P4pc: An Electrophysiological Marker of Strategic Attentional Disengagement?

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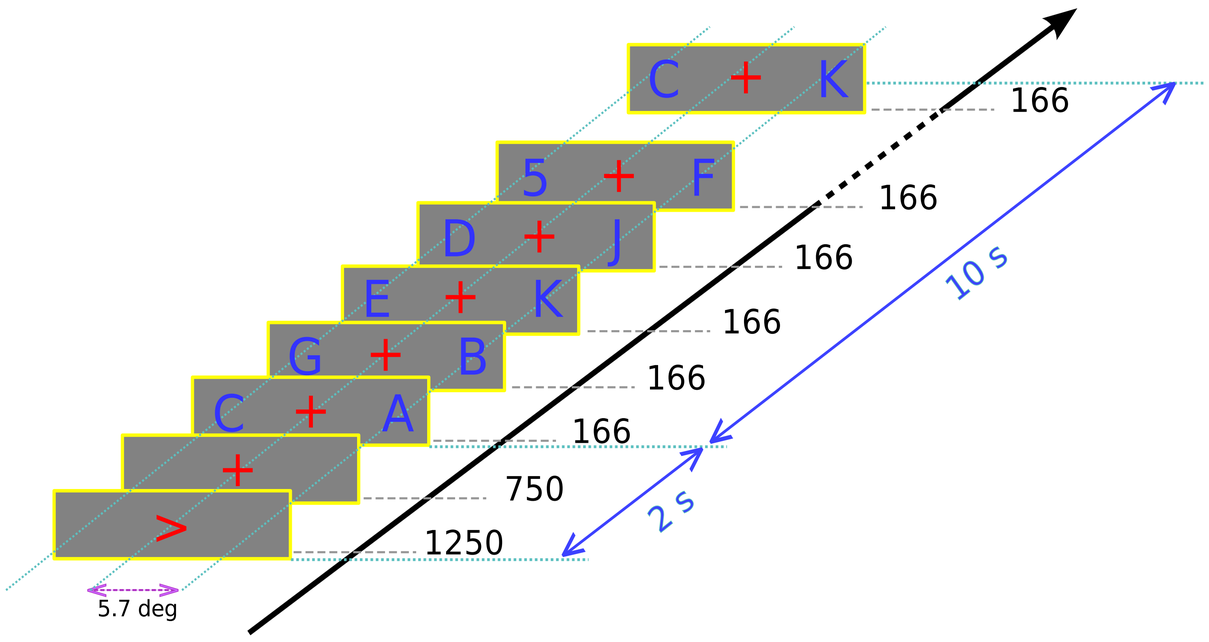
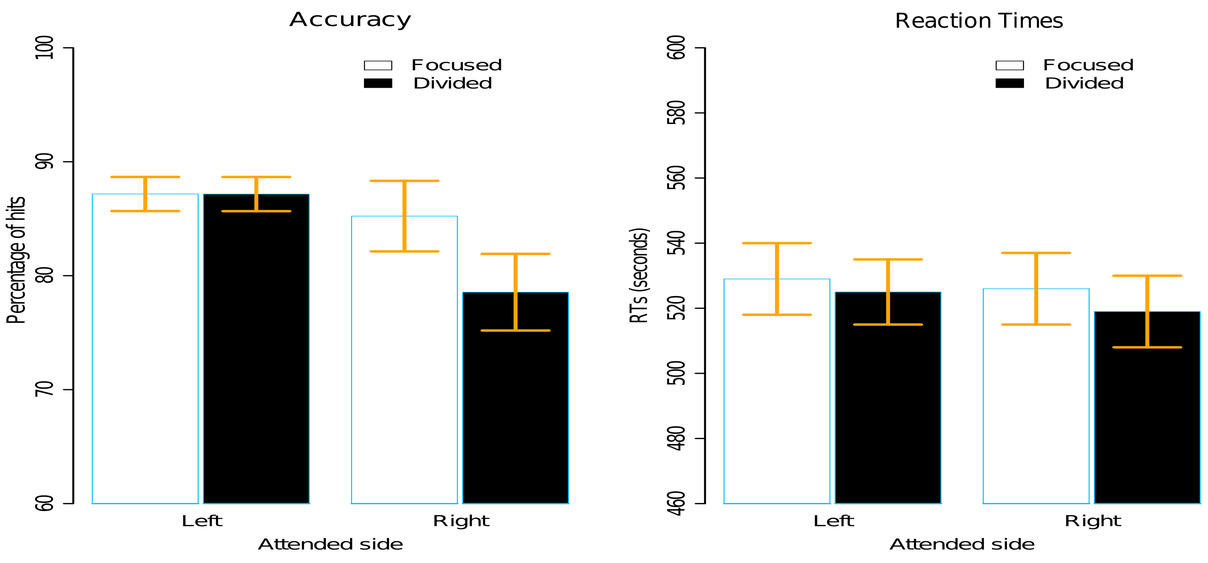
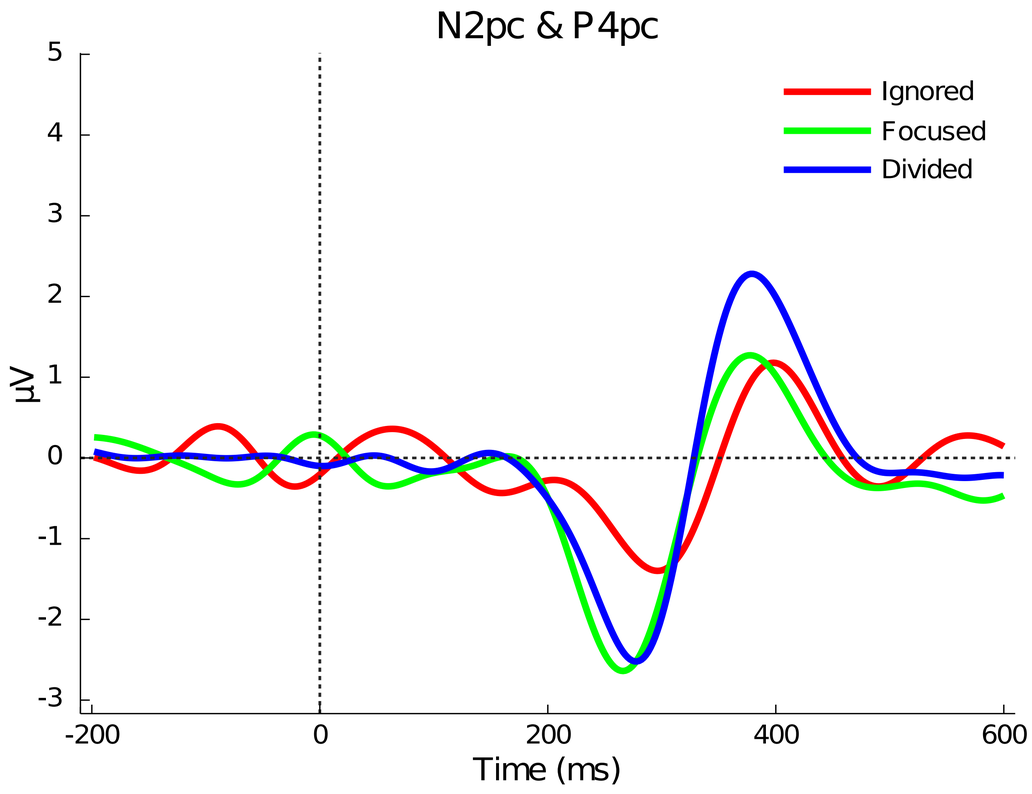
Does an ERP component that serves as a marker of attentional disengagement or task switching in the way that the N2pc serves as a marker of attentional engagement or selection exist?



