



“The effects of hierarchical schemes in encoding and free recall of word lists from memory: effective learning strategies”

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Introduction

The cognitive processes of memory have long fascinated theorists and researchers, and are perhaps one of the most difficult areas of psychological research but one which can yield a great deal of important information to aid in the development of effective learning strategies. A main issue is that research can only reveal indirect information (Eysenck & Keane, 2000).

One of the most influential theories is Tulving’s Encoding Specificity Principle, based on the assumption that context matters in recall and recognition (Eysenck et al, 2000). Baddeley & Godden (1980) agreed with this notion with respect to recall memory, but showed that recognition was not context dependent. Of particular relevance to this study is that by Bower, Clark, Lesgold & Winzenz (1969) which investigated the effects of hierarchical retrieval schemes in recall memory, comparing the results of these with those using randomised word lists. The experimenter-imposed organisation generated an intrinsic context for the to-be-remembered words, finding that recall was up to three times better when word lists were in organised schemes. Broadbent, Cooper and Broadbent (1978) reported similar results when they used hierarchically organised word lists, words in a matrix and unorganised word lists in recall tests, as did D’Argembeau, Comblain & Van der Linden (2005) who found better free recall performance effects with positive self-referent information, and suggested that such effects are a result of control of memory retrieval as opposed to initial encoding.

Bower et al (1969)’s study used a repeated measures design with, in all but one instance, a modality difference between stimuli input (visual) and output (spoken). This raises some issues in the light of the influential Working Memory Model (Baddeley & Hitch, as cited in Eysenck et al, 2000) which differentiated between visual and audio processing. An important issue identified by Bower et al (1969) is that of pairwise association, or the difficulties of developing semantic hierarchies that are widely meaningful and sensible.

This study addressed these two issues by comparing recall performance between words in a highly structured, non-ambiguous hierarchical organisation with the same words in a randomised list, using an interference task to prevent sub-vocal rehearsal. Modalities of input and output were the same, and there was no opportunity for

between-experiment rehearsal. The use of a non-ambiguous hierarchical scheme was predicted to have an effect on recall accuracy compared with that achieved using randomised word lists.

Method

Design

The study used an experimental, independent measures design, with two groups of participants: a control group (Group A) and an experimental group (Group B). The independent variable (IV) of interest was a list of 19 words with two conditions: Group A was presented with an unstructured, non-categorised randomised word listing, while Group B was presented with the same words organised into a non-ambiguous hierarchical scheme. The accuracy of recall performance (DV) was measured using a ratio scale (correctly recalled word = 1, incorrect or no-recalled word = 0).

Participants

The participants ($N = 30$) were mature Psychology students engaged in part-time higher education courses through a College Higher Education Centre. An open invitation to take part in the study was made through the students' tutor. Participants received no reward for taking part in the study.

Materials

Each participant was given two A4 sheets of white paper at the start of the experiment. One of the papers contained the list of printed words: one set presented words in a hierarchy containing no linking lines or circles, the other presented the same words in a randomised single list, both of which can be found in the Appendix. The second sheet was blank save for an "A" or "B" discretely printed on the underside of the sheet. The participants used this sheet to write down their recalled words.

Procedure

The experiment was run on three separate occasions with different sets of participants. On each occasion, participants were randomly assigned to Group A or B by blindly selecting a ticket printed with an A or B. Participants were provided with clear verbal instructions by the researcher on what they had to do, but were not informed of the purpose nor focus of the experiment to control for participant bias.

Participants were given two minutes in which to study the words on a sheet of paper. At the conclusion of this period, participants were instructed to turn over their word papers, and were immediately tasked with counting backwards from 50 out loud as an interference task to prevent sub-vocal rehearsal of the learned words. Participants were then given a two minute period in which to write down as many of the words that they could recall using the second blank sheet of paper.

On all three occasions, participants in both Groups took part in the experiment simultaneously in the same classroom environment. Participants were arranged within the room in such a way as to avoid any information exchange, and were specifically instructed not to make contact with each other during the experiment.

Participants were not debriefed at the end of the experiment to avoid introducing a confound with subsequent groups.

Results

The results were calculated for each group on the basis of one correct word = 1, a no-word or incorrect word = 0.

The use of the hierarchical word scheme had an effect on free recall accuracy in Group B ($\bar{X} = 15.2$, $SD = 3.01$) compared with Group A ($\bar{X} = 12.93$, $SD = 3.11$), however the frequency distribution for Group B was negatively skewed whereas that for Group A was normal. This has implications in respect of the accuracy of the measures of central tendency in describing a typical score. Figures 1 and 2 below illustrate this discrepancy.

