control the next to last three list positions (14, 15, 16). If the NIP effect was a recency artifact as has been suggested, then the obtained order of recall ranks is identical to the ordering that would have been predicted if the list items had been divided as last two items (position 17 and 18) previous three items (positions 14, 15, and 16) first two items, and previously recalled items. Thus the Battig and Slaybough data did not offer strong support for a NIP effect that is independent of recency.

Roberts (1969) employed a part-to-whole free recall task (Tulving, 1967) to investigate the NIP effect. Subjects received 15 trials on a part list of 16 words, then free recall learned for 8 trials a whole list containing the 16 items from the part list plus 16 new items. The 16 added items tended to be recalled prior to the part list items. A multitude of variations between this procedure and the typical free recall method make it difficult to assess the results. Roberts, for example, counted each added item as a "new" item on each trial of the whole list. Thus previously recalled items are counted as new items on later trials of the whole list. Subjects may recall the 16 added items before the part list items, but within the added items may not employ a NIP strategy. The Roberts procedure provides a basis for clustering and organization beyond that provided by the normal procedure. Wood (1969) has shown that items that are presented together tend to be recalled together; Ss may have adopted the strategy of recalling two clusters of items: old list and new items. If the new item cluster were recall first more than half of the time a NIP effect would have been demonstrated. At most Roberts' study can only offer weak support for the independent NIP hypothesis.

Many current theoretical accounts present a two process model of verbal memory (Glanzer and Cunitz, 1966; Murdock, 1967; Glanzer, 1969). According to these theorists both short term and long term memory participate in free recall. Short term memory (STM) consists of a limited capacity storage buffer containing approximately six or seven recently presented items. Long term memory (LTM) contains items that are more permanently stored and are tied to the subject's associative network. During recall the S outputs STM items then LTM items. This dual action has been held to account for the serial position curve. Primacy items are believed to be in LTM while recency items reside in short term storage (Glanzer and Cunitz, 1966; Glanzer and Meinzer, 1967).

One possible model that could reconcile the NIP controversy is based on this two process view of free recall learning. The model would make the NIP effect dependent on STM but independent of nominal recency. The model would assume that through covert processes such as selective attention and rehearsal, Ss could maintain previously unrecalled items in STM during list presentation. Rehearsal could alter the covert recency of list items. In other words, Ss follow a strategy of maintaining new items in STM and then recalling items in STM first. Waugh (1969) used a similar notion to explain Von Resteroff effects. This maintenance in STM hypothesis could account for the negative data of Shuell and Keppel (1968) and Baddeley (1968). Since the NIP effect is dependent on STM, the delay that destroyed STM would also destroy the NIP effect.

The purpose of the present study was to investigate the maintenance in STM hypothesis under conditions that remedied some of the faults of previous studies. Three groups of Ss free recall learned a word list under different degrees of randomization. For one group list order remained constant over trials. For a second group list items were randomized with each of three areas of the 18 item list. The third group enjoyed total list randomization. On one list they recalled immediately after list presentation; on the other a delay occurred between study and test. If the NIP effect were dependent on the migration on unrecalled items to the last list positions (the artifact hypothesis), then no NIP effect should occur in groups 1 and 2, but should appear in group 3. The hypothesis suggested above predicted a NIP effect under all three degrees of randomization. Neither hypothesis would predict an NIP effect for the lists learned with an interpolated delay. Since the artifact hypothesis and the maintenance model suggested here led to differing predictions for groups 1 and 2 with immediate recall, the experiment provided a strong test of these two explanations.

METHOD

Subjects. Sixty-two male and female Ss drawn from the paid volunteer pool at the University of Illinois were used in the study and paid $1.50 for their participation. The Ss were not necessarily naive to free recall experiments. Two Ss failed to follow instructions and were not included in the data analysis.

Design. A two-between, two-within factorial experiment was planned. Three degrees of randomization of list items and two-delay no-delay orders constituted the between S factors. The three degrees of randomization employed were: no randomization (constant order) of list items (NR), constrained randomization of list items within the primacy, recency and middle areas of the list (CR), and overall (total) list randomization (TR). Subjects in the NR condition received the items in the same order on each trial, for Ss in the CR group, the first 6, middle 6, and last 6 items were randomized amongst themselves on each trial. Randomization of all 18 list words on each trial obtained for Ss in the TR condition. The Ss learned two lists of words under one of the above conditions; for one of the list a delay was interposed between presentation and recall; on the other list recall followed immediately after list presentation. The position of the delay (DP) (delay on first list/delay on second list) provided the second between S factor. Each S received 6 trials on each list, trials provided the other within S factor in the analysis of the learning data. In the analysis of the priority data, the list words were divided into two types, newly recalled and previously recalled items. The priority data was collapsed over trials so item type became the other within S factor.

