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Determinants of Short-term Forgetting: Decay, Retroactive Interference or Proactive Interference?

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Abstract

In two experiments short-term forgetting was investigated in a short-term cued recall task designed to examine proactive interference effects. Mixed modality study lists were tested at varying retention intervals using verbal and non-verbal distractor activities. When an interfering foil was read aloud and a target item read silently, strong PI effects were observed for both types of distractor activity. When the target was read aloud and followed by a verbal distractor activity, weak PI effects emerged. However, when a target item was read aloud and non-verbal distractor activity filled the retention interval, performance was immune to the effects of PI for at least eight seconds. The results indicate that phonological representations of items read aloud still influence performance after 15 seconds of distractor activity.

Determinants of Short-term Forgetting: Decay, Retroactive Interference or Proactive Interference?

Most current models of short-term memory assert that to-be-remembered items are represented in terms of easily degraded phonological representations. However, there is disagreement on how the traces become degraded. Some propose that trace degradation is due to decay brought about by the prevention of rehearsal (Baddeley, 1986; Burgess & Hitch, 1992; 1996), or a switch in attention (Cowan, 1993); others attribute degradation to retroactive interference (RI) from other list items (Nairne, 1990; Tehan & Fallon; in press; Tehan & Humphreys, 1998). We want to add proactive interference (PI) to the possible causes of short-term forgetting, and by showing how PI effects change as a function of the type of distractor task employed during a filled retention interval, we hope to evaluate the causes of trace degradation.

By manipulating the type of distractor activity in a brief retention interval it is possible to test some of the assumptions about decay versus interference explanations of short-term forgetting. The decay position is quite straightforward. If rehearsal is prevented, then the trace should decay; the type of distractor activity should be immaterial as long as rehearsal is prevented. From the interference perspective both the Feature Model (Nairne, 1990) and the Tehan and Humphreys (1995,1998) connectionist model predict that there should be occasions where very little forgetting occurs.

In the Feature Model items are represented as sets of modality dependent and modality independent features. Forgetting occurs when adjacent list items have common features. Some of the shared features of the first item are overwritten by the latter item, thereby producing a trace that bears only partial resemblance to the original item. One occasion in which interference would be minimized is when an auditory list is followed by a non-auditory distractor task. The modality dependent features of the list items would not be overwritten or degraded by the distractor activity because the modality dependent features of the list and distractor items are different to each other. By the same logic, a visually presented list should not be affected by an auditory distractor task, since modality specific features are again different in each case.

In the Tehan and Humphreys (1995) approach, presentation modality is related to the strength of phonological representations that support recall. They assume that auditory activity produces stronger representations than does visual activity. Thus this model also predicts that when a list is presented auditorially, it will not be much affected by subsequent non-auditory distractor activity. However, in the case of a visual list with auditory distraction, the assumption would be that interference would be maximised. The phonological codes for the list items would be relatively weak in the first instance and a strong source of auditory retroactive interference follows. This prediction is the opposite of that derived from the Feature Model. Since PI effects appear to be sensitive to retention interval effects (Tehan & Humphreys, 1995; Wickens, Moody & Dow, 1981), we have chosen to employ a PI task to explore these differential predictions.

We have recently developed a short-term cued recall task in which PI can easily be manipulated (Tehan & Humphreys, 1995; 1996; 1998). In this task, participants study a series of trials in which items are presented in blocks of four items with each trial consisting of either one or two blocks. Each trial has a target item that is an instance of either a taxonomic or rhyme category, and the category label is presented at test as a retrieval cue. The two-block trials are the important trials because it is in these trials that PI is manipulated. In these trials the two blocks are presented under directed forgetting instructions. That is, once participants find out that it is a two-block trial they are to forget the first block and remember the second block because the second block contains the target item. On control trials, all non-target items in both blocks are unrelated to the target. On interference trials, a foil that is related to the target is embedded among three other to-be-forgotten fillers in the first block and the target is embedded among three unrelated filler items in the second block. Following the presentation of the second block the category cue is presented and subjects are asked to recall the word from the second block that is an instance of that category.

Using this task we have been able to show that when taxonomic categories are used on an immediate test (e.g., *dog* is the foil, *cat* is the target and *ANIMAL* is the cue), performance is immune to PI. However, when recall is tested after a 2-second filled retention interval, PI effects are observed; target recall is depressed and the foil is often recalled instead of the target.

