

Attention modulates visual perception during moving visual scenes: a daily challenge

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Background

Covert peripheral attention tends to be investigated during fixation on static backgrounds. In the real world, however, we are often presented with a moving pattern of optic flow, either from our motion through the world or if parts of the world moves past us. Such visual movement may trigger eye movements.

It is unclear if attention is robust enough to still occur even during the potentially highly distracting situation where visual motion is presented that is strong enough to elicit eye movements.

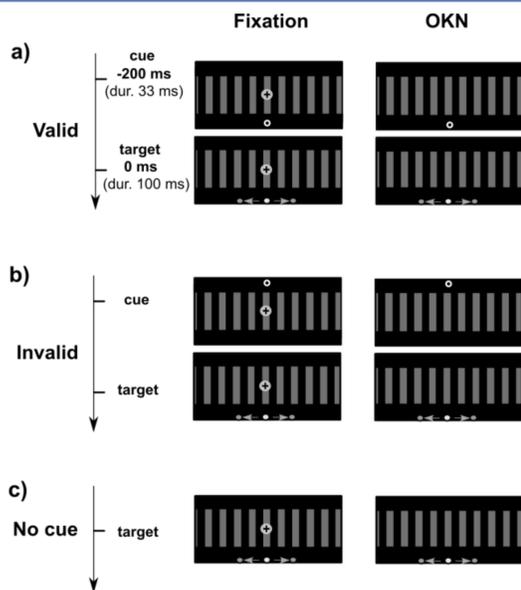
Hypothesis: modulation of behaviour and the P1 ERP component by exogenous attention, during and despite optokinetic stimulation and during ongoing continuous reflexive eye movements.

Discussion

- Similar effect of exogenous attention on behaviour and brain activity occurs during reflexive eye movements as during fixation:
- RTs were decreased on valid trials.
- Smaller P1 ERP component followed valid trials.
- Exogenous attention did not affect the oculomotor response during OKN: no SPV difference between valid and invalid trials.

Attention modulated the perceptual judgment of stimuli presented during OKS, and the perceptual processing of those stimuli. These results suggest that attention overcomes the challenges to visual perception generated by our own movement through the environment.

Methods and visual motion perception task during OKS



Participants:

- 30 right-handed healthy volunteers (19 F, mean age 28 ± 6 years)

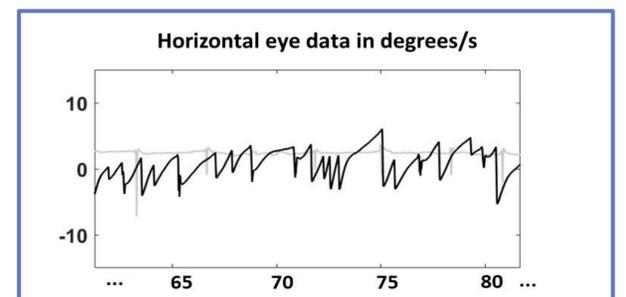
Methods:

- EEG (64-channels)
- Eyetracking (EyeSeeCam)

Exogenous cuing task during optokinetic stimulation.

During both blocks bars were moving to the left, visual target stimuli (dots) were presented in either the upper or lower part of the screen. Targets moved left, right or were still. Cues (hollow circles) were always presented 200 ms before targets (filled dots, see panel a, b).

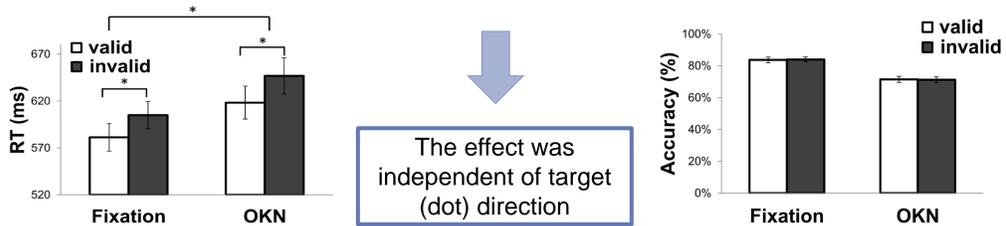
OKN with leftward slow-phase elicited by leftward OKS



Example of 20 seconds of eye movement data, showing the horizontal plane from one subject, during OKN (in black) and during fixation (in grey).

