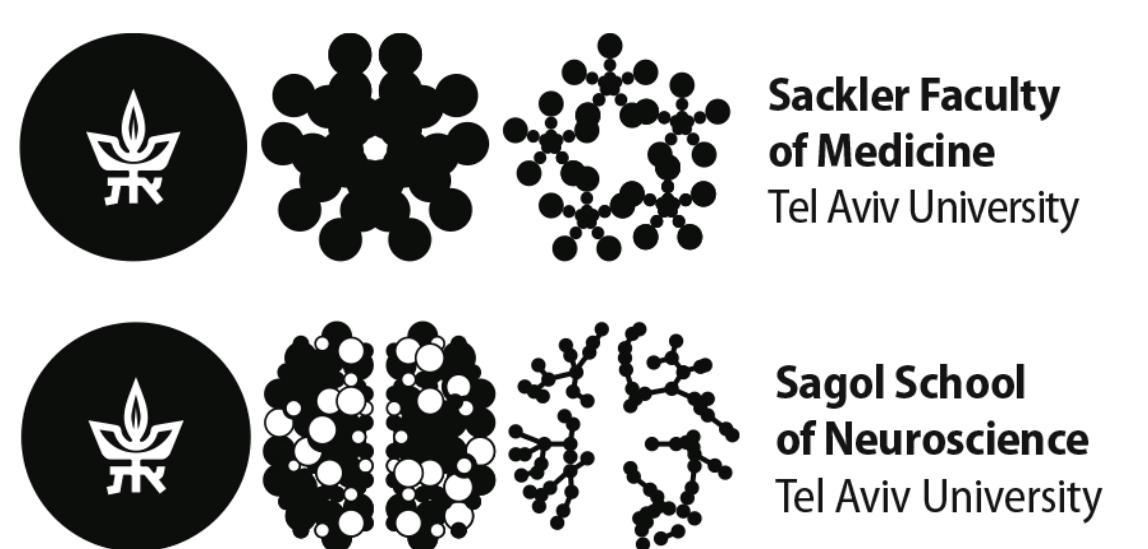


Noradrenergic tone modulates visual awareness and visually-evoked activity



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Introduction

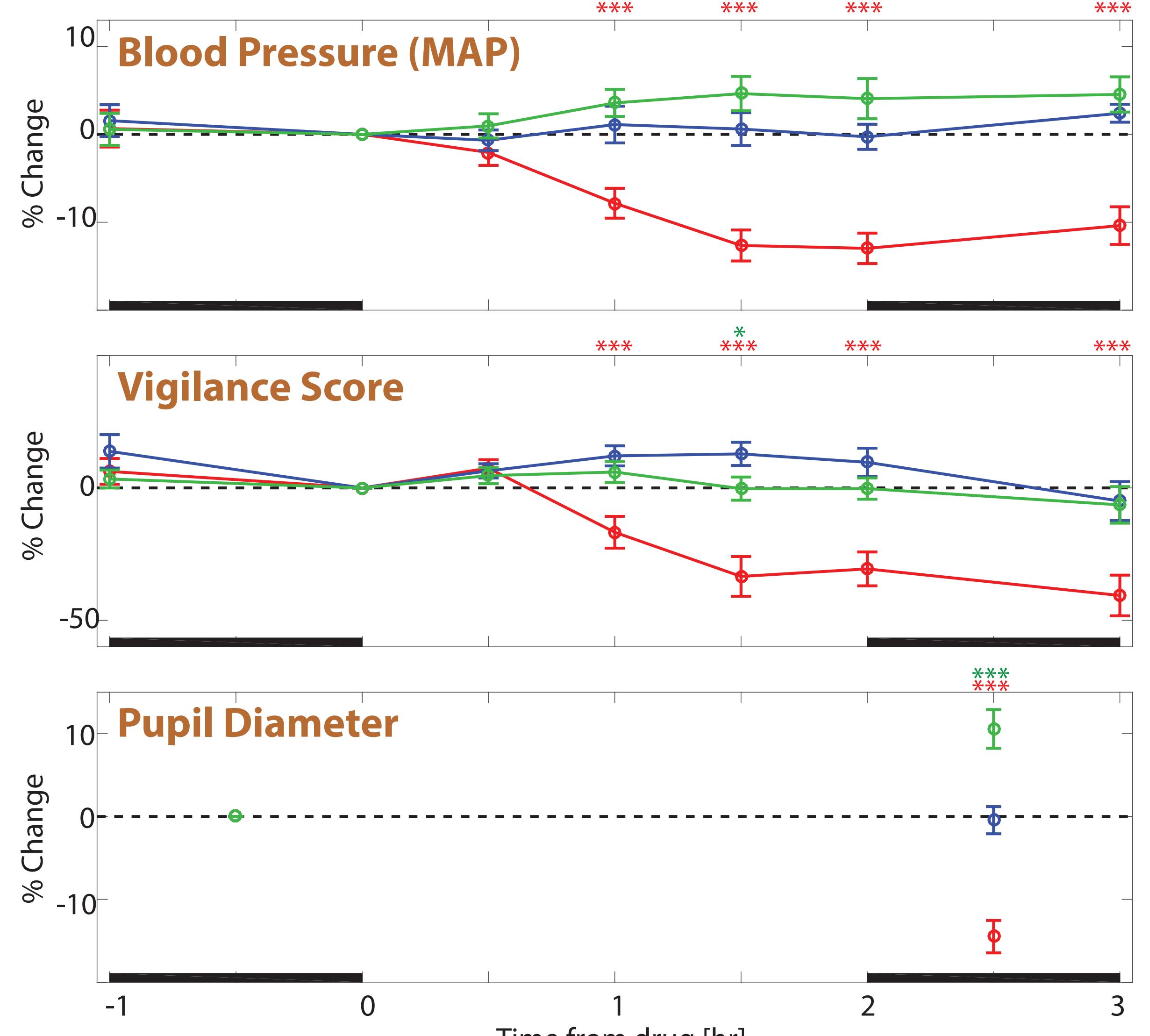
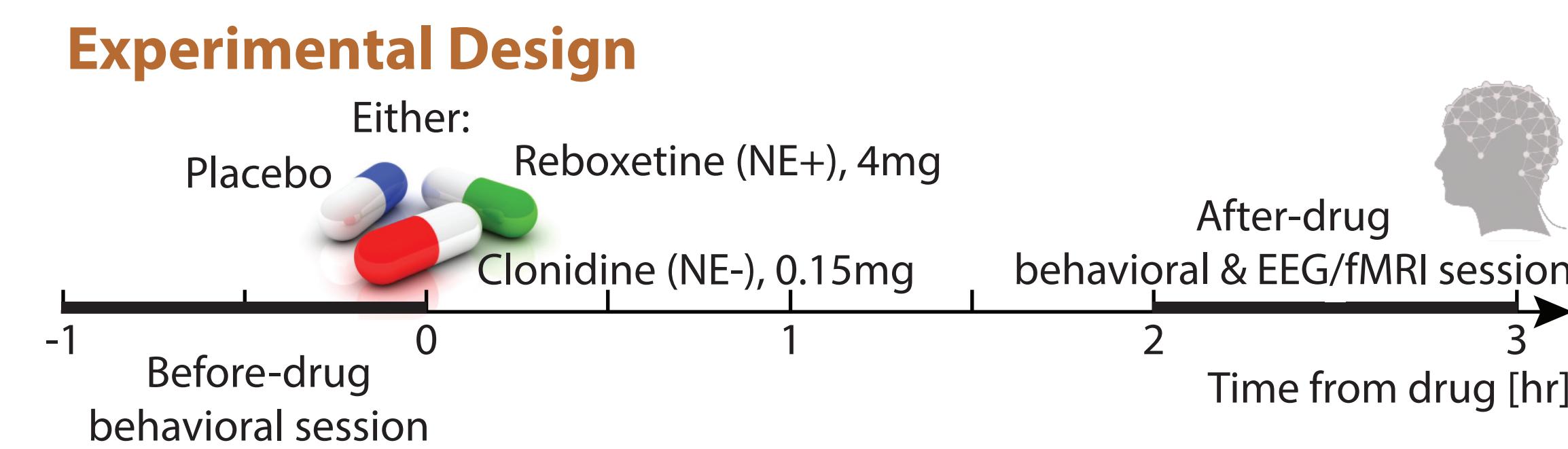
The locus coeruleus-noradrenaline (LC-NE) system may facilitate the incorporation of external events into subjective experience:

- During sleep and anaesthesia LC-NE activity is markedly reduced, and reinstated upon recovery of conscious perception.
- During wakefulness LC-NE activity correlates with perception and implicated in orienting towards behaviorally relevant stimuli and boosting sensory SNR.
- However, causal evidence for the role of NE in perception remains absent.