In explaining these results, Tehan and Humphreys (1995) assumed that items were represented in terms of sets of features. The representation of an item was seen to involve both semantic and phonological features, with the phonological features playing a dominant role in item recall. They assumed that the cue would elicit the representations of the two items in the list, and that while the semantic features of both target and foil would be available, only the target would have active phonological features. Thus on an immediate test, knowing that the target ended in -*at* would make the task of discriminating between *cat* and *dog* relatively easy. On a delayed test they assumed that all phonological features were inactive and the absence of phonological information would make discrimination more difficult.

A corollary of the Tehan and Humphreys (1995) assumption is that if phonological codes could be provided for a non-rhyming foil, then discrimination should again be problematic. Presentation modality is one variable that appears to produce differences in strength of phonological codes with reading aloud producing stronger representations than reading silently. Tehan and Humphreys (Experiment 5) varied the modality of the two blocks such that participants either read the first block silently and then read the second block aloud or vice versa. In the silent aloud condition performance was immune to PI. The assumption was that the phonological representation of the target item in the second block was very strong with the result that there were no problems in discrimination. However, PI effects were present in the aloud-silent condition. The phonological representation of the read-aloud foil appeared to serve as a strong source of competition to the read-silently target item.

All the above research has been based on the premise that phonological representations for visually presented items are weak and rapidly lose their ability to support recall. This assumption seems tenable given that phonological similarity effects and phonological intrusion effects in serial recall are attenuated rapidly with brief periods of distractor activity (Conrad, 1967; Estes, 1973; Tehan & Humphreys, 1995). The cued recall experiments that have used a filled retention interval have always employed silent visual presentation of the study list and required spoken shadowing of the distractor items. That is, the phonological representations of both target and foil are assumed to be quite weak and the shadowing task would provide a strong source of interference. These are likely to be the conditions that produce maximum levels of PI. The patterns of PI may change with mixed modality study lists and alternative forms of distractor activity. For example, given a strong phonological representation of the target, weak representations of the foil and a weak source of retroactive interference, it might be possible to observe immunity to PI on a delayed test. The following experiments explore the relationship between presentation modality, distractor modality and PI

Experiment 1

The Tehan and Humphreys (1995) mixed modality experiment indicated that PI effects were sensitive to the modalities of the first and second block of items. In the current study we use mixed modality study lists but this time include a two-second retention interval, the same as that used by Tehan and Humphreys. However, the modality of the distractor activity was varied as well. Participants either had to respond aloud verbally or make a manual response that did not involve any verbal output. From the Tehan and Humphreys perspective the assumption made is that the verbal distractor activity will produce more disruption to the phonological representation of the target item than will a non-verbal distractor activity and the PI will be observed. However, it is quite possible that with silent-aloud presentation and a non-verbal distractor activity immunity to PI might be maintained across a two-second retention interval. From the Nairne perspective, interference effects are likely to be maximised when the modalities of second block and the distractor activity are the same. From the decay perspective, as long as rehearsal is prevented the modality of the distractor should not be an issue.

Method

Participants. Twenty first-year students from the University of Southern Queensland voluntarily participated in this experiment for course credit or a free ticket in a raffle for a cash prize of 200 dollars.

Materials.

For the critical items, two instances were sampled from 40 taxonomic categories (McEvoy & Nelson, 1982). The item selected to be an interfering foil was a high dominant instance of the category and the target was a relatively weak member of the category. The filler items were selected from the unused categories from the McEvoy and Nelson norms and from the Shapiro and Palermo (1970) norms, such that there was no overlap between the category membership of filler and critical items.

The experiment consisted of ten one-block trials and forty two-block trials. In the standard version of this task, category specific proactive interference is manipulated in the two block trials in that on an interference trial an interfering foil from the same category as the target item is presented in the first block, and the target appears in the second block. On control or non-interference trials, a target item is presented in the second block with no related item in the first block. In creating the trials for each subject, the target and foil were first randomly assigned to the various experimental conditions. On the 20 interference trials the target and foil were then embedded amongst randomly selected filler items such that two four-item blocks were created. In the case of the 20 control or non-interference trials, the interfering foil was replaced by a filler item, such that the target was the only instance of the category in the list. On the interference trials, foil and target always appeared in the same serial position (on half the trials in position 2 and on the other half in position 3) in their respective blocks. For half the interference and control trials, the word SILENT appeared before the first block and ALOUD appeared before the second block. For the remaining half, the order was reversed. ALOUD appeared before the first block and SILENT appeared before the second block.

