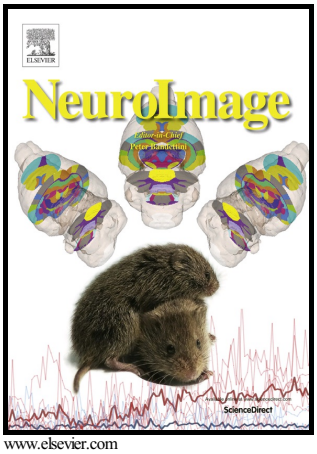

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Alpha Phase Dynamics Predict Age-Related Visual Working Memory Decline

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Abstract

Alpha oscillations (7-14 Hz) are modulated in response to visual temporal and spatial cues. However, the neural response to alerting cues is less explored, as is how this response is affected by healthy aging. Using scalp EEG, we examined how visual cortical alpha activity relates to working memory performance. Younger (20-30 years) and older (60-70 years) participants were presented with a visual alerting cue uninformative of the position or size of a lateralized working memory array. Older adults showed longer response times overall and reduced accuracy when memory load was high. Older adults had less consistent cue-evoked alpha phase resetting than younger adults, which predicted worse performance. Alpha phase prior to memory array presentation predicted response time, but the relationship between phase and response time was weaker in older adults. These results suggest that changes in alpha phase dynamics, especially prior to presentation of task-relevant stimuli, potentially contribute to age-related cognitive decline.

Keywords

Oscillations, alpha, aging, working memory, attention, alerting cue

Introduction

In order to achieve high behavioral performance, limited attentional resources must be efficiently directed towards task-relevant information. Such information could include the timing or spatial position of upcoming visual stimuli. Knowledge of when (Nobre et al., 2007) or where (Posner, 1980) a target will appear enhances detection and shortens response times. Likewise, presentation of neutral warning cues improves response times by heightening alertness or preparedness for upcoming stimuli. The effects of informative temporal and spatial cues are strongly related to the dynamics of 7-14-Hz alpha oscillations, as observed in anticipatory changes in alpha amplitude (Thut et al., 2006; van Diepen et al., 2015; Worden et al., 2000; Zanto et al., 2011) and phase (Samaha et al., 2015). How alpha dynamics are modulated in response to warning or alerting cues is less understood.