Materials. Two word lists (List A, List B) of 18 items each were constructed from unrelated low frequency (1-10 occurrences per million) nouns taken from the Thorndike-Lorge (1944) list. These were portions of lists that had been used in a previous free recall study (Watts and Anderson, 1969). Appendix A presents the lists. List order (A-B, B-A) was counterbalanced within conditions.

The experiment was performed on the PLATO III computer-based education system developed at the University of Illinois (Bitzer, Hicks, Johnson, and Lyman, 1967; Bitzer, Lyman, and Easley, 1966). PLATO consists of a central computer and 20 independent student stations; each student station contains an electric keyset and a television-like cathode ray screen.

A computer program written by the experimenter was used to control the experiment. PLATO presented instruction to S, displayed the lists with appropriate degrees of randomization, and dismissed S when the experiment was completed.

Procedure. Up to 18 Ss were run in any one experimental session. Subjects were randomly assigned to experimental conditions by order of appearance at the experiment[illegible]. Each S was seated at a PLATO experimental station and sta[illegible] on the system. Subjects read the experimental directions on the television screen, then received two trials on a practice list of four nonsense syllables. The first practice trial employed immediate recall; a filled delayed was interposed between presentation and recall for the second practice list. A digit copying task served as the filler.

Items were shown at a one second rate; after the last item was presented either a message saying "recall the words now" or the digit copying task appeared on the screen. If the digit copying task appeared Ss typed in the digits presented on the screen as fast as they could. At the end of 15 seconds the recall message appeared on the screen. During the recall phase Ss wrote their responses on previously prepared recall sheets. When an S recalled all the items he could, he slipped the sheet into a slitted cardboard box then typed the word READY on the keyset. Typing READY initiated the next trial. After the two practice lists had been presented Ss were given the opportunity to review the directions if they desired or to begin the first experimental trial. Experimental trials proceeded in exactly the same way as the practice trials except that 18 words were shown. Each S received 6 trials on one list with delayed recall and 6 trials on another list with immediate recall. The second list began immediately after the sixth trial on the first list. After the sixth trial on the second list, all Ss were asked to recall all the items they could from both lists. After they had completed this task, PLATO directed them to E who paid and dismissed them.

RESULTS

Priority Data. The major focus of this study concerned the position of newly recalled items in Ss recall protocols. The mean standard recall rank as defined by Battig, Allen, and Jensen (1965) provided the primary measure of item position in recall. The standard recall rank (SRR) is computed by rank ordering the items, subtracting the median from each rank, and dividing the remainder by the standard deviation of recall ranks. A mean SRR was calculated for newly recalled and previously recalled items. Only data from trials 2-6 were used in computing the mean SRRs. On Trial 1 all recalled items are "new" items and the concept of an old item is meaningless. A mixed ANOVA was carried out with the priority data and is summarized in Table 1. Only the F for item type proved significant (F [1,54]=38.05, p .01). New items had larger mean SRR than previously recalled items indicating that new items were typically recalled before old items. Table 2 presents the means.

Table 2 indicates new items were recalled prior to old items within every cell. This means that the NIP effect occurred even with a delay interpolated between presentation and recall. Since the NIP effect is assumed to be dependent on STM, this result should not have occurred.

However, analysis of the serial position curves indicated that the interpolated delay was but partially effective in destroying STM. Serial position curves for Trial 1 are presented in Figure 1, the data were collapsed over the Degree of Randomization factor since at Trial 1 randomization is the same for all groups and inspection of the Trial 1 serial position curves at each level of Degree of Randomization disclosed no essential differences between the three DR levels.

The curves in Figure 1 suggested that the interpolated 15 second delay was not effective in eliminating the recency effect. The recency effect appeared to be about as strong regardless of the presence or absence of the delay. An ANOVA performed on the serial position data supported this conclusion. If a delay suppressed the recency effect then a significant Delay Duration X Item Position interaction should have been observed. As Table 3 indicates only the main effect of Item Position was significant, however. A discussion of the reasons delay did not have an effect is presented later.

Table 1

ANOVA Summary Table for Priority Data

| Source | df | Sum of Squares | F |
|---|---|---|---|
| Between Subjects | | | |
| Degree of Randomization (DR) | 2 | 0.015 | 0.043 |
| Delay Position (DP) | 1 | 0.013 | 0.069 |
| DR x DP | 2 | 0.018 | 0.049 |
| S/DR x DP | 54 | 9.766 | |
| Within Subjects | | | |
| Delay Duration (DD) | 1 | 0.034 | 0.314 |
| DR x DD | 2 | 0.383 | 1.751 |
| DP x DD | 1 | 0.005 | 0.044 |
| DR x DP x DD | 2 | 0.023 | 0.011 |
| S x DD/DR x DP | 54 | 5.907 | |
| Item Type (IT) | 1 | 21.211 | 38.050* |
| DR x IT | 2 | 0.289 | 0.259 |
| DP x IT | 1 | 0.113 | 0.203 |
| DR x DP x IT | 2 | 0.023 | 0.021 |
| S x IT/DR x DP | 54 | 30.103 | |
| DD x IT | 1 | 0.223 | 0.935 |
| DR x DD x IT | 2 | 0.471 | 0.990 |
| DP x DD x IT | 1 | 0.090 | 0.377 |
| DR x DP x DD x IT] | 2 | 0.288 | 0.607 |
| S x DD x IT/DR x DP | 54 | 12.689 | |