All experiments also contain a number of one-block trials that were also tested via immediate cued recall. The order of the filler and experimental trials were randomised for each subject.

Procedure. At the beginning of the experiment subjects were informed that they would be studying a series of one-block and two-block trials, in which each block consisted of four words. It was stressed that at any one point in time they only had to remember the most recent block. Consequently, if the trial was a two-block trial, they were to forget the first block and concentrate on remembering the second block because it would be on this block that they would be tested. They were also told that prior to each block being presented they would receive an instruction about the reading of each item in the block. If the instruction was SILENT they were to read the following four items silently to themselves, but if the instruction was ALOUD they were to read the following four words aloud as they appeared on the screen.

Each trial began with a READY sign displayed on the computer monitor for two seconds. The reading instruction was then presented for one second. The block one items were then displayed individually in lower case at a rate of one word per second. The second reading instruction was then presented again for one second and then the block two items were presented at a rate of one second. Following the presentation of the last item in the second block, two two-digit strings were presented for one second each. A third of the subjects were asked to read each digit string aloud as it appeared on the screen. This replicates the shadowing procedure that Tehan and Humphreys (1995) used. The remaining two groups were requested to make a magnitude judgement about each digit string as soon as it appeared on the screen. They simply had to indicate if the digit string was greater than 50 or less than 50. The way in which this decision was reported differed for two sets of participants. One set of participants reported their judgements verbally by simply saying “smaller” or ‘larger”; the second group made no verbal response, instead they hit either the “S” on the keyboard for the smaller judgement or the “L” key when the digit pair was larger than 50. They had one second to make a response before the second digit string was presented and the second response had to be made. After the second response had been made, the category cue appeared and subjects had five seconds to attempt recall of the instance of that category that had appeared in the second block.

Results

Mean levels of correct recall and errors made, for each condition is presented in Figure 1.

Correct recall. The data were analysed by a 3 x 2 x 2 mixed factorial analysis of variance, with distractor (3 levels) as the between subjects factor and modality (2 levels) and interference (2 levels) each as within subjects factors. An alpha level of .05 was used as a bench mark for statistical significance in this and subsequent analyses. There was a significant main effect for distractor activity, F (2,57) = 9.90; MSe = 57.27. A Newman-Keuls post-hoc test indicated that recall was significantly better in the keyboard distractor condition (M = 6.55) than the shadowing (M = 5.40) and verbal (M = 4.90) distractor conditions, the latter two not differing from each other. Recall was better in the silent-aloud condition than in the aloud silent condition, F (1,57) = 152.43; MSe = 620.82. PI effects were also present, F (1,57) = 1.65; MSe = 19.27, but a significant modality by interference interaction was also obtained, F (1,57) = 4.76; MSe 6.02. Simple main effects analysis indicated that interference effects were present in the aloud-silent conditions, F (1,59) = 15.13, but not in the silent-aloud condition, F (1,59) = 1.44. No other interactions were reliable.

Errors. Omission errors and block one intrusions constituted a major source of error as evidenced in Figure 1. For omissions, there was a significant main effect for the distractor activity, F (2,57) = 4.98; MSe = 28.39. A Newman-Keuls analysis showed that significantly fewer omission errors were made after the keyboard distractor activity (M = 2.16) than after the shadowing (M = 3.17) and verbal (M = 3.21) distractor activities, which did not differ from each other. Omissions were more frequent in the aloud-silent condition than in the silent-aloud condition, F (1,57) = 47.33; MSe = 98.82. Finally, overall there were more omission errors in the non-interference condition than in the interference condition, F (1,57) = 92.30; MSe = 166.67. A significant modality by interference interaction was evident, F (1, 57) = 38.30; MSe = 98.82. Main effects analysis indicated that the high frequency of omissions in the non-interference condition was present in the aloud-silent condition, F (1,59) = 101.8, but not in the silent-aloud condition, F (1,59) = 2.37. No other interactions reached significance.

The Block one intrusions, pictured in Figure 1, were submitted to a 3 x 2 mixed factorial analysis of variance. None of the interactions reached significance, however, the foil was recalled more frequently in the aloud-silent condition than the silent-aloud condition, F = (1,57) = 159.04; MSe = 357.08. The main effect for the distractor tasks approached statistical significance, F = (2,57) = 2.70; MSe = 8.41, $p < .076$.

