Sternberg

# Agenda

* Introduction
* Hypothesis
* Method
* Results
* Conclusion
* Discussion
* Grand perspective™

## Introduction and assumptions

* Stage theory: cognitive processes unfold in discrete stages, time between stimulus and response is occupied by a series of mental operations, each starting when the preceding has ended. The reaction time (RT) is therefore the sum of the duration of all stages.
  + Subtraction method: By assuming pure insertion, two experiments only differentiating in one variable can be conducted. The difference in RT will be the result of that variable.

## Hypothesis

The experiment was conducted in order to investigate:

1. Whether searching is a serial or a parallel process.
   1. If serial: Whether it is a self-terminating or exhaustive process.
2. Whether a distorted probe is unmasked before searching starts or if it is done on a continuous basis.
3. Whether we see a speed-accuracy trade-off and if this is affected by probe condition.

Expectations are that Ps will perform

1. Serial search evident as higher RT at greater set size
2. Exhaustive search apparent if the slopes of RT-curves are unaffected by probe presence
3. Unmasking in the encoding stage appearing as a higher zero-intercept for masked probes but similar slopes within probe conditions.

## Method

* 12 blocks x 12 trials: memory set (2, 3 or 5 letters exposed 500 ms/letter) + probe + blank 1000 ms
* Measures of RT considers only correct responses

## Results

### Figure 1

* Masking, probe absence and increases in set size increase RT
* RT increases linearly with set size: **serial search (or is it? Will get back to this!)**
* Slopes for present and absent probes are similar and no interaction between set size and probe presence -> **exhaustive search**
* Masked probes have a higher intercept, but similar slopes to unmasked ones -> initial **unmasking before searching**

### Figure 2

* Equal slopes between mask and no mask -> **same search process**
* Different intercepts -> **unmasking happens before searching starts**

### Figure 3

* Accuracy is influenced by set size, masking and probe presence, but not speed
  + Significant main effects: set size, masking, probe presence
  + Interactions: Set size and masking, masking and probe presence,
  + As set size increases, accuracy decreases
* Comparing with fig. 1: masked present might be the most difficult task
  + Highest RT + lowest ACC – bad investment of extra time spent
  + Or, is higher RT cause by more ‘no’-answers, which are slower?
* No speed/acc trade-off

## Figure 4 + 5: careful not to overstate conclusions

* Even when some general trends can be recognised, individual data looks vastly different
* Can we even say that all humans conduct serially exhaustive searches when individual data is this messy?

## Conclusion

* Serial search: Increased set size increases RT
* Exhaustive search: slopes of present and absent probes are similar
* Unmasking before searching: different intercepts but similar slopes for masked and unmasked probes

## Criticism

* Parallel search
  + Increased RT with set size could be due to battery hypothesis (same cognitive capacity divided onto a larger set size in a parallel manner)
* Basic assumptions
  + Pure insertion vs selective influence
  + Subtraction method
  + Stage model/theory
* How can we be certain that it is STM we are investigating?
  + LTMs influence (chunking, semantic network, priming)
    - Priming: An earlier seen letter is read faster the second time it is seen. If a probe is in the following memory set, it will be read relatively faster and therefore leave more time for the rest of the set to be encoded

## Grand perspective™

* STM+WM - Capacity Limit of Visual Short Term Memory in Human Posterior Parietal Cortex
  + Investigates one only the visual part of STM (according to Baddeleys model), while Sternberg investigates the entire throughput.
* STM/WM models
  + Cowan’s model of working memory
  + Baddeley’s multi-store model
  + Atkinson & Shiffrin’s stage model
* Brown-Peterson task
  + Trigram of letters -> interference task (counting backwards in threes) -> recall trigram
  + Proactive interference: performance decreases following each trail, but when task is changed, performance increases back to baseline
* Specific neurons in dlPFC are localized to parts of visual field, but only when keeping information from it in mind, not when viewing it.
* **Knowlton et al**.: Probabilistic weather prediction task -> Predict the weather from cues. Amnesic patients (hippocampus, no declarative memory of the task, but performance improved), Parkinson patients (basal ganglia, has declarative memory of the task, but no performance improvements).
* **Adelman et al**: Letters in words are processed in parallel. This effect is more prominent for the first couple of letters in a word, since we often don’t articulate the last parts of our words (due to overlap with the following word in a sentence)