Investigating Individual Differences in Episodic Memory:
What do the Neural Correlates of Recognition Reveal?

Catherine A. MacLeod and David I. Donaldson.

UNIVERSITY OF STIRLING

Department of Psychology, University of Stirling, Scotland.

Background

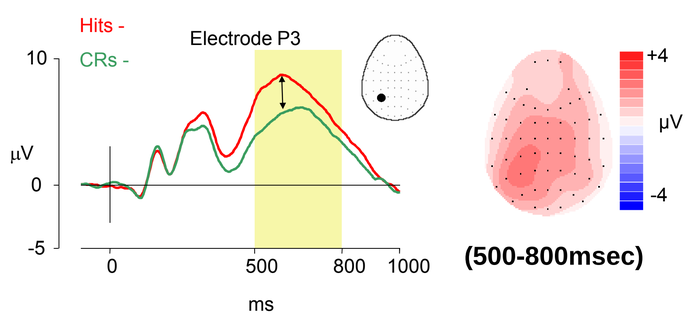
There are many factors that might contribute to the observable differences in memory performance amongst individuals.

We use event-related potentials (ERPs) with a simple old/new recognition memory paradigm to investigate two possible contributing factors:

- The utilisation of support processes by individuals.
- Differential use of core retrieval processes.

A key retrieval process involved in recognition memory is recollection, which allows detailed recovery about a previous encounter with an item, and is believed to have a distinct ERP signature (the left parietal effect).

Left parietal effect:
Correctly identified old items (Hits) show greater activation than correctly identified new items (correct rejections - CRs), a difference maximal over left-parietal electrodes between 500-800ms.



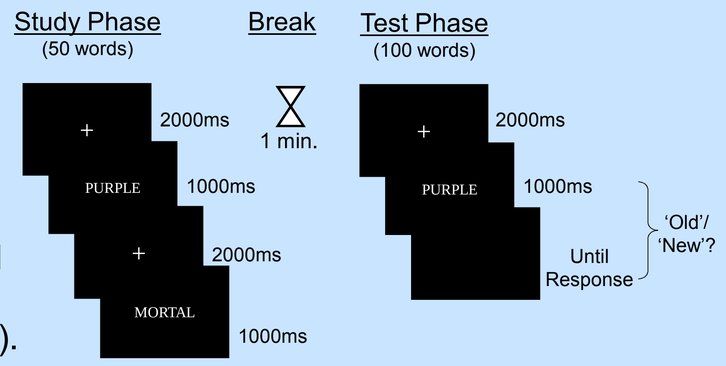
The magnitude of the left-parietal effect has been shown to vary with context, task and stimuli, and is further thought to be modulated by the amount and quality of information retrieved.

We use ERPs to investigate the factors contributing to individual differences in recognition memory.

We hypothesize that differences in memory will be reflected in the magnitude of the left parietal index of recollection.

Method

- N=129 right-handed native English speakers.
- Participants completed a simple old/new recognition memory task for words and were ranked by discrimination accuracy (Pr).

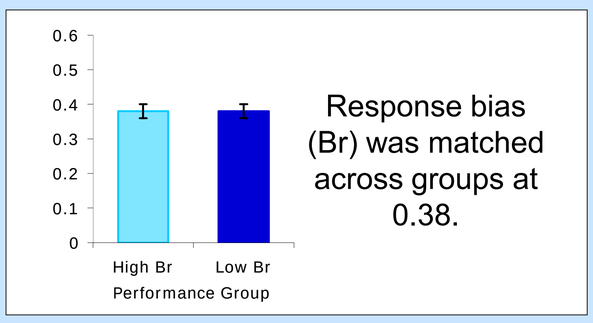


- Matching for response bias (Br) 18 of the highest and 18 of the lowest performers were selected.
- EEG was recorded during the test phase and ERPs were formed by averaging all Hit responses together, and all CR responses together. These ERPs were then averaged across the participants in each group.
- The magnitude of the old/new effect (the difference in amplitude between Hits and CRs) was compared across performance groups.

Results

Behavioural Results:

- Discrimination accuracy (Pr) in the high performance group was 0.80 and 0.40 in the low performance group, with a standard deviation of 0.09 in both groups.

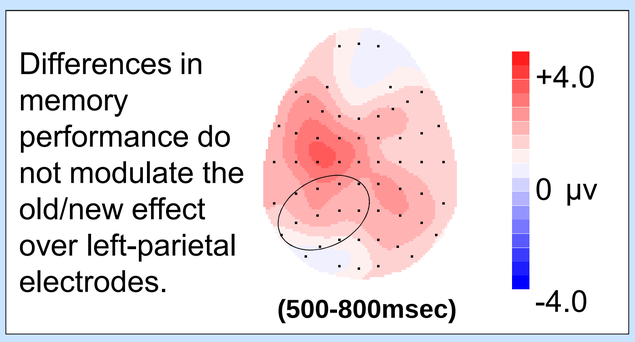


Graph showing average Br values across conditions.

