Prior dynamic experience modulates spatial attentional rhythm

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INTRODUCTION

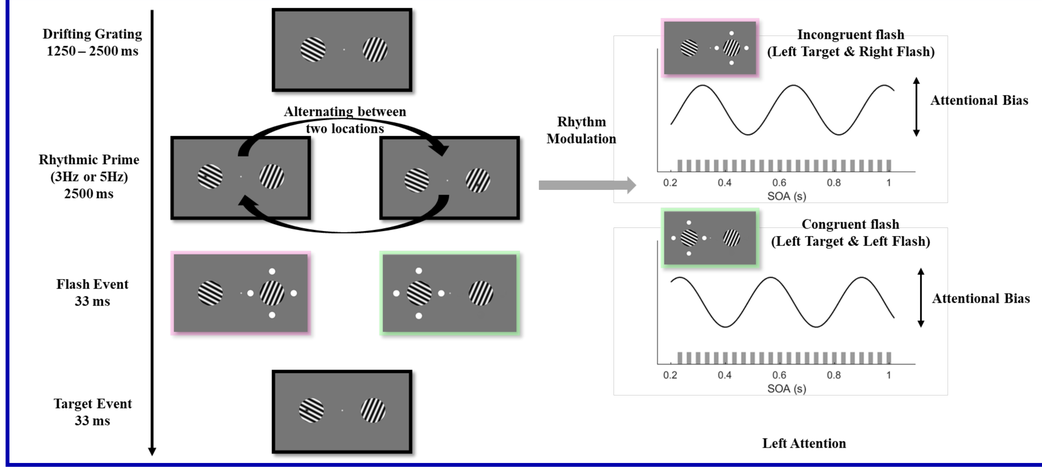
The brain efficiently coordinates its limited resources over external information through attention. It is well established that attention can improve the behavioral performance by selectively focusing on the most task-relevant information (Carrasco, 2011). Interestingly, by taken a temporal perspective, recent studies propose that attention works in a dynamic way rather than remain stationary. These experiments demonstrate that multiple locations, objects, and features are rhythmically sampled over time (Laudau & Fries, 2012; Fiebelkorn et al., 2013; Re et al., 2019). However, it remains largely unknown whether attentional rhythm is inherently hardwired or can adapt to prior experience and changes flexibly. Therefore, we used time-resolved behavioral measurements on 25 human subjects to examine whether externally induced rhythm in prior experience would influence spatial attentional rhythm.

METHODS

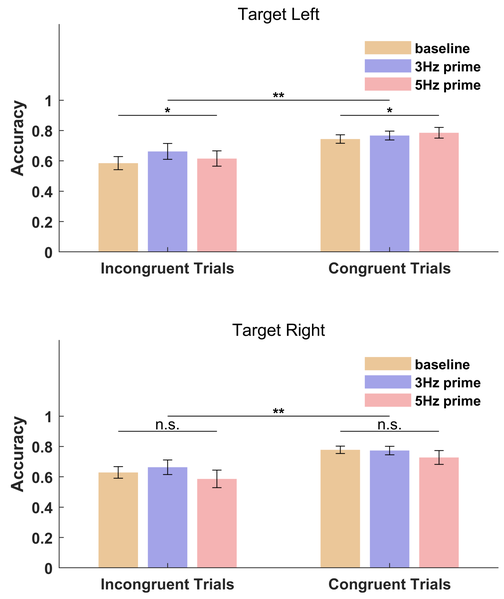
Each trial began with a fixation screen for 1000 to 1200 ms and drifting grating screen for 1250 to 2500 ms. Then, subjects were exposed to a rhythmic prime, i.e., a near-threshold stimulus presented alternatively between two spatial locations for 2500 ms at 3 Hz or 5 Hz. Next, after a varied time interval (200 to 1000 ms in steps of 33 ms), a near-threshold probe appeared at one of the two locations. Subjects needed to detect the target and the accuracies were measured. The precise amplitude of the target was adjusted individually during a 1-up-1-down staircase procedure in advance to achieve a 50% threshold.

Throughout the experiment, each subject has to first complete a pre-test condition without the rhythmic prime to collect the baseline of attentional rhythm, and a post-test condition with a random 3Hz or 5Hz rhythmic prime to test the effect of externally induced rhythm. In each condition, each time lag on a given relative location repeated 20 times per subject.

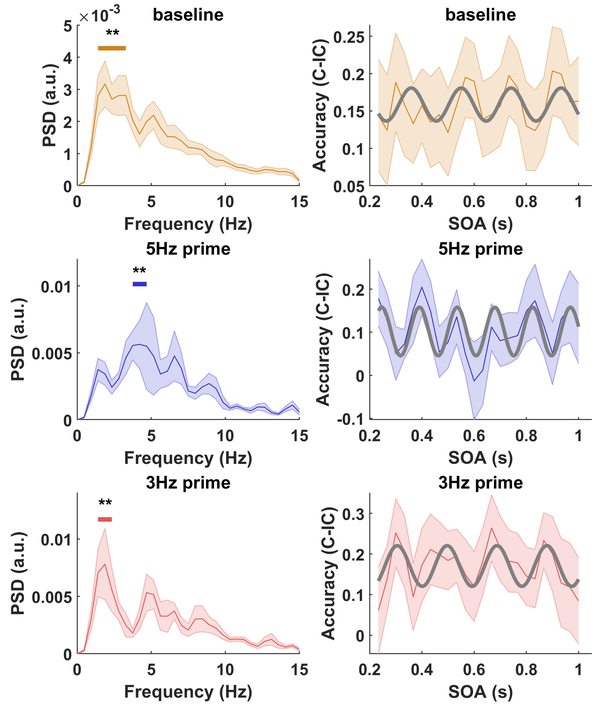
Experimental Procedure and Design



Overall Performance



Accuracy Time Courses and Spectral Analysis



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CONCLUSIONS

Taken together, our results suggest that visual attentional rhythm is not a fixed clock and could be modulated by and adapt to prior dynamic experience.