A Special Place in Our Minds: Examining the Serial Position Effect

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A special place in our minds: examining the serial position effect

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Previous research in free-recall tasks have demonstrated a “serial position effect” in people’s recall; that is to say words around the beginning and end of a list are more readily recalled than those in the middle. In the present study participants were read out one of two 18-word lists, one where the words either shared a common conceptual category and where the words did not. It was expected that words a serial position effect would demonstrate, and that mean word recall for the common concept list would be higher than the mean recall of the non-common concept list. The results of this study confirmed the hypothesis regarding the serial position effect, but mean recall was not significantly higher in the common concept list; however ANOVA found a significant interaction effect between list type and a words position on the list.

The subject of memory has, for some time, been a subject of interest in the world of psychological research, more specifically our short-term memory. Perhaps the first researcher in the field was Hermann Ebbinghaus (1964). His Magnum Opus “Memory: a Contribution to Experimental Psychology” (1964), includes a series of free-recall experiments he conducted to discover whether the position of a word on a list affected how easily it could be recalled. In these experiments he pre-recorded lists of “nonsense syllables” (e.g. DAX) then played them to himself and tried to recall as many words as he could (Ebbinghaus, 1964). Ebbinghaus found that words around the beginning and end of the list were more readily recalled than those around the middle; he characterized this as the “serial position effect” (manifests as a “serial position curve” on a graph) (Ebbinghaus, 1964). He
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explained this tendency to remember words around the beginning and end of the list was the product of human long-term and short-term memory processes. In essence, he postulated that words at the beginning of the list were more easily recalled because they had more time to be committed to long-term memory (Known as the “Primacy Effect”); while words at the end of the list were more readily recalled because there was a greater chance of them still being in short-term memory (known as the “Recency Effect”) (Ebbinghaus, 1964).

Glanzer and Cunitz (1966) further examined the serial-position effect and both long-term and short-term memory; more specifically, Ebbinghaus’ postulations that short-term and long-term memory are the cognitive processes underlying the primacy and recency effects (what cause the serial position curve). To test the hypothesis that long-term memory was responsible for people’s tendency to remember words around the beginning of the list during free-recall memory tasks (where participants are read a list of words then asked to recall), Glanzer and Cunitz varied the interval between the words as they were read off the list and number of times the list of words were presented to participants before they were asked to recall the list (Glanzer and Cunitz, 1966). They argued that these processes have been demonstrated to be reliable and valid methods of improving long-term memory and would affect the first portion of the serial position curve (Glanzer and Cunitz, 1966), as it is this section of the list that would most likely be committed to long-term memory. They found that both increasing the time between when each word is read out and the number of times a list was read to a participant, yielded a significant improvement in recall, with regards to
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the first section of the serial position curve, but did not affect the average word recall in the later two thirds of the serial position curve (Glanzer and Cunitz, 1966). These results provide support for long-term memory being the process behind the first part of the serial position curve, and therefore part of the serial position effect.

Glanzer and Cunitz (1966) also wished to test Ebbinghaus' hypothesis that short-term memory was the process that underlies the recency effect. To do this they manipulated the time between when the experimenter read out the last word on the list and when the participant was asked to recall the list (Glanzer and Cunitz, 1966). Although past studies have shown that the mere passage of time does not necessarily mean that the words will exit the participant's short-term memory, as they can rehearse the words so they stay fresh in their minds (Glanzer and Cunitz, 1966). To account for this issue they had participants perform simple math problems during the delay (if they were in one of the experimental conditions) (Glanzer and Cunitz, 1966). They found that a longer delay tended to decrease the average amount of words (around the end of the list) that participants could recall. These results lend support to Ebbinghaus' contentions that short-term memory is the process behind the recency effect, and therefore latter part of the serial position curve.

Previous studies in the field of memory have also focused on whether words that belong to a common conceptual category are easier to recall. Tulving and Pearlstone (1966) presented participants with lists of words (12, 24, and 48 words) where the amount of words that shared a common conceptual category varied. Participants were then immediately tested on recall with or without the
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category name present; they found that the recall in the presence of the category
name was better than when the category name was not displayed (Tulving and
Pearlstone, 1966). These results seem to indicate that having a list of words belong
to a common conceptual category can facilitate recall.