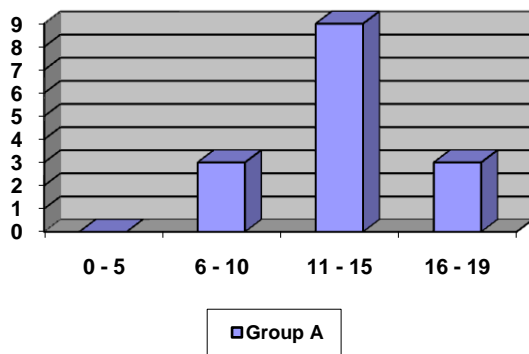
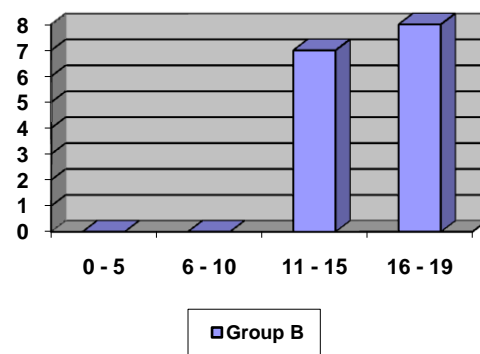


Figure 1: Distribution of Group A accurate recall scores as a function of their frequency.



Figures 2: Distribution of Group B accurate recall scores as a function of their frequency.

To determine the significance of the effect, the data was subjected to a Mann-Whitney U inferential statistical test. This revealed that there was no significant effect of hierarchical word schemes on free recall accuracy (Mann-Whitney U ($n_1 = 15$, $n_2 = 15$), = 70.5, $p > 0.05$). The null hypothesis cannot therefore be rejected.

Discussion

This study sought to investigate the effects on non-ambiguous hierarchical word schemes on free recall accuracy compared with recall using a randomised word list. The between participants experimental design used identical conditions for each of the two groups, with participant bias controlled. The results, although revealing a slight tendency towards a more accurate level of recall when using the hierarchical word scheme, did not reveal any significant effects when calculated statistically. This is at variance with the findings of Bower et al (1969), although there are differences in the methods and materials used.

What is of interest is the way in which the participants recalled the words. Without exception, all participants in Group B recalled their words in an exact replica of the hierarchical structure of the to-be-remembered list although no prior guidance was given on the structure of the words, suggesting that the participants used the hierarchy as a retrieval plan which is consistent with Bower et al (1969)'s findings. Why did they not achieve a much higher level

of accurate scores than those working with randomised lists? Potentially, the answer may lie in the notion that the Group B participants spent more time memorising and subsequently recalling the *structure* of the hierarchy, than the words themselves. If this were to be the case, then the hierarchical structure could be said to have represented a cue overload. Conversely, those who recalled from the randomised word list typically listed their words out in a single or dual column pattern, often with the order of recall mirroring the order of the to-be-remembered list. This may explain why more participants in Group A were able to recall between 11 and 13 words than those in Group B, whereas those in Group B displayed more consistency in accurate recall with a greater number of words.

Two further observations can be offered to explain the phenomena. First, the participants were all students, and the experimental environment was their own classroom. It is possible to hypothesise that these participants are more likely than non-students to be competent and rehearsed in the use of learning strategies and information recall. Even those students provided with randomised lists could arguably possess higher than normal learning and recall capabilities. Secondly, the trend in the scores from Group B showed an obvious consistency towards higher volumes of accurately recalled words, suggesting that the use of hierarchies in learning and retrieval strategies is effective in generating greater efficiencies.

In conclusion, although this study has not revealed a significantly improved volume of accurately recalled words using the non-ambiguous hierarchical method, it does support the notion of semantically meaningful hierarchies in the development of efficient learning and performance strategies. It would be useful to repeat the study with a different set of non-ambiguous hierarchical schemes of words to determine the wider effectiveness of these strategies, and also to repeat the study with non-student participants.

References

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Appendix

Word List

Condition A: Randomised List.

Naples

Montreal

Orlando

Liverpool

World

Bristol

England

Winnipeg

Italy

Washington

Europe

Rome

Americas

Ottawa

Dallas

USA

London

Florence

Canada

Condition B: Hierarchical Schema

Europe		World	Americas	
England	Italy		USA	Canada
London	Rome		Washington	Ottawa
Liverpool	Florence		Dallas	Montreal
Bristol	Naples		Orlando	Winnipeg