*p .01

Table 2

Mean Standard Recall Ranks in Each Experimental Condition

| | Delay | | No Delay | |
|---|---|---|---|---|
| | New Items | Old Items | New Items | Old Items |
| No Randomization | | | | |
| First List Delay | .351 | -.020 | .659 | -.058 |
| Second List Delay | .612 | -.044 | .325 | -.034 |
| Constrained Randomization | | | | |
| First List Delay | .651 | -.164 | .548 | -.147 |
| Second List Delay | .603 | -.234 | .398 | -.013 |
| Total Randomization | | | | |
| First List Delay | .559 | -.101 | .465 | -.102 |
| Second List Delay | .427 | -.031 | .521 | -.064 |

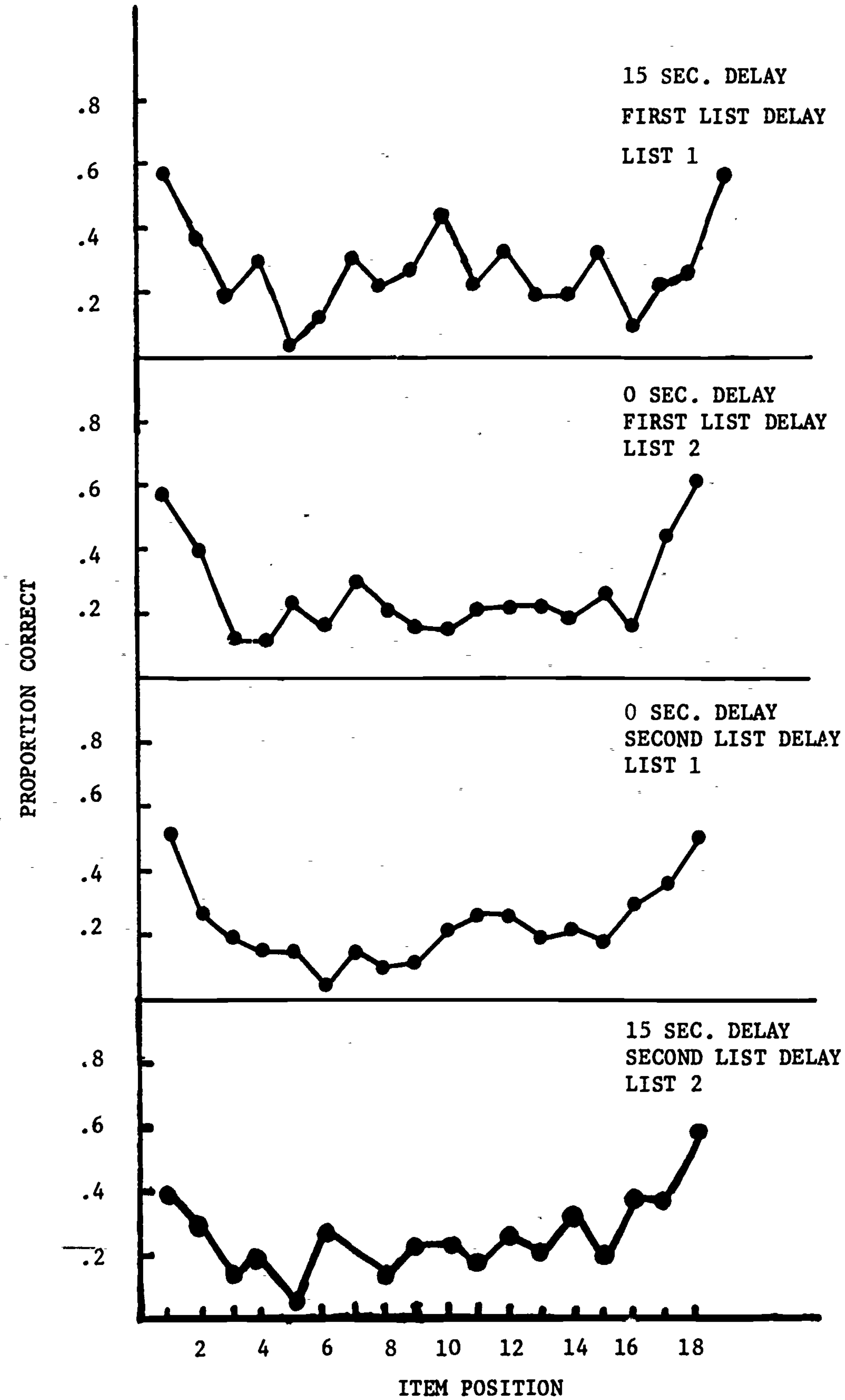


Figure 1. Proportion of correct items in each serial position as a function of Delay Position and Delay Duration