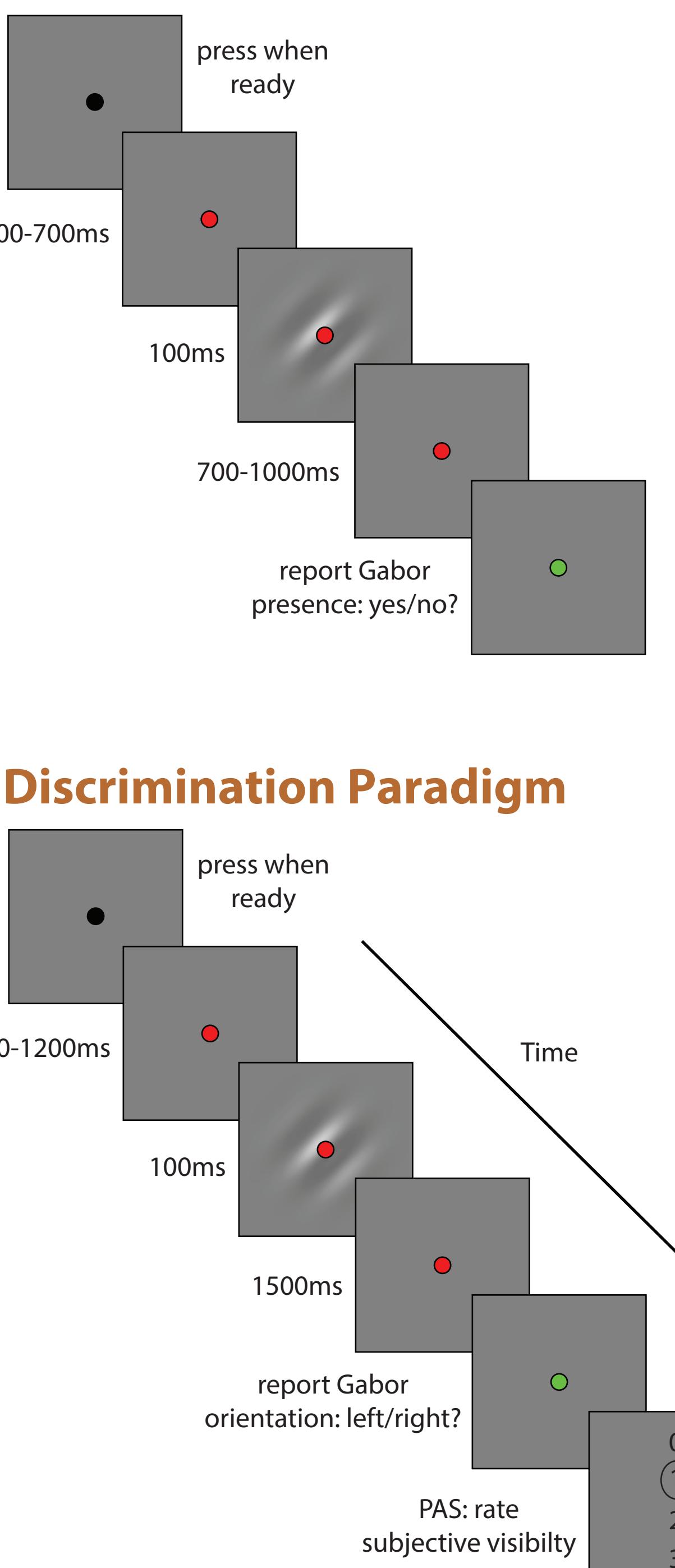
We directly tested the causal role of NE in perception by pharmacologically and bi-directionally manipulating NE-levels in healthy volunteers performing liminal visual detection and discrimination paradigms, while collecting EEG and fMRI data.

Experimental Design & Physiological Results

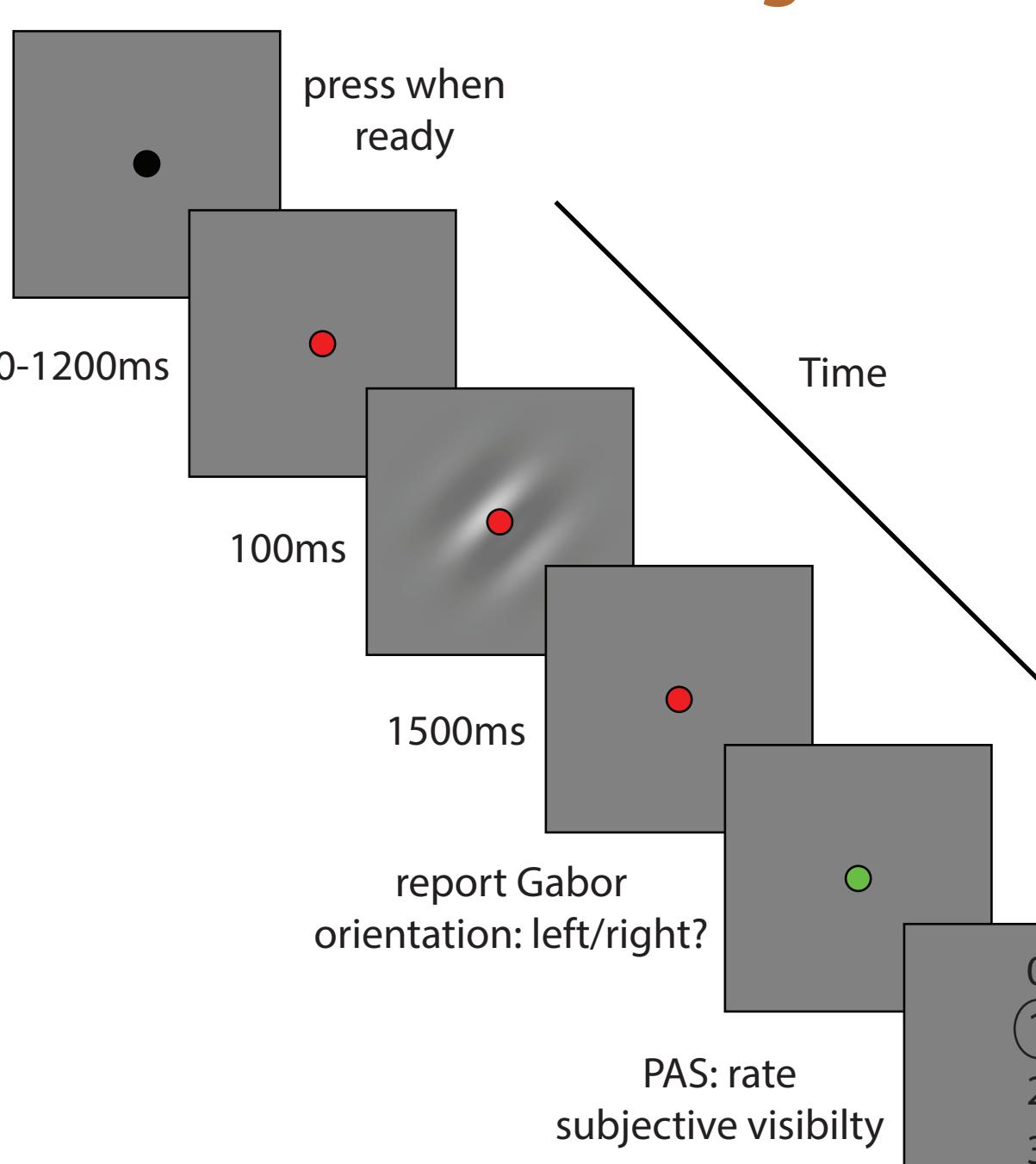
Noradrenergic drugs exert robust effects on peripheral and subjective measures of arousal