- The high performance group had a mean hit rate of 88% with a response time of 856ms and a false alarm rate of 7% with a response time of 1665ms.
- The low performance group had a mean hit rate of 63% with a response time of 899ms and a false alarm rate of 23% with a response time of 1053ms.

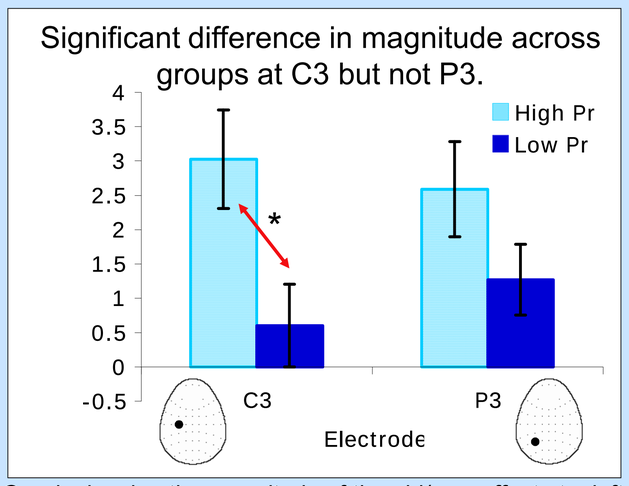
ERP Results:

- A comparison of the size of the old/new effect in the high and low performance group show that the magnitude of the effect did not differ at left parietal electrodes in the 500-800ms time window.



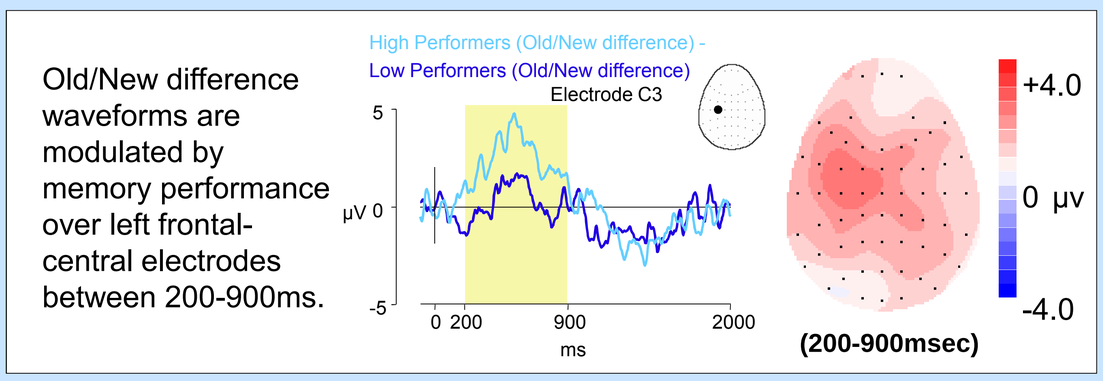
Topographic map showing the difference in the magnitude of the old/new effect between high and low performers in the 500-800ms time window in µV.

- Whilst there was no significant old/new effect difference between groups over left parietal electrodes in the 500-800ms time window, a difference over frontal-central electrodes was apparent.
- High performers exhibited a greater old/new difference over left frontal-central electrodes than low performers, a difference maximal at electrode C3.



Graph showing the magnitude of the old/new effect at a left frontal-central electrode (C3) and a left parietal electrode (P3) in the 500-800ms time window, for each performance group.

- Timing of this left frontal-central old/new effect was not restricted to the 500-800ms time window, but evident between 200-900ms post-stimulus.



ERP old/new difference waveforms showing change in µV over time, averaged across participants for high and low performers. Topographic map showing the difference in magnitude of the old/new effect in µV, between performance groups.

Conclusions

- Differences in behavioural performance did not modulate the size of the left parietal old/new effect associated with recollection as predicted.
- A modulation of the old/new difference over left frontal-central electrodes was apparent between 200-900ms, reflecting an old/new difference over these electrodes for high performers not present for low performers.
- Previous studies have reported early onsetting frontal old/new ERP differences which are thought to reflect retrieval support processes (see Rugg & Wilding, 2000, Trends in Cognitive Sciences, for a review).
- The variation in old/new effect size over left frontal-central electrodes presented here resembles previously reported ERP effects of support processes in both timing and distribution.
- This suggests that differences in the engagement of support processes allows high performers to do better then low performers.

Our results suggest that differences in memory performance between individuals do not simply reflect differential engagement of core retrieval processes.

Differences in memory performance may reflect broader support processes engaging the frontal lobes.

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Correspondence address: cam8@stir.ac.uk