Discussion

There are two aspects to the current results that are of primary interest. The first is that the effects of the distractor activity separate along a verbal/non-verbal dimension rather than a shadowing/magnitude estimation dimension. The equivalence of the shadowing and spoken magnitude response would suggest that the two tasks are equally difficult. However, verbal aspects of the distractor activity are producing more disruption than the keyboard response. One possibility here is that subjects may surreptitiously rehearse while making the manual response. We think that this is unlikely; finding and pressing the S key is probably less automatic than verbally responding “smaller” and given that subjects have only 1 second to process and respond, we do not think that there is sufficient time available to switch attention between rehearsal and distractor tasks.

The interaction of PI effects with presentation modality of the second block is another key aspect of the results. Immunity to PI is observed in the silent-aloud condition; target recall is equivalent in the interference and control conditions and block one intrusions occur relatively infrequently. In the aloud-silent lists target recall is depressed in the interference conditions and block one intrusions represent a major source of error. In other words, strong PI effects are evident. This is exactly the same pattern of performance that Tehan and Humphreys (1995) found on an immediate test. Consequently, the explanations provided by Tehan and Humphreys seem appropriate in this instance.

The fact that immunity to PI is observed after a two-second retention interval is something that we have not found before. If the argument presented in this paper is correct then the phonological features of the auditory target item are able to survive two seconds of distractor activity. Furthermore, the strength of the block-1 intrusions would indicate that the phonological representation of the foil in the aloud-silent condition appears to survive for even a longer period of time. Longoni, Richardson and Aiello (1993) have provided some evidence to suggest that phonological codes may not be as transient as most people think. In the next experiment we looked at forgetting over retention intervals ranging from one second to eight seconds. Again we were interested in the effects of the different distractor activity on PI and modality effects.

Experiment 2

Method

Participants. Two hundred undergraduates, from introductory psychology units, served as participants. They were given course credit for participating in the experiment. One hundred participants were assigned to the verbal distractor condition and these participants were further divided into groups of twenty participants for each of the five retention intervals. The remaining hundred participants engaged in the keyboard distractor condition with groups of twenty participants performing under the five different retention intervals.

Materials and Procedure. The number of trials and the formation were exactly the same as those adopted in Experiment 1. In this experiment only two types of distractor activities were employed; the verbal and keyboard versions of the magnitude estimation task. Five retention intervals were used; one second, two seconds, three second, four seconds and eight seconds. For each retention interval the number of digit strings presented after the last item in each trial varied such that participants were making a magnitude estimation judgement once every second, for the respective retention intervals.

Results

The data are summarised in Figure 2.

Correct recall. The correct recall scores were subjected to a 2 x 2 x 2 x 5 mixed factorial analysis of variance. The analysis showed a significant effect for retention interval, F (4,190) = 24.54; MSe = 180.44. The verbal distractor was more disruptive than the keyboard distractor, F (1,190) = 8.76; MSe = 64.41. There was a highly significant main effect for modality of presentation, F (1, 190) = 540.61; MSe = 1725.78, and target recall was better in the control trials than interference trials, F (1,190) = 161.93; MSe = 258.78. These main effects were moderated by a three way interaction between distractor, modality and interference, F (1, 190) = 5.89; MSe = 9.90. All other significant interactions are incorporated in this three-way interaction. As is evident in Figure 2, the key finding underlying this interaction is that no reliable differences between the control and interference trials were observed in the silent-aloud condition when a keyboard distractor was required, F (1, 95) = 1.46; MSe = 1.37. However, PI effects were present in the aloud-silent condition exposed to a verbal distractor activity; F (1, 95) = 72.58; MSe = 1.83, the aloud-silent condition under keyboard distraction; F (1, 95) = 75.68; MSe = 1.78, and the silent-aloud condition after verbal distraction F (1, 95) = 37.00; MSe = 1.58.

