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Subject Area - Psychology

The Effects of Chunking and Distraction on Short Term Memory Recall.

Abstract.

This report aimed to investigate the effects of distraction and chunking on short term memory performance. A serial recall task was used to investigate this in a sample of 20 male and female undergraduate student in a within subject design. This data was analysed with a two way repeated measures ANOVA and the results show that there are significant improvements in recall when the items are chunked. In addition there is a significant deterioration in recall following the distraction technique. However, there are no interaction effects between these factors. These findings are discussed in terms of potential means of improving short term memory.

Introduction.

It is generally accepted that there are three different memory systems; sensory memory, short term memory and long term memory. These distinctions were first defined by Atkinson and Shiffrin (1971). Sensory memory is that which holds information from the senses for up to several seconds at the most. Short-term memory in contrast, is whatever we are thinking about at any given moment and has a relatively rapid input and retrieval. Miller (1965) argued that human short term memory has a span of approximately seven items, plus or minus two. Finally, long term memory is the permanent memory system which has a virtually unlimited capacity but takes longer to retrieve and to store (Baddeley, 1990).

Evidence suggests that short-term memory is primarily phonological involving an articulatory loop of rehearsal in working memory (Baddeley, 1990), whereas long term memory relies primarily on the semantic code (Baddeley, 1990).

It is well known that there is both a primacy and a recency effects in short term memory. This means that there is an improved recall of words at both the start and at the end of the presentation list whereas there will be more information lost from the middle of the presentation.

There are two theories concerning the loss of information in short term memory. The decay theory proposes that loss is the result of trace decay, e.g. the simple automatic fading of the memory. Whereas the interference theory proposes that the forgetting is caused by other information getting in the way. One of the main ways to assess this has been to impose a distraction technique during or after the items which are to be memorized. For example Wolach and Pratt (2000) studied the effects of both phonological and noise distracters on short term memory recall and showed that both distracters negatively affected the memorization process. The stronger that the distracter was to the material to be memorised than the more severe this effect was.

The recency effect is greater for auditory than visually presented material. This is called the modality effects. It has been shown that if an irrelevant item is spoken at the end of a list, the recency effect is reduced for auditory but not for visually presented lists. This is called the suffix effect.

Many other factors can adversely affect short term memory recall. For example, Banbury, Macken, Tremblay and Jones

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(2001) studied the effects verbal distractions on short term memory. The degree of interference was related to the properties of the sound specifically and even quiet background sounds have a negative effect upon recall. The word frequency and the rate of presentation are also influential in short term memory recall as is presentation type. For example Frankish (1985) found that there was a substantial recall advantage for grouped lists with auditory but not with visual presentation.

One of the other most important factors to influence short term memory recall is that of chunking. The process of chunking was originally defined by De Groot (1956) and Miller (1956). A chunk is simply defined as a collection of elements having strong associations with one another but weak associations with other chunks (Gobet et al, 2001). An example of a chunk is illustrated below.

G O H T A C P U D

D O G H A T C U P

The second example is easier to recall as it is more meaningful, containing an internal structure. The components DOG, HAT and CUP can much more easily be committed to memory than the unconnected letters. Humans tend to use the process of chunking spontaneously (e.g. writing down telephone numbers). This has been termed goal orientated chunking (e.g. a conscious process) while there is also a perceptual or non-conscious form of chunking (Gobet et al, 2001). This adoption of some form of grouping strategy when presented with unstructured list makes rehearsal easier and utilises primacy and recency effects within groups.

However, the effects of chunking are modality dependent. For example, inserting pauses improves memory for spoken but not written sequences and using a different tone of voice may also help to improve recall (Frankish, 1989) Many studies have attempted to identify the mechanisms by which chunks are created, restored and retrieved. It is important to study chunking as it is sure to underly many aspects of human learning.

Individuals with defective short terms memory systems have told us a lot about memory and illustrate the need for continued research in this field. An example is that of a patient referred to as HM, who developed an incapacity learn new material (Milner 1966). HM underwent surgery to remove portions of his temporal lobes to stop the seizures he had suffered from since a child. The surgery was successful in this respect but afterwards HM could not maintain normal short term memory for more than a minute despite a perfectly good long term memory for events which happened before the surgery. Specifically he lacked the ability to transfer new short term memories into long term ones. He could repeat information for many minutes, but if distracted, even briefly, he would forget. HM is not an isolated case and thus the role of the temporal lobes is clearly essential in human memory.

This study therefore aims to assess the effects of the chunking of items and the presence of a distracter technique prior to recall on short term memory. It is hypothesised that chunked items without a distraction will facilitate greater recall than chunked items followed by a distraction. In addition it is hypothesised that chunked items without distraction will result in greater recall than non chunked items with a distraction. Overall, chunked items will be more successful in terms of recall than non chunked items and the presence of the distracter will result in a deterioration in recall.