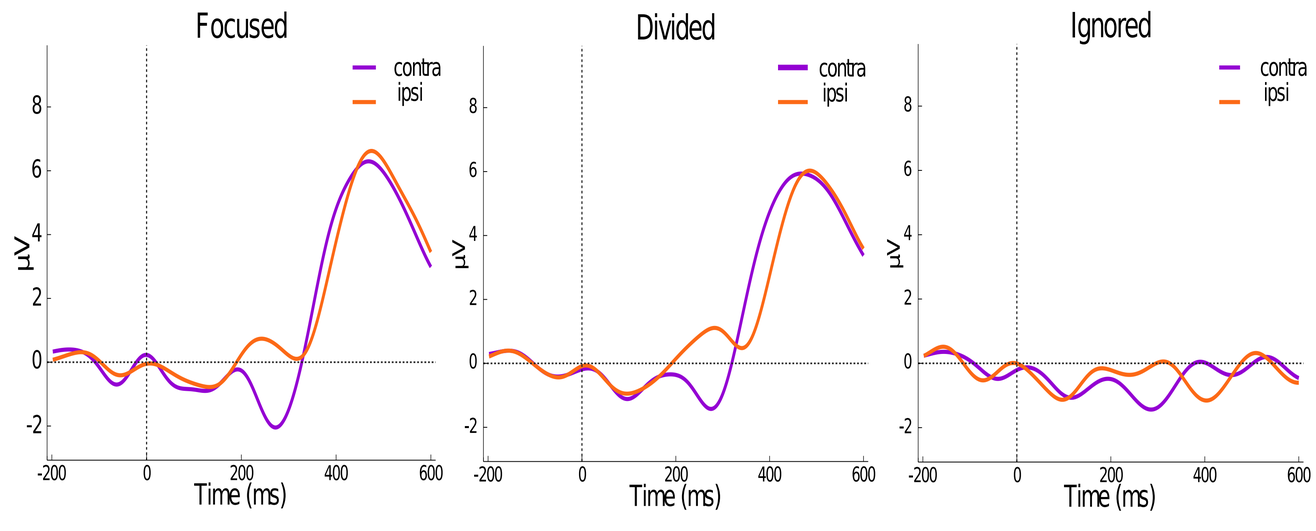
TASK Participants performed a visual detection task (respond to the digit 5 embedded in a stream of letters A to K). Two stimulus streams, one to the left and one to the right of fixation, were displayed simultaneously. At the beginning of each trial a cue indicated whether targets on the left, right, or both sides should be responded to.