The current study seeks to see if a serial position effect will manifest when
students at Huron University College are read out an 18-word list. This study will
also examine if a list of words that shares a common conceptual category is more
easily recalled than a list that does not share a common category, and whether
there is an interaction between a common conceptual category and a words
position on a list that effects recall. It is expected that the serial position effect will
be demonstrated, that is to say people will more readily recall words at the
beginning of the list and end of the list (first 6 words and last 6 words). Given the
previous results it is expected that students in the common conceptual category
will perform better. This will likely manifest as an increase in the average recall of
words in the middle of the list, resulting in a less pronounced serial position
effect/serial position curve.

Method

Participants

The present study consisted of 20 students at the University of Western
Ontario; more specifically with 10 of these 20 are officially students at Huron
University College, one of the University of Western Ontario's affiliate colleges. 14
of the participants were female while the remaining 6 were male. 16 of the
participants were psychology majors while the remaining 4 were either majoring
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in philosophy or political science. In this study the participant’s ages range from
18-22. Participants were approached by the researcher and asked to participate in
the study, and accepted based on their willingness to participate. Consequently
people were not assigned to groups randomly, but rather conveniently; that is to
say students were asked if they wished to participate in a psychology study and
upon agreeing were placed in whichever group had less participants at the time.

**Materials**

Two materials in this study were an information sheet/consent form and
debriefing letter. This study also had two 18-word lists that were read out to the
participants. One of the lists contained words belonging to a common conceptual
category, animals, while the other lists words did not share a common conceptual
category. Both lists’ words were chosen from a list of 925 nouns located in the
appendix of Pavio, Yuille, and Allan’s (1968) study “Concreteness, Imagery, and
Meaningfulness values for 925 Nouns”. This was done to control concreteness
(how easily something can be referenced to sensory experience e.g. a table would
have high concreteness as most people have seen a table), imagery (how readily a
word can arouse non-verbal images, for example table would also score high in
imagery because when people hear the word they can easily picture a table in their
minds eye), and meaningfulness (refers to the average number of written
associations a person can think up within 30 seconds after hearing a word) (Pavio,
Yuille, and Allan, 1968). This was done to restrict confounds on the between
subjects variable of common conceptual category. Subjects were also provided
with a piece of paper numbered 1-18 for participants to write their answers on.
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Procedure

Researchers approached students in a classroom setting and asked them if they were willing to participate in a psychology study. If they agreed, they were given a letter of information/consent form to read and sign, respectively. After reading the letter of information, participants were asked if they were ready to proceed; after indicating they were ready, the researcher read the list of words out to the participant with a one second gap in between the presentation of each word. After the list was read out, subjects were given a sheet (numbered 1-18) to write answers on and were asked to recall as many of the words on the list that they could. Subjects were told that they did not have to answer in any order so long as the word they wrote was part of the list they were read. After all of the data was collected, participants were scored on each third of the list. That is to say if they recalled 3 words out of the first 6, 2 words out of the second 6, and 4 words out of the third 6 then that person’s score for the first third would be 3, 2 for the second third, and 4 for the third of the list. The average scores for each third of the last were calculated for both the common conceptual category group and the non-common-conceptual category group and graphed.

A 2x3 mixed factor repeated measures design ANOVA was conducted via SPSS to determine whether the main and interactions effects of the variables were statistically significant. Planned contrasts in the form of T-tests were also conducted through SPSS to confirm which means were significantly different.
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Results

The results of this study are displayed in figure 1. In both the common conceptual category and uncommon conceptual category groups, average recall for the first and last 6 words of the list is higher than the average recall for the middle six. In the common conceptual category there is a less pronounced difference between the average recall for the last 6 words and middle six words (2nd section mean recall was 2.4, while mean recall for the third section recall was 2.6), than in the uncommon conceptual category (2nd section mean recall was 1.3, while 3rd section mean recall was 3.6). Also it should be noted that average recall for each section, albeit the final 6 words, for the common conceptual category list was higher than average recall for the uncommon list (again, with the exception of the third section which was higher for the uncommon list). Mean recall for all three sections on each list was 2.9 (Common) and 2.5 (Uncommon).