Detection Paradigm

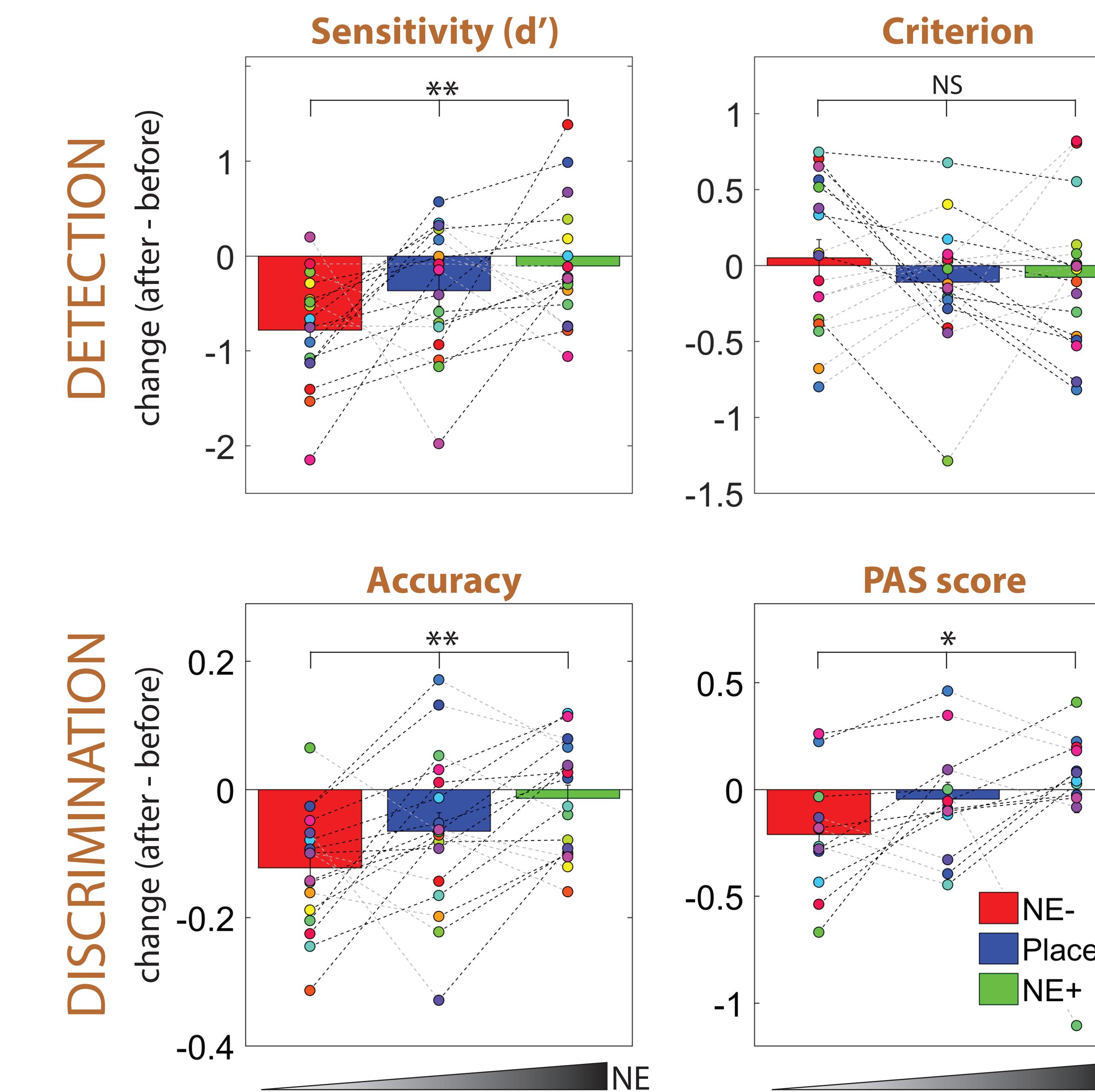


Discrimination Paradigm



Behavioral Results

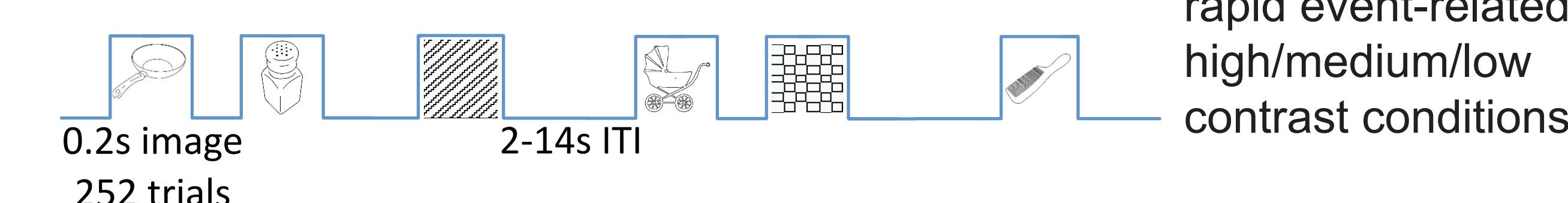
Noradrenaline affects liminal