Omission errors. The pattern of omission errors was basically the same as in Experiment 1. Main effects for retention interval, F (4,190) = 17.00; MSe = 67.26, presentation modality, F (1,190) = 104.35; MSe = 182.40, and interference, F (1,190) = 231.32; MSe = 471.24, were found. There was no main effect for distractor type, F (1, 190) = 1.38; MSe = 5.45. The interaction between distractor, modality and interference was significant, F (4,190) = 4.33; MSe = 8.41. For all comparisons involved, significantly more omissions were made in the control condition than the interference condition but the effects were stronger in the aloud-silent condition; aloud-silent verbal distractor, [M control = 4.05, M Interference = 1.30] F (1,99) = 139.94, aloud-silent keyboard distractor, [M control = 3.81, M Interference = 1.53] F (1,99) = 87.05, silent-aloud verbal distractor, [M control = 1.90, M Interference = 1.50] F (1,99) = 7.29, and silent-aloud keyboard distractor, [M control = 1.94, M Interference = 1.18] F (1,99) = 16.08.

Block one intrusions. Analysis of recall of the foil indicated that there were main effects for modality of presentation, $F(1,190) = 529.25$; $MSe = 2.20$, type of distractor activity, $F(1,190) = 9.63$; $MSe = 3.37$ and retention interval, $F(4,190) = 12.49$; $MSe = 3.37$. The interaction between retention interval and presentation modality was the only significant interaction, $F(4,190) = 4.30$; $MSe = 2.20$. Simple main effects analyses indicated that production of the foil increased with retention interval in the aloud-silent condition, $F(1,198) = 13.55$; $MSe = 1.55$, but remained constant across retention intervals for the silent-aloud conditions, $F(1,198) = 2.44$; $MSe = 4.91$.

Discussion

The results of the experiment are quite straightforward. Again the verbal distractor produces more disruption than the keyboard distractor. As was the case in Experiment 1, there is a relationship between PI effects and presentation modality. In the aloud-silent conditions, PI effects are present for both types of distractor activity. In the silent-aloud condition PI effects are present with a verbal distractor, a result that was not observed in experiment 1. However, immunity to PI is again found with a keyboard distractor, even after 8 seconds of distraction.

If it is true that phonological representations play a key role in determining the presence or absence of PI effects, then the current results speak to the susceptibility of these representations to degradation. In the silent-aloud condition with a non-verbal distractor, target recall remains quite high and there is minimal effect of a visually presented foil. These data suggest that a phonological representation of the target can be held for at least 8 seconds with little degradation. However, with a verbal distractor activity, it would appear that some degradation of the phonological trace is produced.

Interference effects are observed across all retention intervals, both in terms of depressed target recall and frequency of block one intrusions.

In some senses, the aloud-silent condition is more interesting. In both the verbal and non-verbal distractor conditions the foil has a large impact upon performance. There are two possible explanations for this: In the first case, Tehan and Humphreys' (1995) initial experiments used mixed modality lists to engender a strong phonological representation of the foil. They found PI effects on an immediate test, just as we find PI effects on a delayed test. They argued that they had been successful in maintaining phonological codes for the foil. Given that the visual distractor activity had little impact on the phonological codes for the target in the current experiment it is possible that the phonological representation of the foil is surviving intact across the different retention intervals. If this is so it would indicate that phonological codes can last for at least 15 to 16 seconds of subsequent activity. The data also suggest that the discrimination between target and foil becomes more difficult at longer retention intervals. Given strong pre-experimental differences between the foil and the target and a strong phonological representation of the foil, recall of the target would become increasingly difficult and recall of the foil would increase as the phonological representation of the target weakens.

The alternative explanation is that the phonological codes have dissipated for both the target and the foil and that the differences we observe are due to the pre-existing differences in category dominance of the target and the foil[1]. If this argument is correct, then performance in the aloud-silent condition should look very similar to performance in a silent-silent condition since in both instances the phonological codes for target and foil no longer support recall. To test for these possibilities a post hoc experiment was conducted using a silent-silent presentation condition with three groups of subjects exposed to either two, four or eight seconds of verbal distractor activity. The results of these groups are presented in the lowest panel in Figure 2. Comparing this condition to the aloud-silent condition with verbal distraction, it is clear that performance is reasonably similar in the control conditions, but there are large differences between the interference conditions in terms of target recall and block one intrusions. In other words, the modality of the first block is having an impact upon performance. Hence, it is concluded that the phonological representation of the foil is surviving the distractor activity across all retention intervals when the foil is read aloud.