A 2x3 mixed factor repeated measures ANOVA was conducted, via SPSS, to assess statistical significance of the results. Maulchy's test of sphericity was insignificant, consequently sphericity was assumed. The ANOVA found there to be a significant within subjects main effect of word position, with an obtained f value of (f(2,36)=6.86, p<0.05 two tailed). The ANOVA also determined there to be no between-subjects main effect of common conceptual category, (f(1,18)=1.46, p>0.05 two-tailed). However there was a significant interaction effect between the variables of position on list and common conceptual category, (f(2,36)=5.03, p<0.05 two-tailed).
Figure 1: Average number of words correctly recalled out of the 1st, 2nd, and 3rd sections (six words in each section) of the common and uncommon conceptual category lists.
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Follow up T-tests were conducted on the combined mean word score for each third of the common and uncommon conceptual category list to determine which third's means were significantly different. The means for number of words recalled for the different thirds of both lists combined are: 3.05 for the first 6 words, 1.85 for the second 6 words, and 3.1 for the final 6 words. A dependent t-test found there to be a significant difference between the mean of words recalled in the first six and second 6 words, \( t(19) = 3.6, p < 0.05 \) two-tailed. The means of the middle and last 6 words differed significantly, \( t(19) = 2.6, p < 0.05 \). However there was no significant difference between the mean recalled of the first and last 6 words of both lists, \( t(19) = 0.114, p > 0.05 \) two-tailed.

Discussion

Previous research regarding free-recall tasks have managed to demonstrate a serial position effect, or in other words that people will more readily recall words at the beginning and end of a list rather than those located in the middle. Furthermore it was expected that mean recall on the common concept list would be higher than the mean recall of the non-concept list. The results of this study seem to confirm this hypothesis as the graph demonstrates that, in both categories, people recall more of the first and last 6 words than the middle 6. It does not confirm the hypothesis that mean recall for the common concept list would be higher than the mean recall for non-concept list.

The t-tests results showed that the differences between the means of the first third/last third, and the means of the second third were significant; however the difference between the means of the first third and last third of the list were
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found to not be significant. This demonstrates that a serial position effect manifested and not because of sampling error; a difference between the means of the first and last thirds of the lists would preclude the researcher from making such an argument.

The results do not support the hypothesis that average recall was higher in the list of words that shared a common conceptual category than recall on the list that did not. However as a significant interaction effect between the variables position and variable (manifested in figure one, where the uncommon list’s serial position curve intersects the common list’s serial position curve) is perhaps an explanation for why no significance was found for the main effect of common conceptual category.

The results of the current study seem to, for the most part, exhibit scientific adequacy. The serial position curve has been demonstrated in Glanzer and Cunitz (1966) study and subsequently replications; additionally the ANOVA demonstrates that the results have statistical significance. Furthermore the word lists were controlled for “concreteness”, “imagery”, and “meaningfulness” (using Pavio, Yuille, and Madigan’s (1968) study) to mitigate confounds. A notable, but perhaps minor, shortcoming in this study was the lack of random assignment of participants. Future studies in this area should randomly assign participants to a condition with a random number generator to make it a random sample; as the current study was contingent on willingness and availability of participants, this was not an option. Future studies could further improve the strength of the results by increasing sampling size and perhaps controlling gender of participants to an equal
A special place in our minds: examining the serial position effect proportion (as the current study had a disproportionate number of female participants).

Future studies could test whether increasing list size varies the curve of the serial position curve. It is likely that the longer a word list the steeper the serial position curve, that is to say there should be a more significant difference between the average number of words recalled in the first and later parts of the list in relation to words located around the middle of the list. Future research could also focus on the interaction effect between common conceptual category and a word's position on the list. More specifically why the mean number of words recalled around the beginning of the common list was higher in the common conceptual category (expected), but mean recall for the last 6 words was higher in the common list (unexpected). As the ANOVA found the interaction effect to be significant this certainly requires further investigation.

Research in this study is consistent with previous findings, with the exception of the interaction effect between the variables of common concept and position on list. Future research needs to be conducted to examine the nature of the interaction between the variables. As memory is a quintessential part of our existence, should we not try to understand as much of it as we possibly can?
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References


Appendix: Raw Data Table and Word Lists
Table 1. Raw data for uncommon and uncommon concept lists (10 participants for each list)

<table>
<thead>
<tr>
<th>List</th>
<th>Mean recall for First 6 words</th>
<th>Mean Recall for Second 6 words</th>
<th>Mean Recall for Third 6 words</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common</td>
<td>3.6</td>
<td>2.4</td>
<td>2.6</td>
</tr>
<tr>
<td>Uncommon</td>
<td>2.5</td>
<td>1.3</td>
<td>3.6</td>
</tr>
</tbody>
</table>
Alligator
Beast
Caterpillar
Fox
Elephant
Cheetah
Horse
Insect
Whale
Frog
Lobster
Mammal
Warbler
Beaver
Leopard
Bird
Python
Butterfly
Flag
Examination
Ink
Elbow
Jury
Landscape
Piano
Newspaper
Lemon
Painter
Vessel
Swamp
Tobacco
Yacht
Valley
Window
Rod
Plank