The present experiment demonstrated an increase in the strength of the NIP effect over trials. Figure 2 presents the mean SRRs over trials for Ss who recalled at least one new item on trial. A general rise in the curve through Trial 5 is evident with a sharp drop on the last trial. Since many S had recalled each item at least once by Trial 4 and almost all Ss had recalled each item once by Trial 6 an appropriate statistical analysis was difficult to perform. However, an analysis was performed in which Ss who recalled no new items on a trial were given a SRR of zero. Such a value will tend to reduce difference between first and last trials; thus the analysis must be conservative. This ANOVA produced a significant main effect for trials (P [4,216] = 6.02, p ..01). This finding supports the Battig and Slaybough suggestion that the strength of the NIP effect increases over trials.

An analysis was performed on the number of new items recalled over trials. As would be expected, these decreased as a function of trials (F [4,216] - 134.76, p .01). Figure 3 presents the mean number of new items recalled on trials 2 through 6. The curve is essentially a linear decreasing function of trials. A possible relationship between the number of new items and the strength of the SRR is reserved for the discussion.

Learning Data. An ANOVA was performed upon the number of items recalled on each trial and is summarized in Table 4. Trials produced the only significant main effect, the number of items recalled correctly increased significantly over trials. Figure 4 presents the means. Several of the interactions produced reliable variation in the data. The interaction of the Degree of Randomization and Trials factors was significant; most probably this interaction occurred because the rate of learning varied inversely with the degree of randomization. Subjects in the TR condition learned most slowly, the CR condition produced a medial rate of learning, while the Ss in the NR condition learned most quickly. The interaction of Degree of Randomization X Delay Position X Trials was also significant. The interaction suggested that when an interpolated delay occurred on the first list, there were no differences over trials between the three Degree of Randomization conditions. As can be seen by comparing Figure 4A and 4C with 4B and 4D, the learning curves for the S who received the delay on List 1 (4A and 4C) displayed only small differences between the three degrees of randomization. The difference between Figure 1A and 1C suggests that this effect of a first list delay was stronger on the first list than on the second. By the second list some separation of the three randomization conditions occurred (Figure 4C) while on the first list the curves are essentially colinear (Figure 4A). This difference, no doubt brought about the significant third order interaction (Degree of Randomization X Trials X Delay Position X Delay Duration).

Table 3

ANOVA Summary Table for Serial Position Data

| Source | df | Sum of Squares | F |
|---|---|---|---|
| Between Subjects | | | |
| Delay Position (DP) | 1 | .133 | 0.504 |
| S/ DP | 58 | 15.371 | |
| Within Subjects | | | |
| Delay Duration | 1 | .104 | 0.820 |
| DD x DP | 1 | .004 | 0.033 |
| SX DD / DP | 58 | 7.363 | |
| Item Position (IP) | 17 | 24.147 | 7.389* |
| DP x IP | 17 | 3.558 | 1.089 |
| S x IP/ DP | 986 | 189.545 | |
| DD x IP | 17 | 3.588 | 1.233 |
| DP x DD x IP | 17 | 3.688 | 1.267 |
| S x DD x IP/ DP | 986 | 168.753 | |