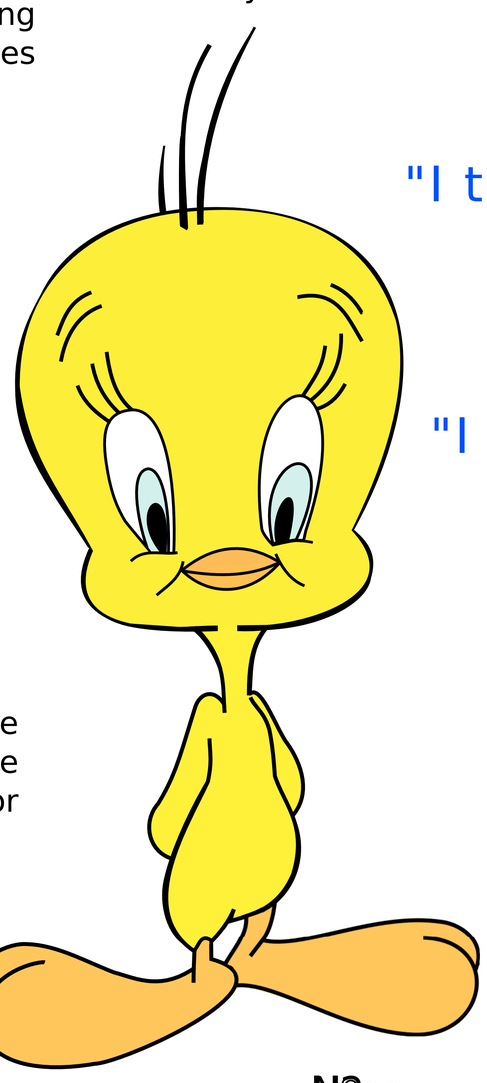
BEHAVIORAL RESULTS Target detection was lower in the divided- than in the focused-attention condition. An apparent bias to attend left, especially in the divided-attention condition, was revealed by higher hit rates for left- than for right-side targets (see [1] for similar results).