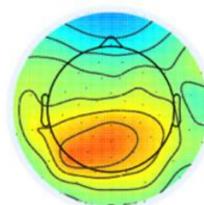
Behavioural response during fixation and optokinetic nystagmus

Exogenous attention affects reaction times but not accuracy during fixation and optokinetic nystagmus



The effect was independent of target (dot) direction

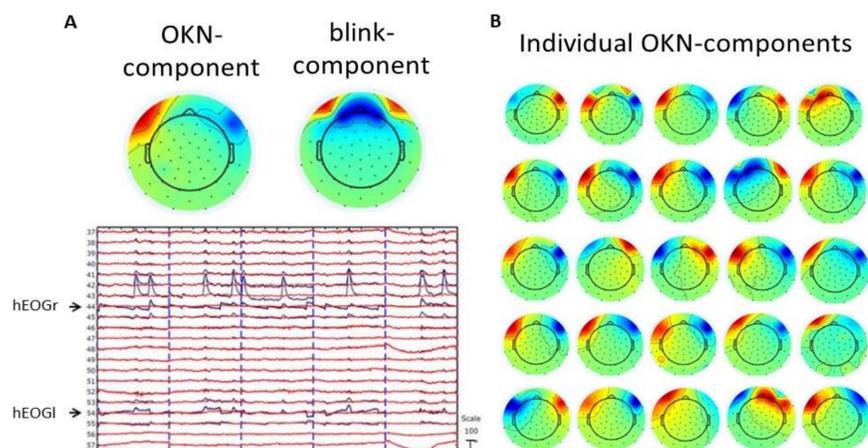
Brain activity during fixation and optokinetic nystagmus



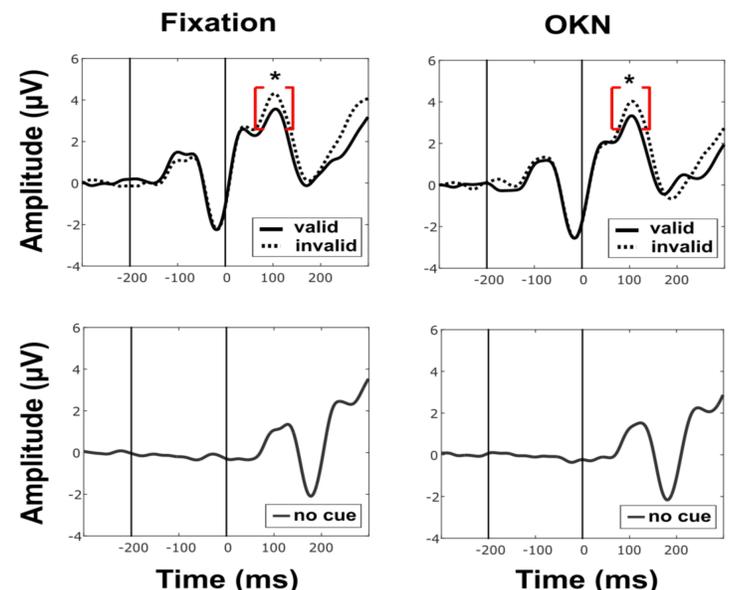
ERP-scalp distribution for valid still targets during fixation, showing the scalp distribution of the P1 component (80- to 120 ms post-target).

Exogenous attention affects the P1 component of ERP during both fixation and during OKN

EEG during OKN: Independent Component Analysis



Topographies of OKN (upper left) and blink (upper right) components identified by ICA, in one representative participant. Lower panel: example of raw data showing the EEG signal before (blue) and after (red) the components detected were removed (panel A). Map of individual OKN components showing the consistency of this component in the EEG signal (panel B).



Grand averaged ERPs during fixation and OKN. Targets were presented at time zero; valid and invalid targets were preceded by cues at 200 ms before target onset (first row) or without cues ("no-cue", second row).