*p .01

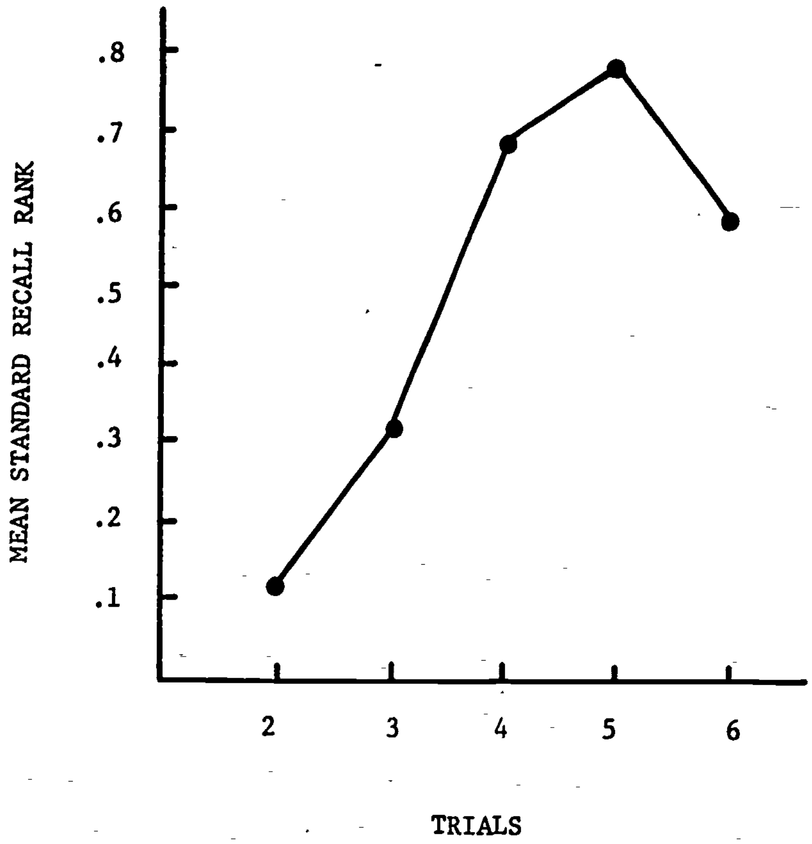


Figure 2. The mean standard recall rank of new items as a function of trials

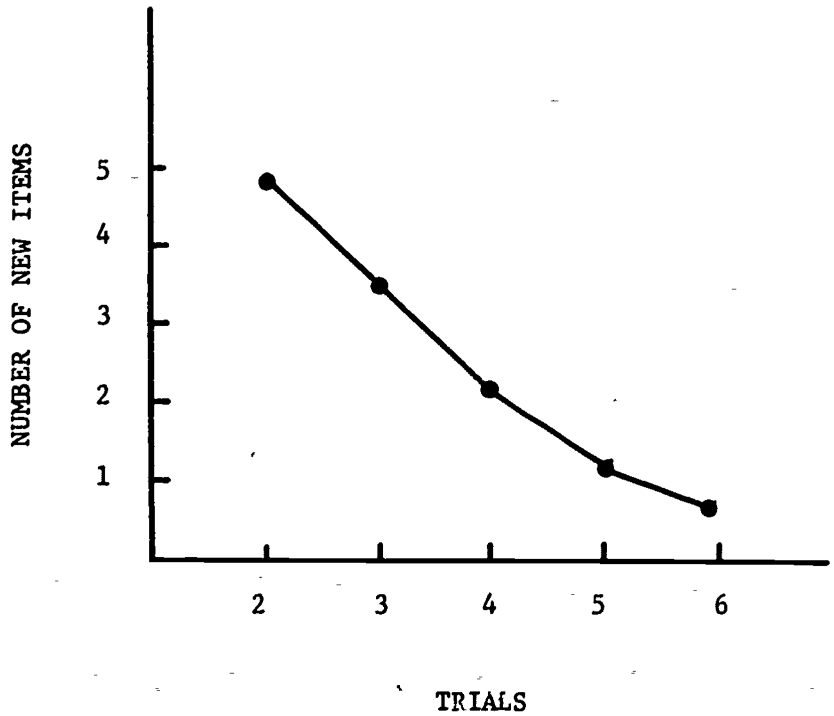


Figure 3. The mean number of new items as a function of trials

Table 4

ANOVA Summary Table for the Learning Data

| Source | df | Sum of Squares | F |
|---|---|---|---|
| Between Subjects | | | |
| Degree of Randomization(DR) | 2 | 271.34 | 2.23 |
| Delay Position (DF) | 1 | 18.05 | 0.30 |
| DR X DP | 2 | 134.43 | 1.10 |
| S/DR X DP | 54 | 3282.08 | |
| Within Subjects | | | |
| Delay Duration (DD) | 1 | 0.005 | 0.0005 |
| DR X DD | 2 | 2.48 | 0.1029 |
| DP X DD | 1 | 3.20 | 0.26 |
| DR X DP X DD | 2 | 5.83 | 0.24 |
| S X DD/ DR X DP | 54 | 650.15 | |
| Trials (T) | 5 | 8549.94 | 594.80** |
| DR X T | 10 | 114.73 | 3.99** |
| DP X T | 5 | 1.95 | 0.14 |
| DR X DP X T | 10 | 59.81 | 2.08* |
| S X T/ DP X DR | 270 | 776.22 | |
| DD X T | 5 | 3.89 | 0.48 |
| DR X DD X T | 10 | 5.27 | 0.32 |
| DP X DD X T | 5 | 7.27 | 0.89 |
| DR X DP X DD X T | 10 | 34.75 | 2.14* |
| S X DD X T/DR X DP | 270 | 439.15 | |

