The Effect of Temporal Attention on Visual Discrimination and Subjective Visibility Across Different Temporal Regularities

Christina Bruckmann[1,2] & Assaf Breska[1]

[1]Max-Planck-Institute for Biological Cybernetics, Tübingen, Germany
[2]University of Tübingen, Germany

christina.bruckmann@tuebingen.mpg.de

BACKGROUND

How does temporal attention affect visual perception?

Temporal attention has been shown to robustly improve discrimination performance.

Fewer studies have investigated the effect of temporal attention on subjective perception.

Objective and subjective measures correlate, but were dissociated in spatial attention.

Does temporal attention differentially affect subjective and objective perception?

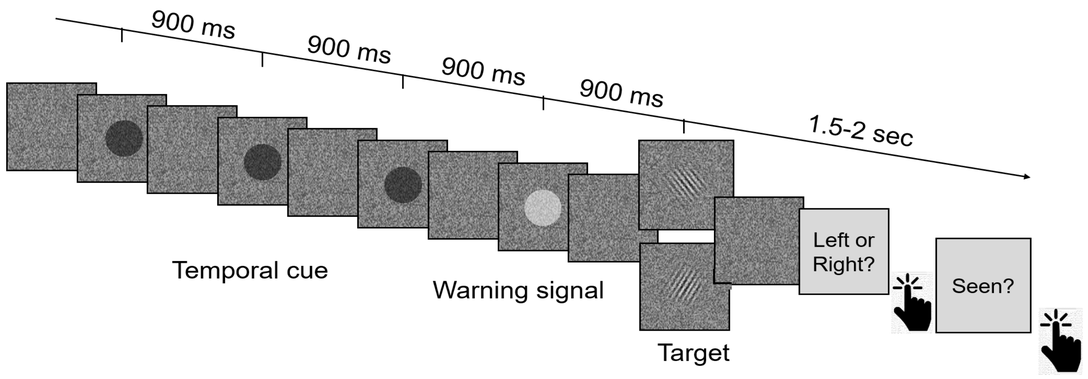
Are rhythms special in driving temporal expectations?

Neural entrainment models suggest that rhythms uniquely drive temporal attention through phase alignment already in sensory circuits.

However, in a motor task, aperiodic predictive attention cues lead to comparable phase alignment and behavioural benefits.

Can memory-based predictions compare to the more automatic predictions of rhythmic entrainment even at low sensory levels?

