Diagnosing Short-Term Memory Scanning Using Systems Factorial Technology: A Conceptual Replication

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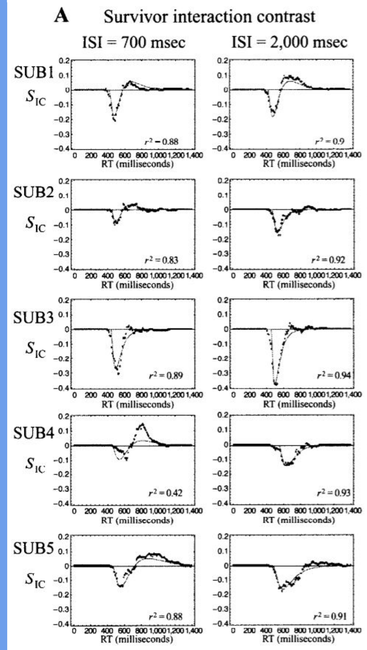
Overview

The present study conceptually replicates the influential Townsend and Fific 2004 paper, "Parallel versus serial processing and individual differences in high-speed search in human memory,". We used a larger sample size and collected less data on more participants, so we are looking at aggregate data rather than individual differences. We also used a U.S.-American population rather than Serbian.

Past Research

- Townsend and Fific (2004) utilized Systems Factorial Technology (SFT) to identify whether humans use parallel or serial processing, and demonstrated striking differences between individuals and across different interstimulus intervals (700ms. vs. 2000ms.)
- SFT can also be used to determine the stopping rule (exhaustive vs. self-terminating) and whether capacity is limited or unlimited. However, in the current analysis only target absent cases were used to control for stopping rules



Each subject (N= 5) participated in multiple trials across conditions

All data was aggregated per subject

4 of 5 subjects demonstrated serial processing according to their SIC curves

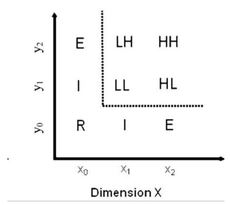
1 subject (SUB3) more closely represented parallel processing

These individual differences prompted our desire for aggregated data across subjects

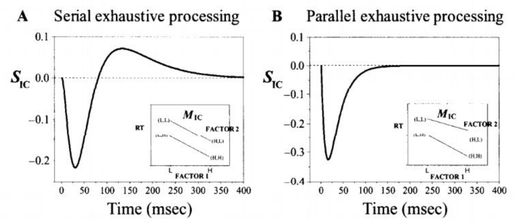
Methods

- Sample: N= 261 undergraduate GVSU students
- **Phonemes used:**
  - **Fricatives:** FAS, SAF, SAV, VAS, FAV, VAF
  - **Nasals:** MAL, LAM, NAL, LAN, MAN, NAM
  - **Plosives:** PAK, KAP, KAD, DAK, PAD, DAP

Factorial Combination of Position and Phonemic Dissimilarity	Memorized Set	Target
HH	MAL, NAM PAK, PAD	NAL KAD
HL	NAM, SAV FAS, NAM	VAS LAM
LH	KAD, FAS VAS, MAL	PAD FAV
HH	VAS, FAV MAN, NAL	NAL FAS



- We used a computerized task to administer trials where 2 items (phonemes) were presented, then an interstimulus interval of either 700 or 2,000 milliseconds, followed by a target item. Participants had to decide whether the target item was presented in the original set or not
- Factors include dissimilarity of first item memorized to target item and dissimilarity of second item memorized to target item. High dissimilarity of items was expected to be associated with slower reaction times
- Only target-absent conditions were included in this analysis
  - This allows us to view solely exhaustive processes

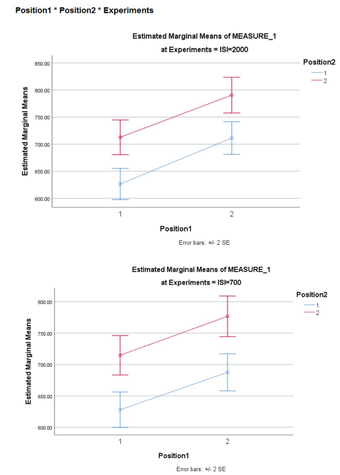


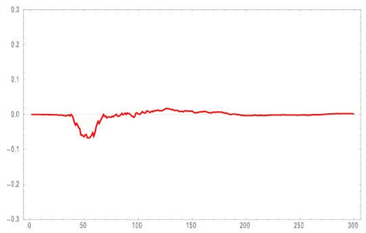
Results

Mean Interaction Contrast and Survivor Interaction Contrasts:

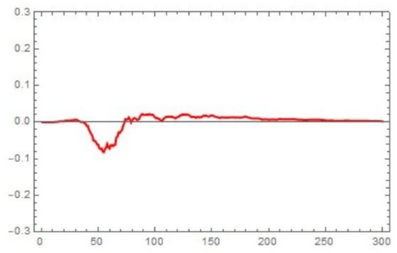
$$M_{IC} = RT_{LL} - RT_{LH} - (RT_{HL} - RT_{HH})$$

$$S_{IC}(t) = S_{LL}(t) - S_{LH}(t) - [S_{HL}(t) - S_{HH}(t)]$$





ISI=700



Our Repeated Measures ANOVA resulted in main effects of dissimilarity of item 1 (F=199.878, p-value<0.0001) and of item 2 (F=405.326, p-value<0.0001) on reaction time and a significant interaction between dissimilarity of item 1 and ISI (F=4.156, p-value=0.042). The other interaction terms were not significant.

Discussion/Limitations

- Averaging across subjects, our results indicate serial exhaustive processing, similar to the original 2004 study.
- However, using aggregate data prevents us from examining individual differences.
- By only analyzing the target-absent conditions, we forced processing to be exhaustive. Future research will address target-present effects
- GLM is simplistic in its analytical value, future studies will employ more specific methods of analysis: SEM for example

References

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