*p .05
**p .01

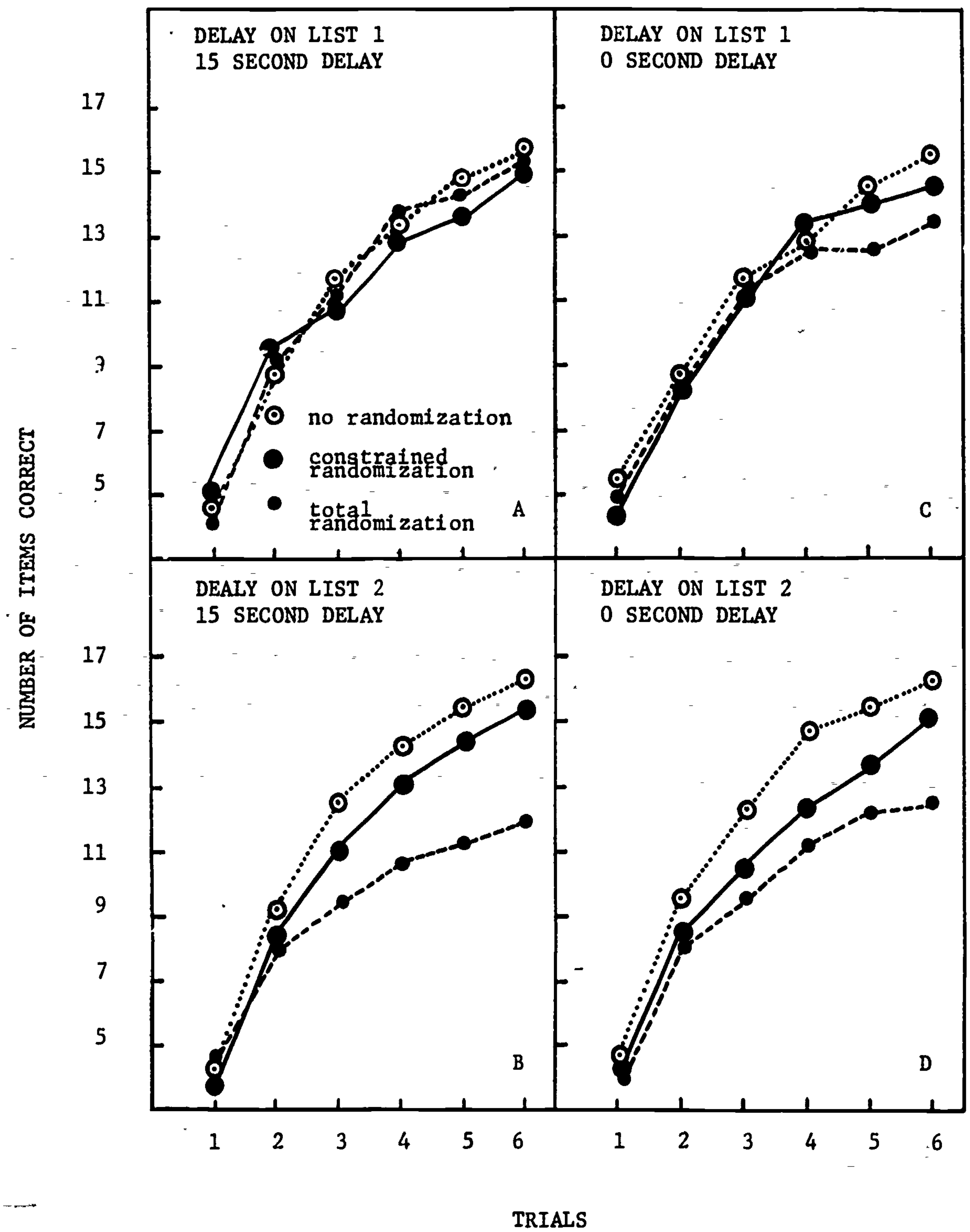


Figure 4. The mean number of items correct as a function of Degree of Randomization, Delay Position, Delay Duration, and Trials

## DISCUSSION

The major finding of this study was that the NIP effect occurred even when it was not possible for unrecalled items to migrate to the recency positions. Subjects displayed an NIP effect with no randomization and constrained randomization of the list as well as with total randomization. This finding effectively refuted the artifact hypothesis of Postman and Keppel (1968) and Shuell and Keppel (1968).

The finding of an NIP effect with all three degrees of randomization was congruent with the maintenance model of the NIP effect proposed in the introduction. According to the maintenance model, Ss selectively attend to and covertly rehearse new items. These activities maintain new items in STM. During test phases Ss recall first items in STM, then recalls more permanently stored items from LTM. Since Ss have maintained new items in STM this procedure produces the NIP effect. As there is no reason to expect that degree or randomization would interact with these hypothesized mechanisms the maintenance model predicts that the NIP effect would be found for each of the three degrees of randomization. As has been said, this result was found.

If the above model were valid, then an interpolated filled delay between study and test should erase the contents of STM and suppress the NIP effect. Indeed previous research (Shuell and Keppel, 1968) had shown that a delay would destroy the recency and NIP effects. However, in the present study a delay had no influence on the NIP effect. Several differences in procedure between this study and previous work could be responsible for these conflicting results.