METHOD

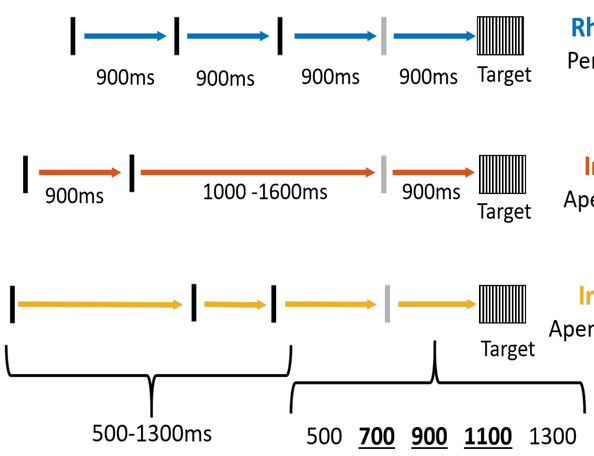


N=31

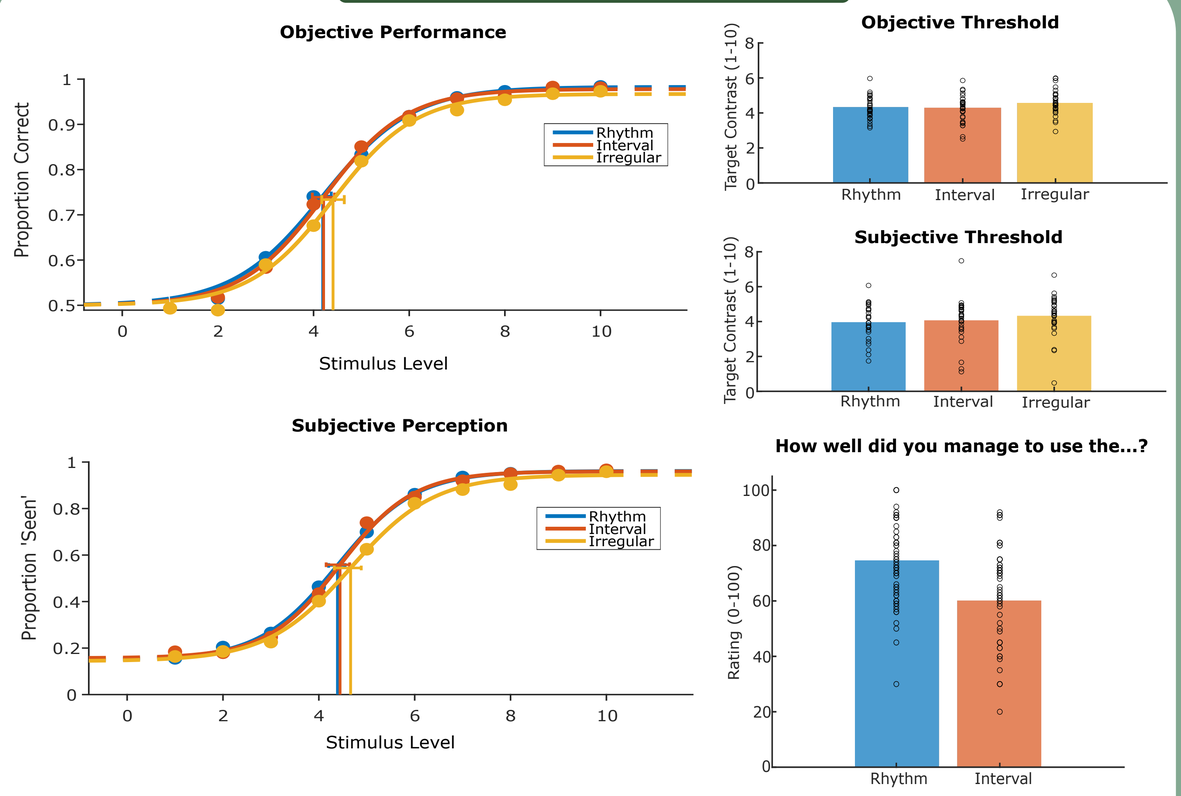
Two Sessions
(1 Behavioural & 1 EEG)