General Discussion

The arguments presented in the current paper are based on three assumptions: Firstly, short-term recall is supported by phonological codes. Secondly, input via audition produces stronger phonological representations than input solely through the visual pathways and finally strong phonological codes are responsible for immunity to PI in short-term recall. In a sense, PI effects have been used as the dependent measure to investigate the effects of modality of presentation and distractor activity in relation to forgetting associated with phonological representations. The results indicate that in mixed modality lists, items that are read aloud appear to have stronger phonological representations than items that are read silently. In the cued recall task, PI effects are either absent or weak when the target is read aloud. On the other hand, PI effects are very strong when the foil is read aloud. The strength of PI effects do not radically change with the type of distractor used or with changes in retention interval.

Several authors, ourselves included, have suggested that phonological codes are relatively transient in that they either decay rapidly (Baddeley, 1986) or are prone to retroactive interference (Nairne, 1990; Tehan & Humphreys, 1995). In the current experiments, phonological codes that are the result of auditory input do not rapidly loose strength with a non-verbal distractor. The effects can be observed after 15 seconds of presentation and distractor activity. This finding is inconsistent with the idea of a rapidly decaying trace.

The absence of strong phonological information is not the sole source of forgetting in these experiments. If one looks at the silent/aloud condition with the keyboard distractor, it is clear that there is very little PI involved. Presumably there is very little degradation of the phonological trace of the target. However, there is forgetting involved in both the interference and control trials, in that absolute levels of target recall deteriorate across retention intervals. There are three possible explanations for this effect. The phonological representations are being degraded by subsequent activity, but only marginally so. The non-verbal distractor activity may not degrade the phonological representations of the target or foil per se, instead it may produce a noisier background for retrieval. Thirdly, the distractor activity may well be incorporated into the list structure such that the target has to be discriminated from an increased number of filler items. Current accounts of such discrimination processes suggest that this is easier to do when the retrieval interval is short rather than long. Whatever the account of the retention interval effects in this and other conditions, forgetting is not likely to be due to the rapid decay of phonological representations.

With verbal distractor activity we see some evidence of increased levels of interference, in that in the no-interference conditions there is an increase in the number of omission errors; in the interference conditions block-1 intrusions increase in frequency. These findings can again be explained in terms of increased degradation of the phonological trace of the targets, or verbal distractor activity providing a noisier background for retrieval than the non-verbal distractor.

While auditory phonological representations may persist for some time, the same is not true of the representations that are the result of unspoken visual input. Here there is evidence for the rapid degradation of the phonological trace. In the aloud-silent conditions we see that in the control lists the number of omissions increases dramatically across retention interval as does the number of block-1 intrusions on the interference trials. These findings indicate that the phonological representations rapidly loose their ability to support recall. As to a cause of the disruption, interference effects are again implicated in this process in that verbal distractor activity produces more disruption than non-verbal distractor activity.

The present research has implications for current theories of short-term memory. Most current theories that address the issue of forgetting assume trace decay as the forgetting mechanism (Baddeley, 1986; Burgess & Hitch, 1996; Schweickert, 1993). The results of the current experiments cast doubt on the forgetting assumptions of these models. Nairne’s (1990) feature model and Tehan and Humphreys (1995) explanation of PI assume that forgetting is based upon retroactive interference. Both stress that the modality of the distractor is an important determinant of forgetting such that little degradation occurs if the modality of the distractor is appropriate. There are some differences between the two accounts however. Tehan and Humphreys make the assumption that auditory distractor activity will produce more disruption than non-verbal distractor activity irrespective of the modality of the study material, and this is what emerges in the two experiments. The results of the aloud-silent condition do pose some problems for the Feature Model. Visual distractors should produce more disruption than auditory distractors. This does not happen; auditory distractors produce more disruption than the visual distractors across all experimental conditions.

This investigation commenced with the observation that very little research had attempted to look at different sources of forgetting. The research presented here is based on the assumption that phonological codes support short-term recall. If this assumption were true then it would appear that auditory presentation leads to stronger phonological representations than visual presentation. This can lead to good memory performance or to strong interference effects depending upon just which items have been strongly activated. If there is a strong phonological representation for a target item then by in large the effects of PI are minimised and this is particularly true if the strength of the items used as a distractor activity is low. However, if the representations of the distractor items are strong then RI effects are enhanced and together with this PI effects are exacerbated as well. The current results indicate that interference effects are readily observed in short-term cued recall and that if there are any pure decay effects, they are happening at a much slower rate than has previously been observed.