N2pc and P4pc are the subtractions of waveforms ipsilateral to target presentation from waveforms contralateral to target presentation. N2pcs were larger in the divided and focused than in the ignored attention condition. Comparable N2pcs between focused and divided attention conditions suggest equal degree of target selection in both conditions. Presence of an N2pc in the focused attention condition confirms that the N2pc is not JUST a shift of attention [2]. To-be-ignored targets evoked an N2pc, indicating attentional capture by targets in the irrelevant stream. P4pc amplitude was largest in the divided attention condition, conforming with the need to restore attention to a divided state. P4pc did NOT differ between focused and ignored conditions.The presence of a P4pc in the focused attention condition indicates that disengagement from a selected target does not need to involve moving attention to a different location.The presence of a P4pc for to-be-ignored targets reflects the need to disengage and redirect attention to the relevant stream after erroneous capture. No latency differences were found.



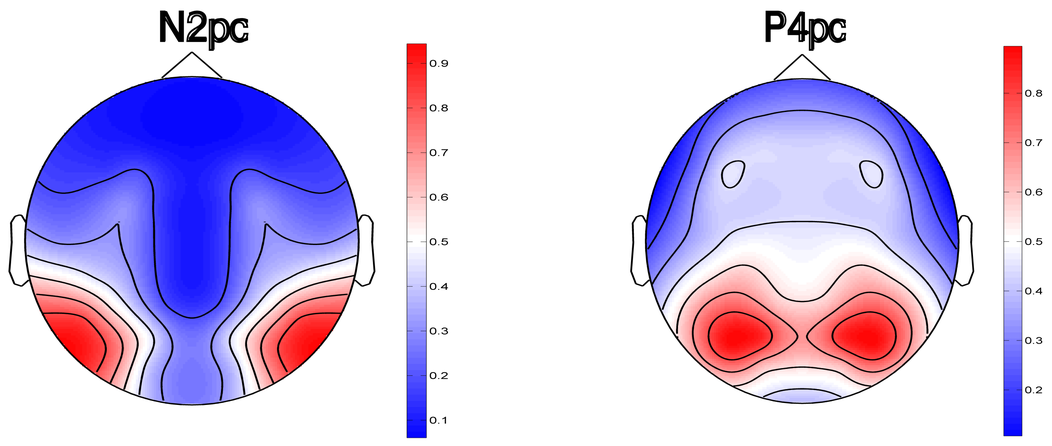
Grandaverages of contra and ipsilateral waveforms across the three attention conditions. A clear P300 is asbsent in the ignored attention condition. Together with the presence of the N2pc and P4pc (see below) these waveforms show the time course of target processing. Attention is first engaged (N2pc) then disengaged from the location (P4pc) however, ONLY targets that need to be further analyzed elicit a P300, whereas the to-be-ignored ones don't.



"I tawt I taw a puddy target!"
(N2pc)

"I did, I did taw a puddy target!"
(P300)

The time course of target processing according to Tweety



Scalp topographies differences between the two components strengthen the conclusion that the P4pc constitutes a genuine component.

CONCLUSIONS The P4pc is a newly documented component which may provide an electrophysiological marker of strategic, top-down controlled disengagement of attention from lateralized visual targets. Such a marker may provide an important tool for the investigation of the nature and dynamics of strategic control of visuospatial attention in complex visual environments with multiple spatially or temporally distributed sources of information.

References
[1] Hollander A, Corballis MC, Hamm JP. Visual-field asymmetry in dual-stream RSVP. Neuropsychologia 2004; 43: 35-40.
[2] Kiss M, Velzen JV, Eimer M. The n2pc component and its links to attention shifts and spatially selective visual processing. Psychophysiology 2008; 45: 240-249.
[3] Lien MC, Ruthruff E, Goodin Z, Remington RW. Contingent attentional capture by top-down control settings: Converging evidence from event-related potentials. J Exp Psychol Hum Percept Perform 2008; 34: 509-530.
[4] Posner MI, Petersen SE. The attention system of the human brain. Ann. Rev. of Neurosci. 1990; 13: 25-42.
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