Total trials per Condition:
240 + 36 catch trials

10 Target Contrast Levels



BEHAVIOURAL RESULTS

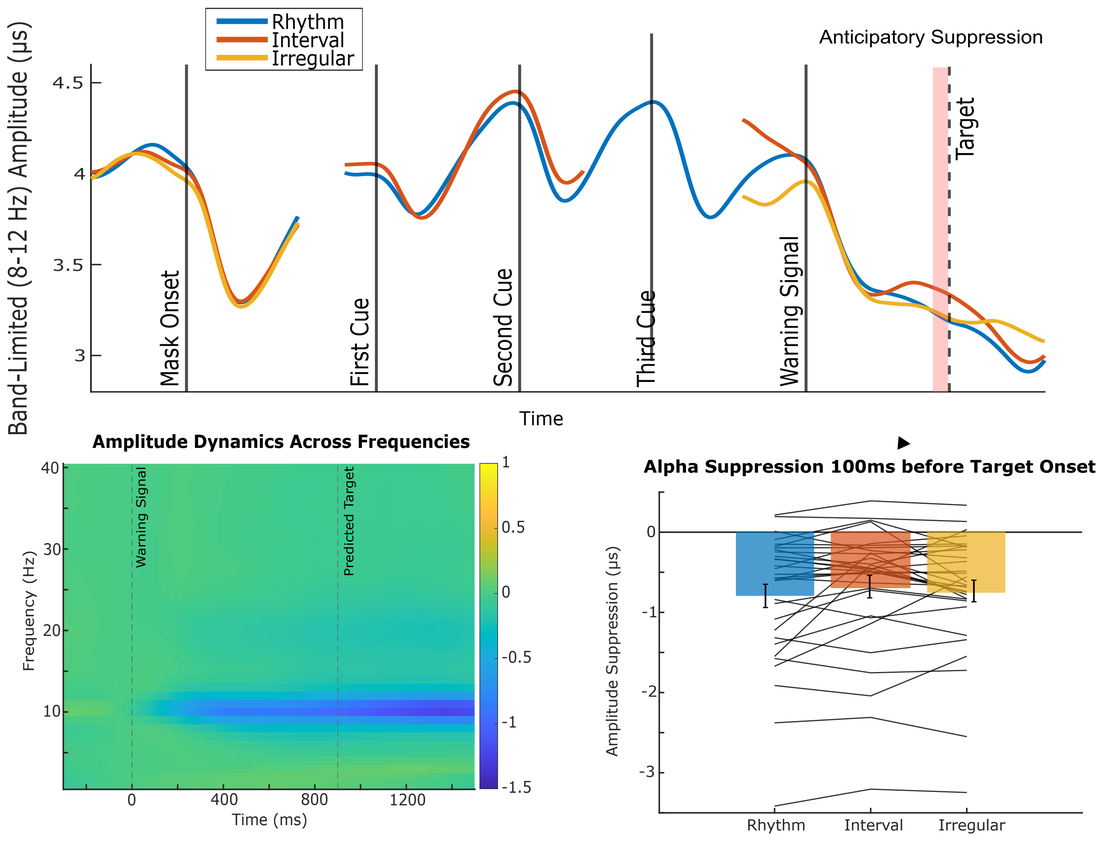


Temporal predictability improves both objective and subjective performance

No difference between rhythm and interval

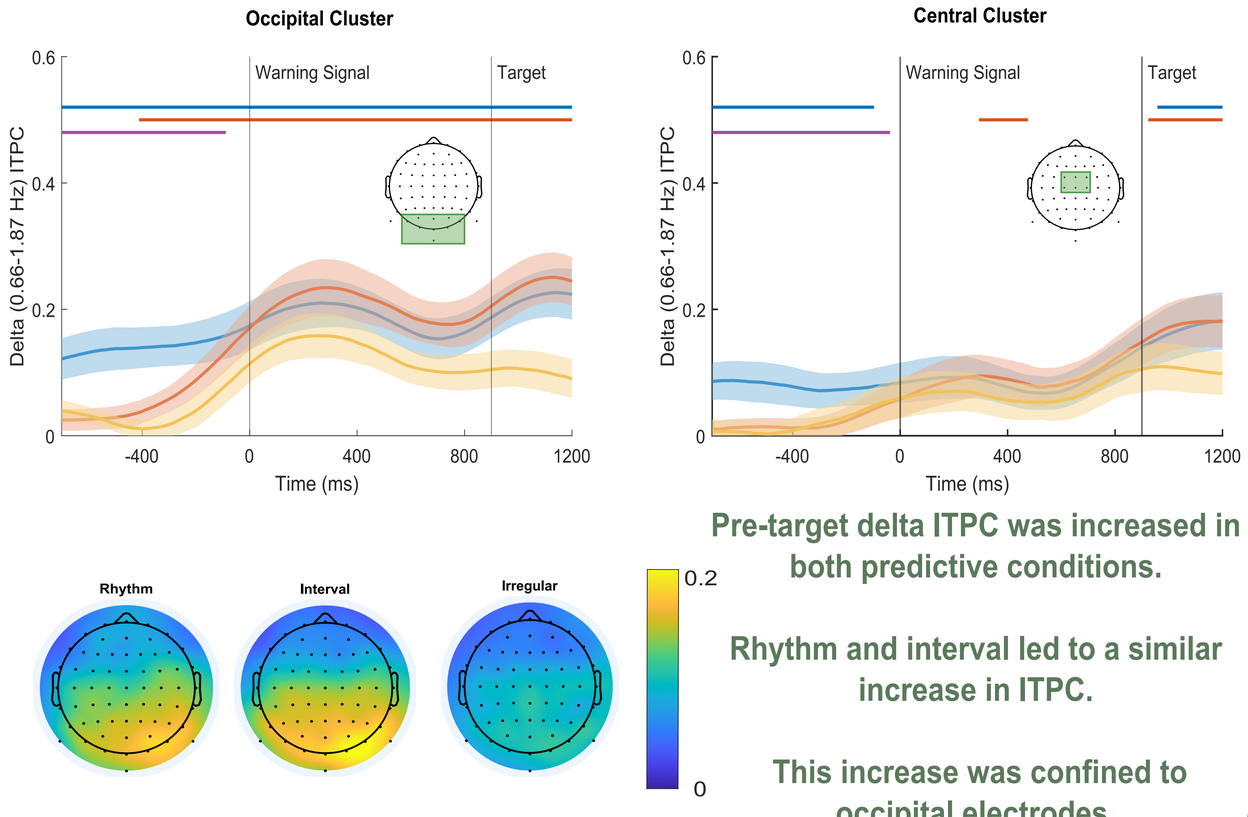
EEG RESULTS

Anticipatory Alpha Band (8-12 Hz) Amplitude Suppression



Anticipatory alpha suppression can be seen in all conditions.

Delta Band (1.11 Hz ± 4.5 dB) Intertrial Phase Coherence



Pre-target delta ITPC was increased in both predictive conditions.

Rhythm and interval led to a similar increase in ITPC.

This increase was confined to occipital electrodes.

SUMMARY & IMPLICATIONS

- The dissociation between the subjective and objective measures of perception and the later reported subjective cue efficiency might suggest that rhythm is indeed a more automatic mechanism while aperiodic predictions require more cognitive effort.
- Alpha band amplitude is suppressed even without precise temporal prediction. We speculate that the warning signal provided suffient timing information to drive this effect.
- Rhythm and interval both lead to an increase in delta ITPC compared to the irregular condition. However, we found no difference in magnitude of these effects. This suggests that even aperiodic predictions can drive low sensory phase alignment.
- Delta ITPC occurred in occipital electrodes in the absence of a fronto-central cluster, indicating that the latter is not necessary for driving low-sensory delta alignment.