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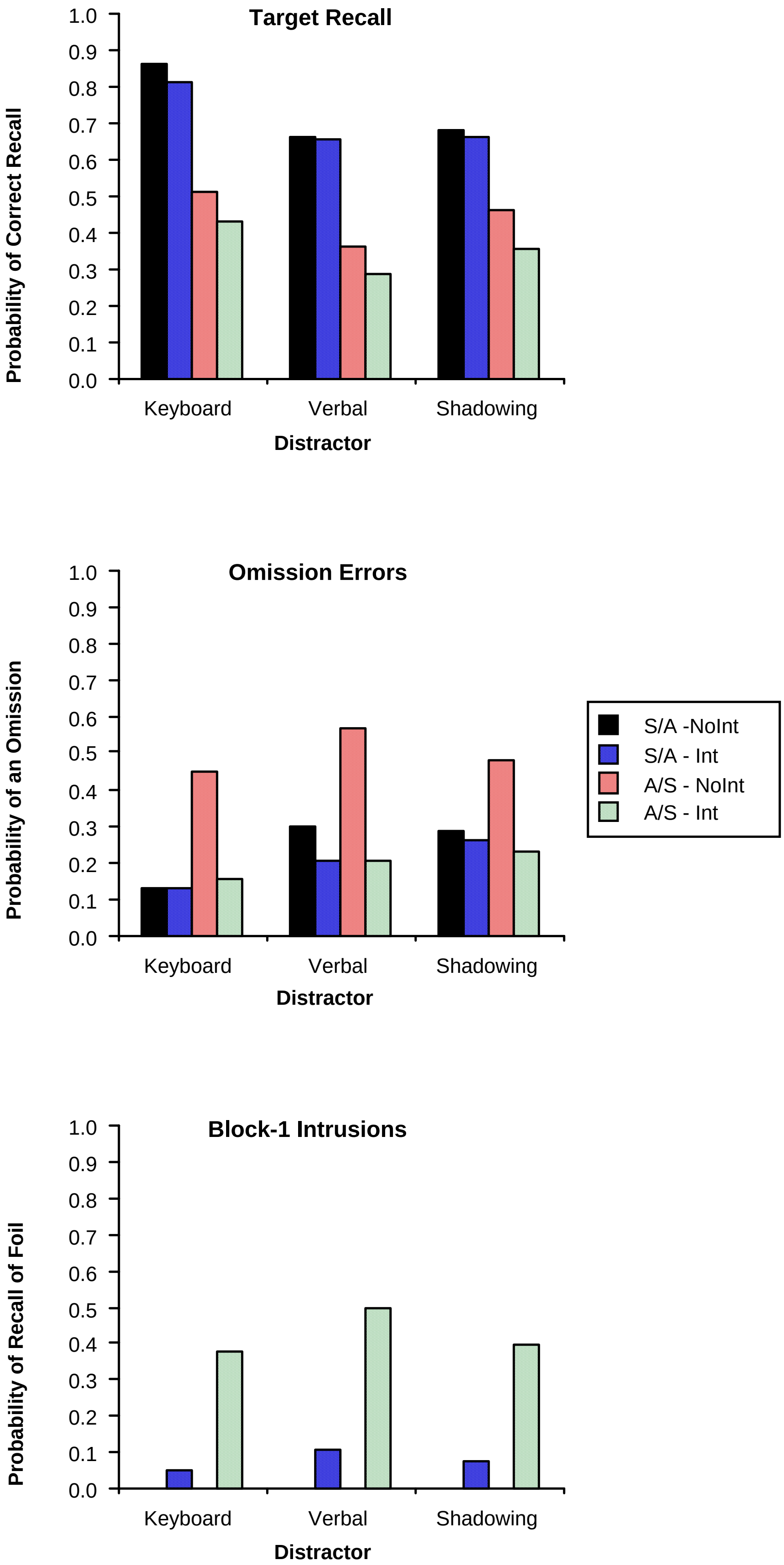
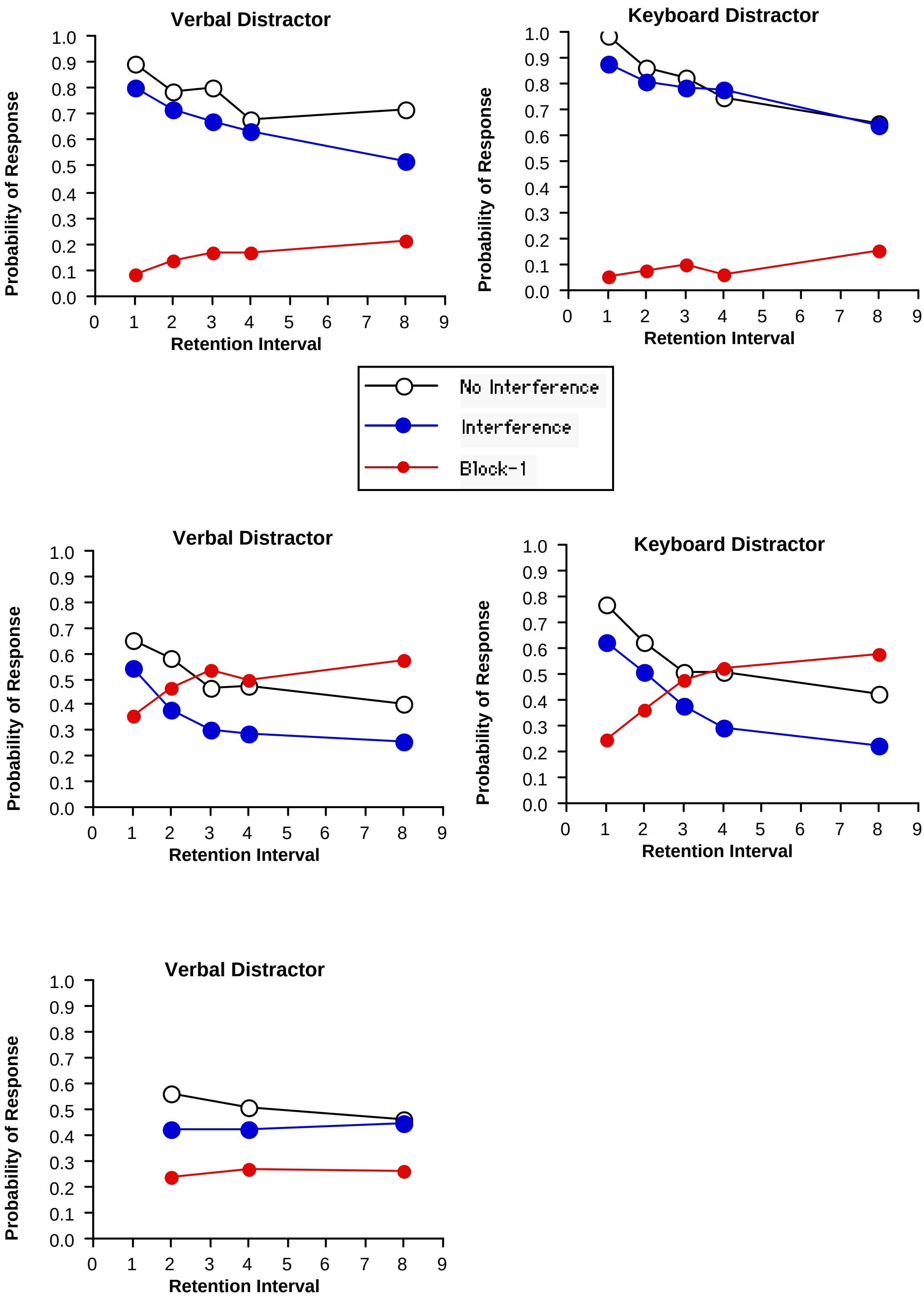
Footnotes

1. We would like to thank Ian Neath and Jim Nairne for suggesting this possibility.

Figure 1. Mean correct recall, omission errors and block one intrusions as a function of presentation modality and type of distractor activity in Experiment 1.

Figure 2. Mean correct recall, omission errors and block one intrusions as a function of presentation modality and type of distractor activity in Experiment 2.


Target Recall
Probability of Correct Recall
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
Keyboard
Verbal
Shadowing
Distractor
Omission Errors
Probability of an Omission
S/A -NoInt
S/A - Int
A/S - NoInt
A/S - Int
Block-1 Intrusions
Probability of Recall of Foil


Verbal Distractor
Keyboard Distractor
Probability of Response
Retention Interval
No Interference
Interference
Block-1
Verbal Distractor
Keyboard Distractor
Probability of Response
Retention Interval
Verbal Distractor
Probability of Response
Retention Interval