visual detection and discrimination



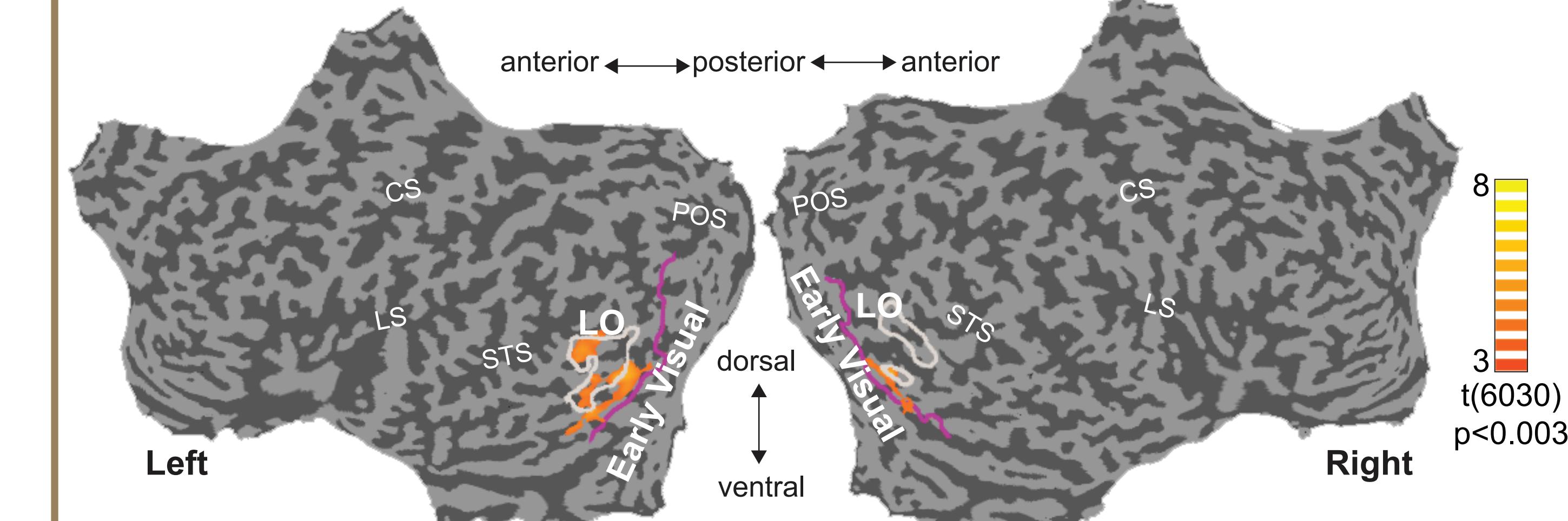
fMRI Results

NE signaling modifies visually-evoked BOLD fMRI responses in high-level visual areas

