

Reliability Indices For Neurophysiological Event Related Potential Effects

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General Background

The work described here took place in neurophysiological laboratories located at the Universities of Stirling and Aberdeen. The focus is on Event-Related Potentials (ERPs), a real time measure of neural activity collected from scalp electrodes. The goal of the project is to assess the reliability of various established neurophysiological ERP effects with the aim of making larger scale, multi-centre imaging a reality. In order to do that we examined three widely studied effects: the P3, the N400 and the Old/New effect. These effects occur within partially overlapping time windows (200-400ms, 300-500ms and 500-800ms respectively) and reflect a comprehensive sample of different kinds of brain activity: from early sensory-perceptual to later cognitive-motor activity.

General Method

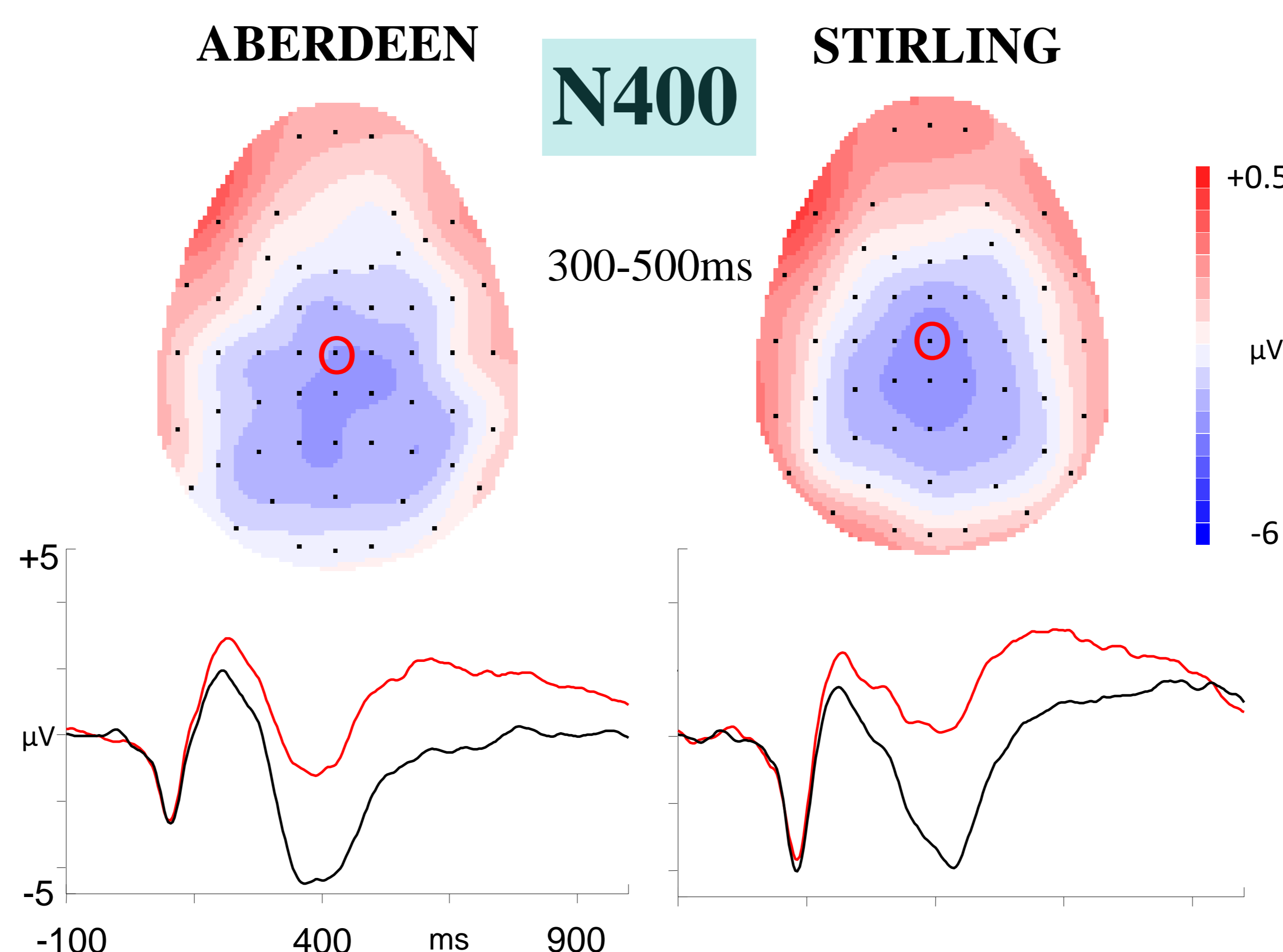
- N= 64 right handed, native English speakers (32 in Stirling, 32 in Aberdeen).
- EEG data were collected using a Biosemi system in Aberdeen and a Neuroscan system in Stirling.
- Data processing protocol was constant across labs.