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The null hypothesis, therefore infers that there will be no difference in recall between the conditions.

Methodology.

Participants were 20 male and female undergraduate students, aged between 18-19 years who participated voluntarily. The sample is highly female biased (15 female and 5 males were recruited). Each participant completed each condition once. The conditions were counterbalanced to prevent the possibility of learning effects.

There were two types of recall stimuli used within this study. The first were chunks which have a similar theme, for example animals (e.g. cat, dog, zebra, mouse, cow, parrott, etc) or colours (e.g. Yellow Green Orange Pink White, etc). The second type were non chunked or unrelated items (for example Cat Red Apple Daisy Nurse Cabbage Table Stockholm Arm).

There were ten lists in each category each of which contained nine items, thus the maximum score it was possible to gain in each condition was 90. A full list of the chunks used can be observed in Appendix One.

Each list was presented visually for a total of 15 timed seconds. The order of presentation of these lists was also counterbalanced to avoid the possibility of presentation effects. Following presentation participants were asked to recall as many of the items as they could utilising a free recall design. i.e. in any order they like. Participant were given one minute to recall as many items as possible in written form.

Following recall the next set of items was presented immediately afterwards.

The distraction technique will take the form of a verbal distracter which was the reading out of ten random numbers (between one-nine) the experimenter following the presentation of the lists, prior to recall.

The four conditions will be referred to subsequently as follows.

Chunked/distraction.

Non-chunked/distraction

Chucked/no distraction

Non-chucked/no distraction.

Analysis.

Descriptive Statistics.

Condition.

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Mean

Standard deviation.

Chunked/distraction.

61.4

4.87

Non-chunked/distraction

54.8

4.93

Chunked/no distraction

65.7

4.37

Non-chucked/no distraction.

58.3

5.12

Table One.Descriptive Statistics showing the mean number of words

recalled in each condition.

The descriptive statistics presented in table one show the mean number of correctly recalled items by the participants in each condition. The greatest rates of recall are observed in the chunked/no distraction condition with participants recalling a mean number of 65.7words.

The next best performance was observed with the chunked items with the distraction technique imposed. In this condition participants recalled a total of 61.4 words on average. Participants performed the least well in the non-chunked conditions, particularly when a distraction was provided alongside, in this case participants only recalled 54.8 words compared to a mean 58.3 words when a distraction was not imposed.

ANOVA.

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In order to assess whether the differences discussed above are significantly, a two way repeated measures ANOVA was conducted. The results show that the main effects of the chunking of the items to be recalled was highly significant ($F = 69.17, p = .000$). The main effect of the distraction task was also highly significant ($F = 96.93, p = .000$). However, there were no interaction effects between the two ($F = .672, p = .423$).

Raw data can be observed in Appendices two and three.

Discussion.

The aim of this study was to investigate the effects of chunking and distraction on short term memory recall in a within subjects design. 20 undergraduate students were assessed on their recall of chunked (e.g. cat, dot, rabbit, mouse) and non-chunked (e.g. cat, house, apple, red) items either with or without a distracter imposed before recall.

The results, as analysed by a two way repeated measures ANOVA show that there are highly significant differences in the number of words recalled between the four conditions. There is both a significant effect of chunking, e.g. chunking improves recall and there is a significant effect of the distracter, e.g. the distracter deteriorates recall. However a significant interaction between the two is not observed.

Therefore this data supports the hypothesis that chunked items without a distraction would cause superior recall than chunked items followed by a distraction. In addition it is hypothesised that chunked items without distraction will result in greater recall than non chunked items with a distraction. Chunked items are generally more successfully recalled than non chunked items and a distracter results in a deterioration in recall.

These findings are in support of those such as Wolach and Pratt (2000) who confirmed that a distraction technique negatively affected short term memory recall in a sample of young male and female subjects, and those of De Groot (1956) and Miller (1956) who have found a superior effect of chunking on recall.

However these results do not support the finding that a distraction technique only negatively affects recall in verbally presented lists. This study also observed this effect in a visually presented list.

On the basis of this research it is suggested that individuals should consciously attempt to use the technique of chunking in helping them to remember things on a day-day basis and that they should bear in mind that distractions are likely to cause memory loss. Individuals should also bear in mind the evidence which suggests that only between five to nine items can usually be held in short term memory.

This study would have benefited from a larger sample size and a greater proportion of male participants in order to examine the possibility that there are gender effects. In addition it would be interesting to look at a wider demographic by including individuals from a broader age range.

It would be interesting to expand this study in order to investigate the possibility that the type of distracter technique in particular, exerts an influence over recall. For example would these effects be replicated if the participant were required to read the distracter themselves rather than listening to it? Or to speak it aloud themselves? Greater attention should

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also be paid to strength of the distracter technique required to create these effects.

It is hoped that future research will tackle these issues in order to increase our knowledge in this field and to continue to offer help for patients suffering from memory deficits.

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