

Background

Realistic evaluation of cognitive theories requires studies in real-life settings (Kranzioch et al., 2013).

Studies comparing auditory target detection processes when seated and walking found attenuated attentional responses during walking using a counting response that suggests depleted availability of attentional resources (De Vos et al., 2014; Debener et al., 2012).

To further understand this relationship, we used a within modality response (manual button press) during walking to evaluate sensory processes and attentional resource allocation to auditory target detection.

- **Aim:** To determine differences in sensory and attentional process deployment for auditory stimulus processing using ERP measures by varying 'real-life' settings.

Method

Three tone auditory oddball task

- 900Hz standard (72% probability) 600Hz distractor, 1200Hz target (each 14% probability)

- Binaural headphone presentation

Press button to acknowledge target

Four conditions (repeated measures, randomised):

1. Laboratory
2. Indoor walking
3. Outdoor seated
4. Outdoor walking



Participants:

N = 18, 15 F, mean 21.78 years, 16 right handed

EEG recording:

14 Ag/AgCl electrodes (10-20 system) Bluetooth enabled Emotive amplifier (49x44x25 mm, 48g), 128 Hz sampling rate, 0.16-45 Hz band-pass filter Acquired via small laptop (Toshiba Portege Z830-10N, 316x227x8.3 mm, 1.12kg) running OpenViBE software

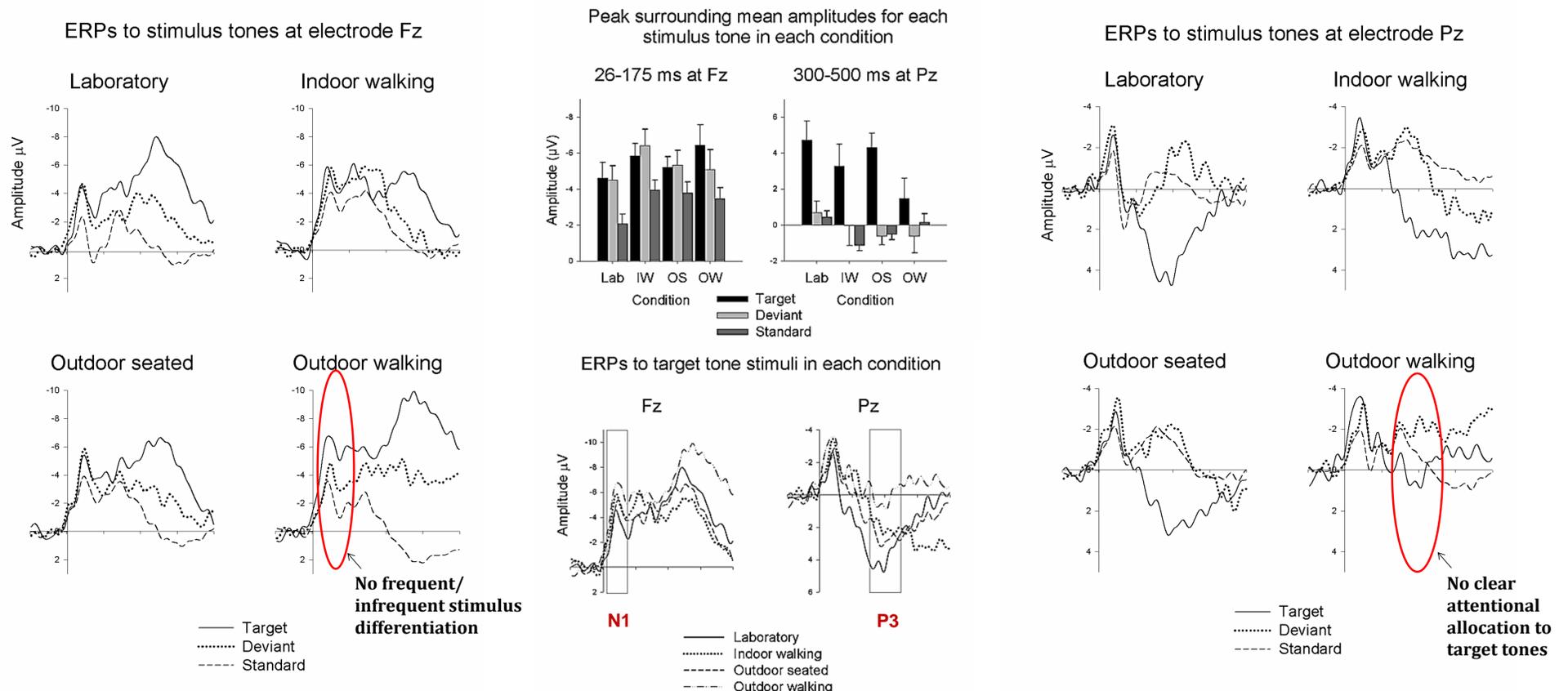
Data processing:

- ICA to attenuate eye blinks only
- 20Hz low pass filtered
- Epochs extracted -200ms-800ms around each target, deviant and standard stimuli onset, baseline corrected and averaged together
- Peak surrounding area means for each stimulus in each condition calculated for N1/P3 ERPs and analysed in ANOVA

Do sensory and attentional processes for auditory target detection differ in real-life settings?

Sensory processes: N1

Attentional Processes: P3



Yes.

Sensory: Frequent/infrequent tone distinctions made by N1 in laboratory, indoor walking and outdoor seated conditions not present in outdoor walking condition.

Attentional: P3 to target tones is present in laboratory, indoor walking and outdoor seated conditions but not evident for the outdoor walking condition.

Discussion

The increase in perceptual and motor demands in the outdoors walking condition reveals a **cost of task on neural processing** of auditory tone stimuli, which is not apparent in each of the other conditions.

The lack of statistical difference in amplitudes elicited to each tone suggests that the **cognitive processes normally employed** to discriminate initial sensory changes and attentional categorisations are **differentially allocated** when perceptual and motor demands are high.

Conclusion

Prior research identified a reliable P3 while walking and counting auditory targets.

Our **manual response required the recruitment of motor processes** and therefore shares resources employed during walking.

Accessing this particular response mechanism **while walking outdoors results in a cost** to sensory and attentional stimulus processing.

We therefore conclude that behavioural response mechanisms impact neural stimulus processing in a way previously undetected in laboratory based studies.

References

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