Background

The N400 effect is obtained by manipulating the degree of association between stimuli, peaks typically 400ms after stimulus presentation and is maximal at centro-parietal sites.

Method

We manipulated the presence of associative relationships (related vs. unrelated) within word pairs, while examining the size of the N400 effect. The experimental procedure consisted of a semantic priming one while the participant performed a judgement of relatedness. There was a 700ms SOA between prime and target. 204 word pairs were presented (102 related, 102 unrelated). ERPs were measured at target presentation.



Results:
Both ERPs and topographic maps show effects consistent in size and topography across labs.

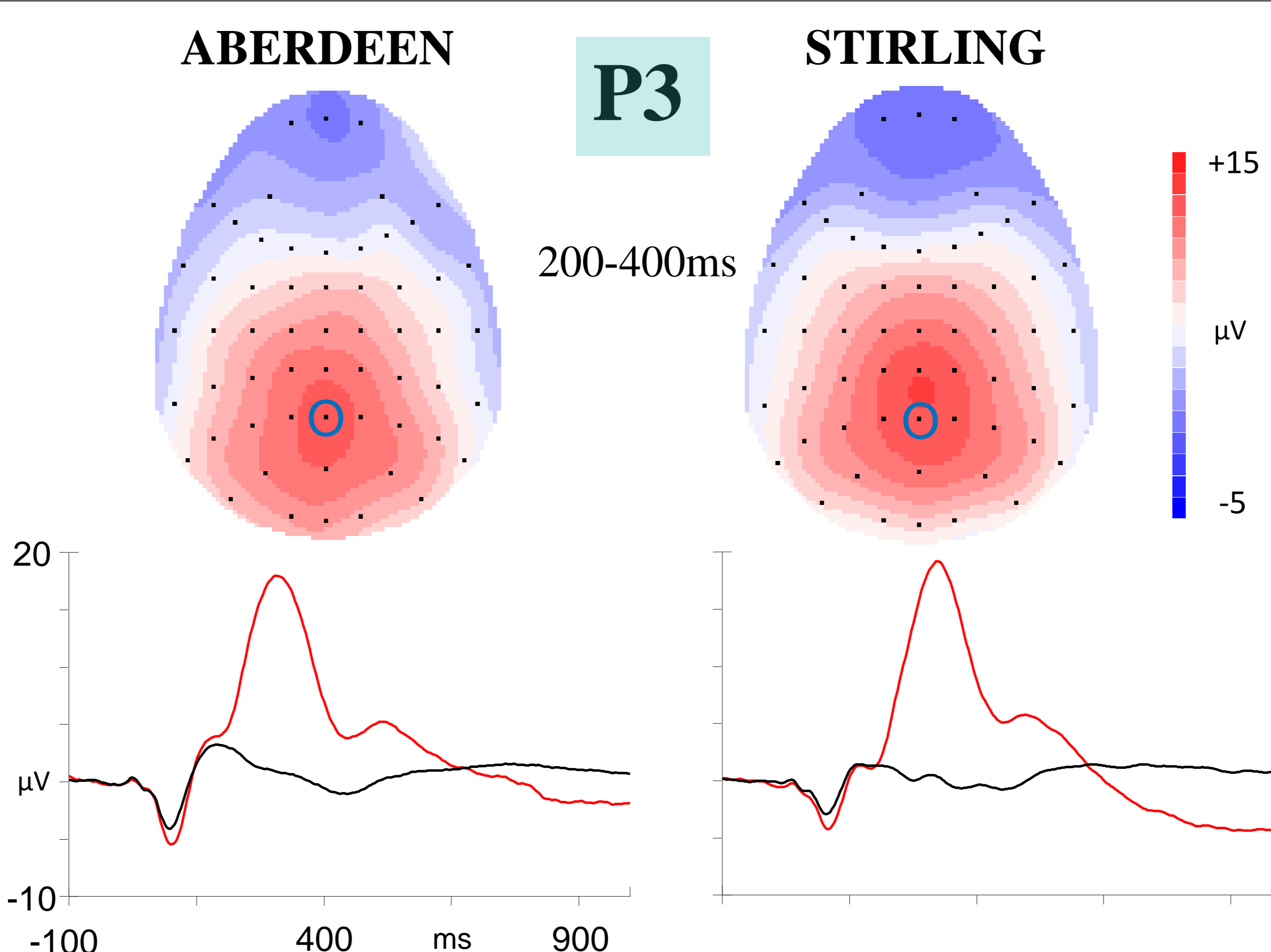
Related Target
Unrelated Target

Background

The P3 effect reflects stimulus control, “attentional” activation, occurs between 200 and 400ms post stimulus and its topography is typically distributed parietally. The effect represents the difference in brain activity between stimuli that evoke a response (pressing a button) and other stimuli that don’t. The P3 effect is sensitive to the relative probability of evocative vs. non evocative stimuli; it becomes larger as the evocative stimuli are less frequent.