The 15 second delay used in the present study was shorter than the interval used in prior research. Shuell and Keppel (1968) used a 30 second filled delay. Glanzer and Cunitz (1966) in a study of the effects of delay on recency employed a 10 second and a 30 second interval. Both studies found elimination of the recency effect at the longer interval, but recency was only weakened not destroyed with a 10 second interval. In this earlier work, the experimenters ran Ss individually. The Ss in this current study performed under the control of a computer-based teaching system. Subjects being observed by a human experimenter may have concentrated more on a boring delay task than Ss performing for a machine. This study employed a digit typing task while previous work had used a counting backwards task to fill the delay interval. On an introspective basis, the backwards counting task seemed more demanding than the simple copying of digits presented on the PLATO screen. All of these factors could have operated to weaken the effectiveness of the delay interval in eliminating STM. The task probably did not require all of the Ss attention, thus covert rehearsal of list items may have occurred. By hypothesis, such rehearsal would have maintained items in STM and permitted an NIP effect. Thus the failure of an interposed delay to destroy the NIP effect may reflect inadequacies in the experimental procedure of this study rather than faults in the proposed model. Further research would, of course, be necessary to explicate this point.

The increase in magnitude of the mean SRRS over trials suggested that the strength of the NIP effect increased over trials. Battig and Slaybough (1969) had also noted such an increase in NIP strength. In fact, in the Battig and Slaybough study new items had negative mean SRRs on early recall trials, but shifted to a high positive SRR during later trials. Battig and Slaybough argued that this data supported the hypothesis of an increase in NIP strength over trials.

Before their data can be used to support such a conclusion, however, a problem with the SRR as a measure of priority must be considered. Because of the way it is computed, the magnitude of the SRR is extremely dependent on the number of new items recalled. The increase in mean SRR may be due simply to the decrease over trials in the number of new items recalled. Consider a case in which on an early trial a Ss recalls five items, the first three of which are new. The S's mean SRR for that trial is 1.22. On a subsequent trial the S recalls nine items only the first of which is new. Thus a higher SRR is obtained for later trials than for the earlier trials, but in both cases all new items occurred before the old items. Since the number of new items recalled must and does decrease over trials (Table 4), the increase in the mean SRRs may not reflect an increase in the strength of the NIP effect, but may be simply an artifactual increase.

The expected proportion of new items in each quarter of each trial is .25. If this value is subtracted from the observed proportion, the resulting measure is independent of the number of new items. An ANOVA using this measure supported the hypothesis of an increase in NIP strength with trials. Significant F-values were obtained for the Quarter of Recall factor (F [3,17] = 25.82, p. .01) and for the Quarter of Recall by Trials interaction (F [12,684] = 7.20, p .01). As can be seen from the graphs in Figure 5 more new items occurred in the first quarter of recall than in other quarters and this percentage increased over trials.

This data strongly argues for an increase in the strength of the NIP effect over trials. Such an increase in strength is reasonable; as trials increase and the number of new items left decreases, the remaining unrecalled items become more unique or conspicuous. Waugh (1969) has used a model similar to the maintenance in STM model to explain the prior recall of unique, conspicuous items. Making the new items more unique should thus make it easier for an S to employ a maintenance strategy.

The finding that rate of learning a list is inversely related to the degree of randomization of the list over trials supported previous work by Jung and Skeebo (1967). These authors had found that recall of lists presented in constant order was superior to the recall of lists presented randomly. This experiment replicated their work and additionally demonstrated that recall with an intermediate degree of randomization was superior to total randomization but inferior to recall of items presented in a constant order. Apparently Ss made use of positional cues in free recalling the lists.

The major findings of this study may be stated concisely. The artifact hypothesis of the NIP effect suggested by Postman and Keppel (1968) and Shuell and Keppel (1968) was effectively refuted. The NIP effect should be regarded as a real psychological phenomenon. This is an important result for it implies that the S is processing the information in more sophisticated manner than had been heretofore assumed. The processing model of free recall presented by Glanzer and Cunitz (1966) and Glanzer and Meinzer (1967). Subjects through the use of processes such as selective attention and covert rehearsal maintain selected items in the short term store. Although the data did not entirely support the predictions of the model the experimental procedure rather than the model may have been at fault. The failure of an interpolated delay to eliminate the NIP effect was likely due to a short delay interval and an ineffective filler task. This study confirmed and extended previous research that demonstrated an inverse relationship between degree of randomization and rate of learning.