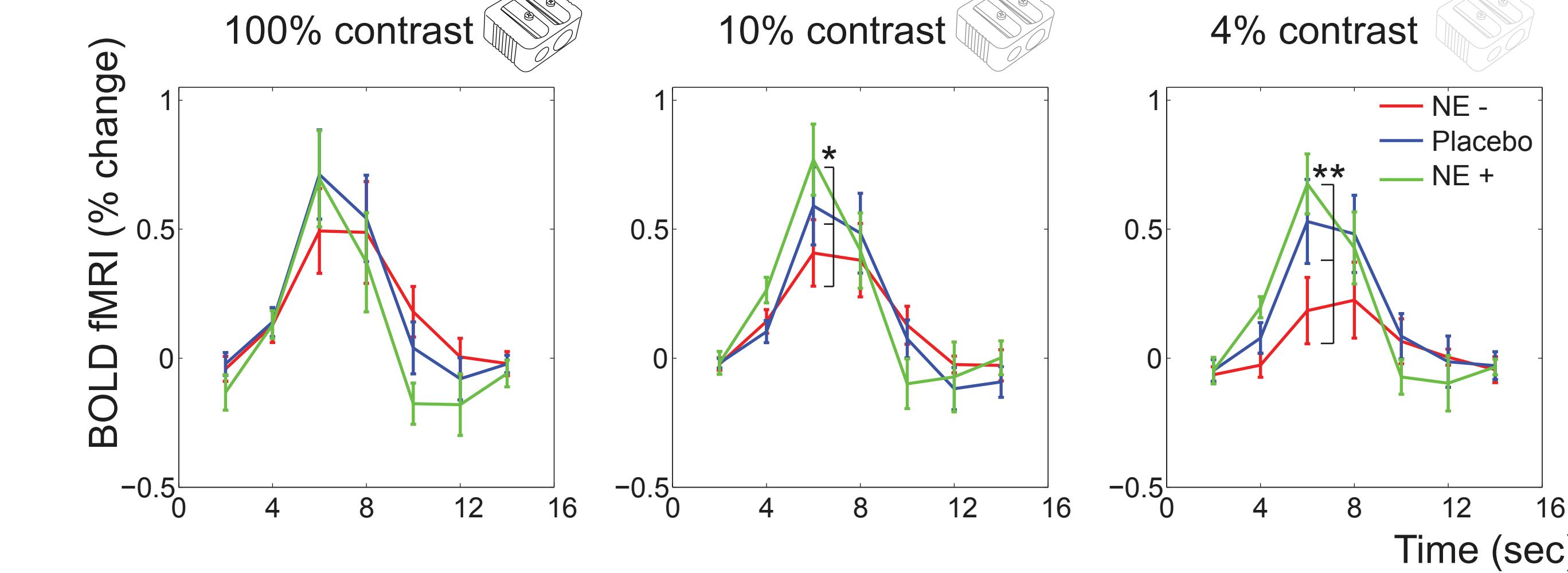
Experimental Design



Placebo responses > NE- responses



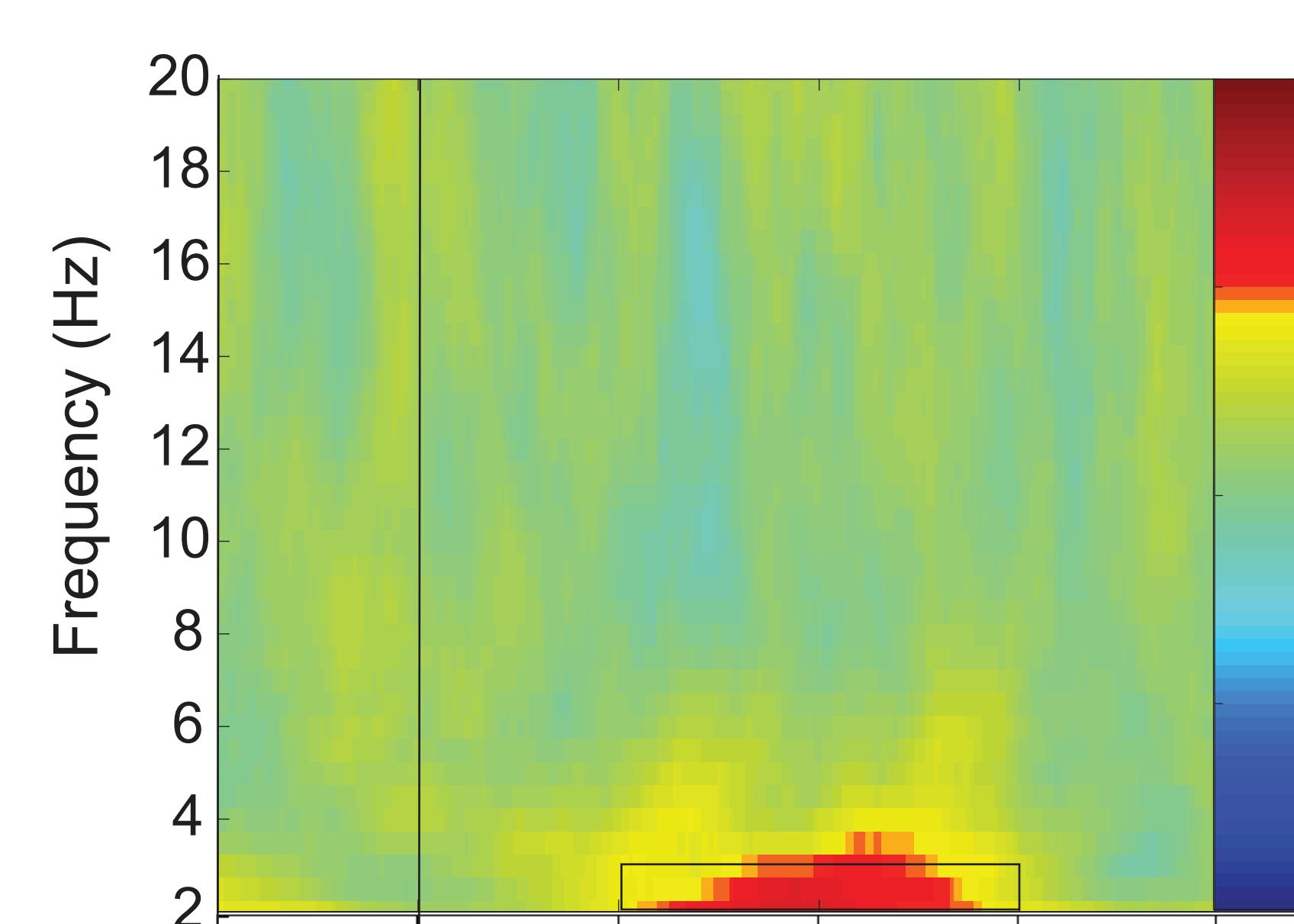
LO response to objects under different drugs and contrasts