Method

Frequent and infrequent auditory stimuli were presented and the participant responded only to the infrequent ones. 400 stimuli were presented overall and infrequent ones comprised 12.5% of the trials.



Results:
Both ERPs and topographic maps show effects consistent in size and topography across labs.

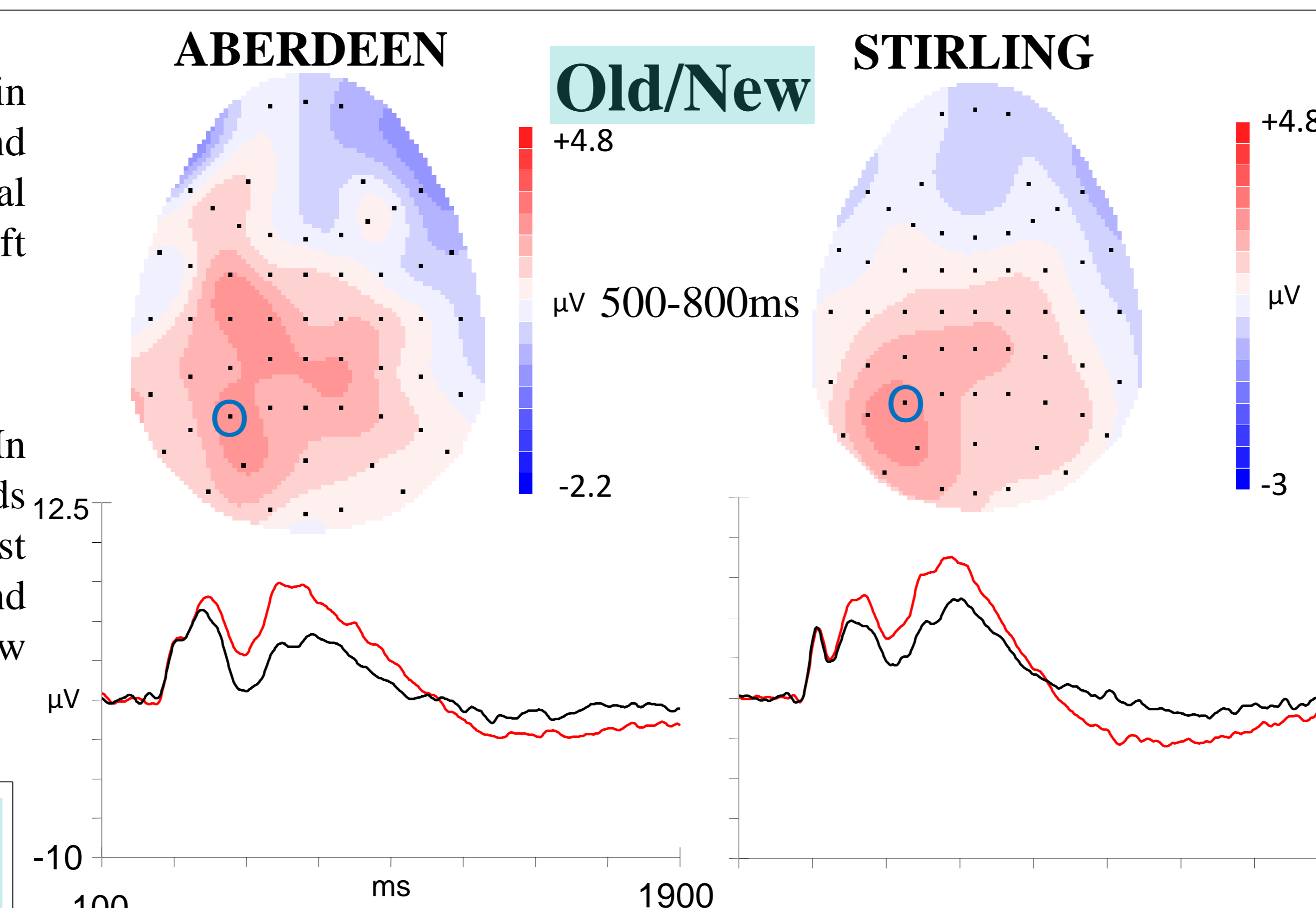
Target Stimulus
Standard Stimulus

Background

The Old/New effect is shown by comparing brain activity evoked by correctly recognized old and new items; the effect is generally maximal between 500-800ms post stimulus and has a left parietal distribution.

Method

88 words were shown during the study phase. In this phase participants judged whether the words referred to living or non living objects. In the test phase 176 words were shown, half of them old and half new, and participants performed an old/new recognition task.



Results:
Size of the left parietal effect was consistent across labs while topography was more left centro-parietal in Aberdeen as opposed to the left parietal distribution in Stirling.

Hits
Correct Rejections

General Conclusions:

Topographic maps, size of experimental effects and smoothness of ERPs show general consistency across the two labs in which the experiment took place.