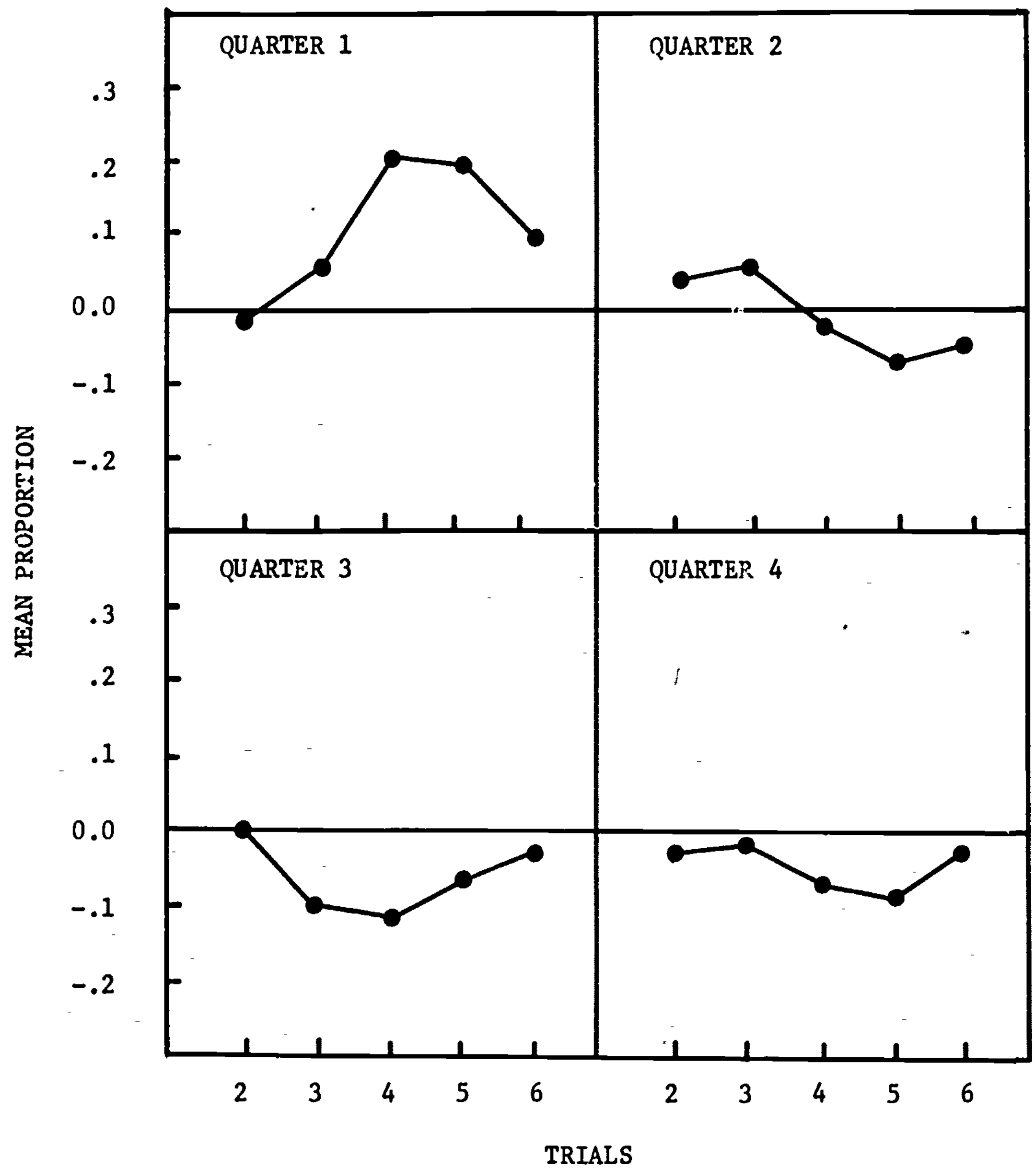


Figure 5. The mean proportion of observed minus expected new items in each quarter of recall as a function of trials

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## Appendix A

### Word Lists Used in this Study

| List A | List B |
|---|---|
| adobe | annex |
| canyon | bale |
| debtor | canteen |
| gill | elegy |
| hawser | fiend |
| idyl | ingot |
| jester | lard |
| kennel | mallet |
| latch | niece |
| necklace | oxide |
| octave | rector |
| paraffin | salon |
| quary | target |
| rabble | urban |
| sandal | valve |
| tallow | whist |
| veneer | yolk |
| zephyr | zinc |

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13. ABSTRACT

The new item priority (NIP) effect in free recall has been attributed to an experimental artifact produced by the joint action of the serial position effect and the randomization of items over trials. A competing hypothesis is that NIP results from a strategy of recalling new items before old items. In this experiment Ss free recalled lists with either no randomization, total randomization, or randomization within the primacy, recency, or middle portions of the list. The NIP effect occurred equally strongly across all conditions and increased over trials. Contrary to previous data an interpolated delay between study and test did not destroy the NIP effect. It was concluded that the artifact hypothesis was untenable and that a strategy hypothesis best explained the data.

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