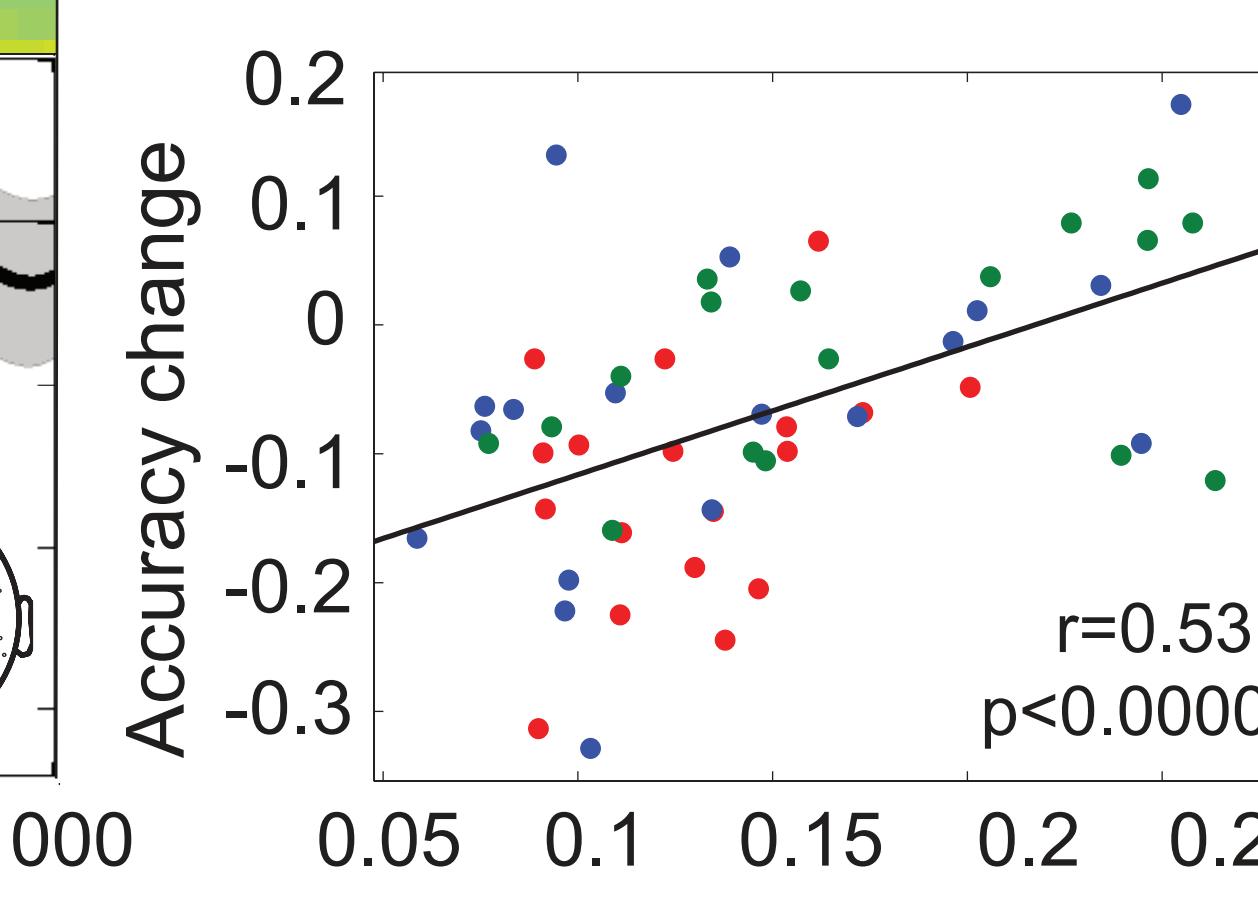
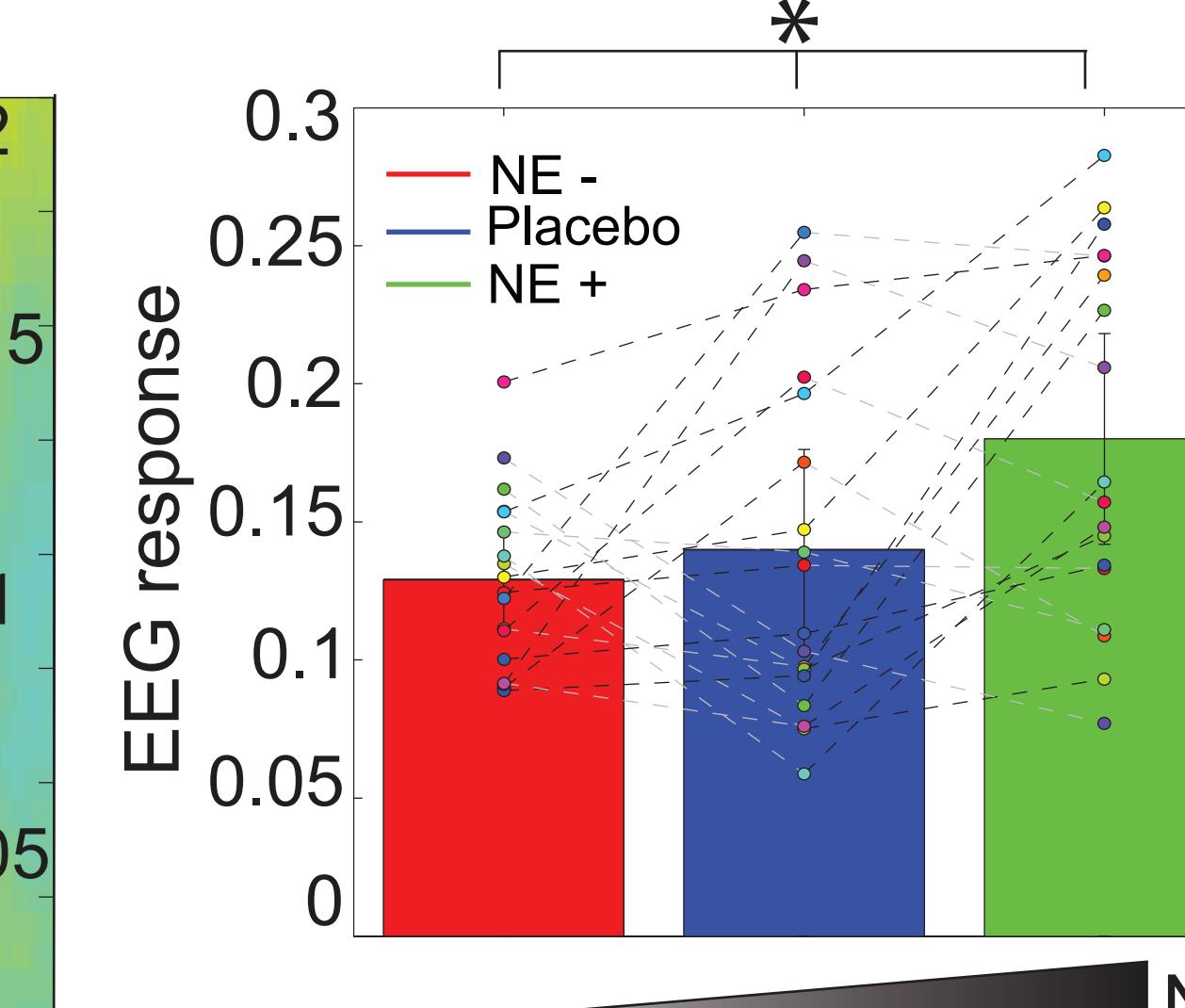
EEG Results

Altered NE signaling directionally affects visually-evoked activity

Inter-Trial Phase Coherence (ITPC)



2-3Hz, 200-600ms ITPC



Conclusions

- NE directionally affects visual perceptual thresholds and subjective visibility, without affecting non-perceptual factors such as response bias.
- More NE led to more consistent EEG responses in occipital nodes.
- These EEG responses were correlated with behaviour.
- The effects were most pronounced in higher-order visual cortices.
- These results hint that NE might play an enabling causal role in visual awareness.

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