Accounting For Short-Term Variability in Human Memory

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Abstract
This study was designed to determine if short-term variability in human memory (within minutes or hours) can be significantly accounted for by external environmental factors.

If so, this would suggest that there do not exist any endogenous states of the brain that are better suited for memory than others, and that the brain has a constant innate memory capacity that is affected by environmental changes.

Participants were situated in a room without external stimuli and distractions while completing a free recall experiment to measure changes in their memory abilities throughout the task.

This variance was then analyzed to determine if a model of external variables could be generated to account for a significant portion of its existence.

Methods and Materials
Our experiment eliminates as many external distractions as possible, with a sound-proof, temperature-controlled room devoid of visual distractions.

• Each subject performs 24 ninety-minute sessions, with each session consisting of 24 lists of 24 words each.
• Subjects freely recall as many words as they remember after a distractor.

Results
Each subject’s sessions were analyzed to determine range of list-level performance. These ranges were then analyzed by a multiple regression model of external variables.

- The average range of probability of recall for lists within one session was 0.557 for all participants.
- A multiple linear regression model was created for each participant in the experiment to regress external variables such as list number and word frequency by probability of recall.
- Subject models were then used to calculate a predicted probability of recall for each list based on the variables.
- Average variability, or range of list performance, was reduced to 0.543 by the predictive models, which is a 2.5% reduction.

Discussion
The model took into account almost every remaining external variable not accounted for by the experiment, but did not significantly reduce variability.

This suggests that independent of external environmental and situational changes, the brain biologically fluctuates between relatively better and worse states for memory, resulting in the variability seen in memory performance.

The results of this study provide insights into the biological phenomena present memory systems in the brain, and depict a reasonable and actual basis for research being done to intracranially account for and control variability in human memory.

Table 1. Multiple Regression Variables.

<table>
<thead>
<tr>
<th>Mean β</th>
<th>SD β</th>
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</thead>
<tbody>
<tr>
<td>Session Number (1-24)</td>
<td>-0.013</td>
</tr>
<tr>
<td>List Number (1-24)</td>
<td>-0.158*</td>
</tr>
<tr>
<td>Average Frequency²</td>
<td>0.019*</td>
</tr>
<tr>
<td>Emotionality⁴</td>
<td>-0.005</td>
</tr>
<tr>
<td>Concreteness</td>
<td>0.004</td>
</tr>
</tbody>
</table>

Note: *p < 0.05

Works Cited

Mentor: Michael J. Kahana, Ph.D. Department of Psychology. Note: The results of this project were presented to the director of DARPA.