

# Cortical Attention and Default Mode Networks in Focused Attention Meditators Assessed with fMRI

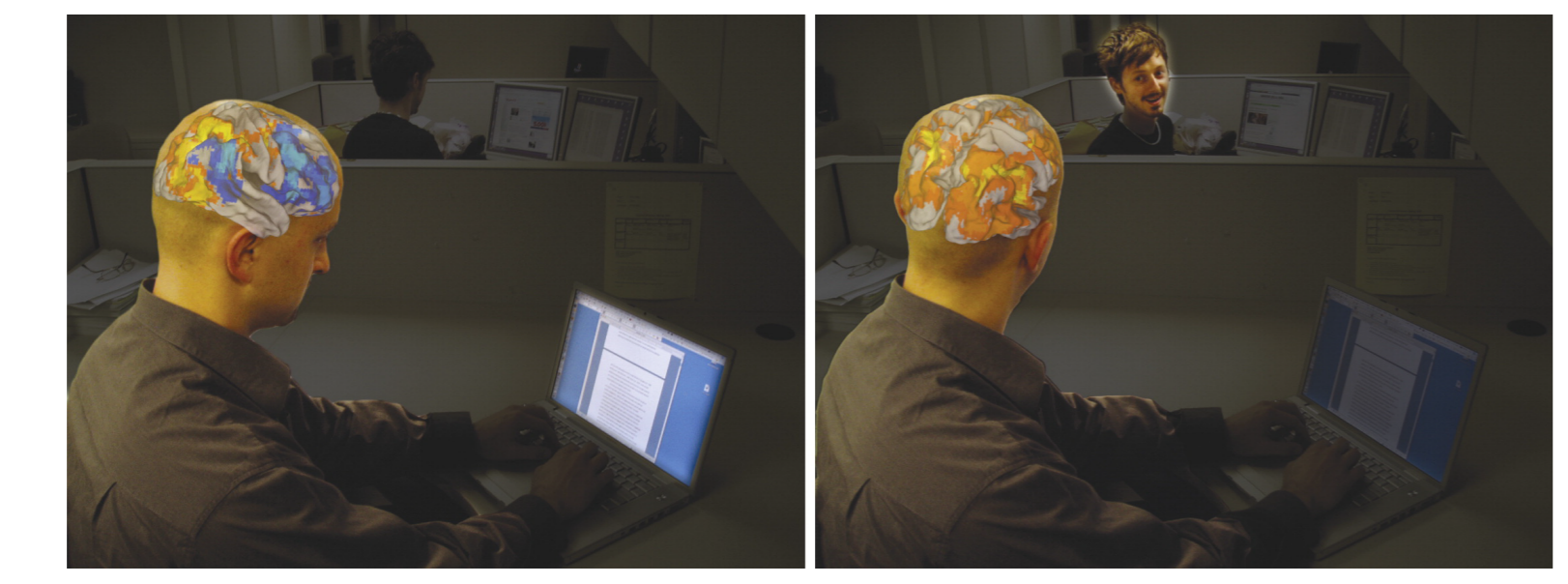
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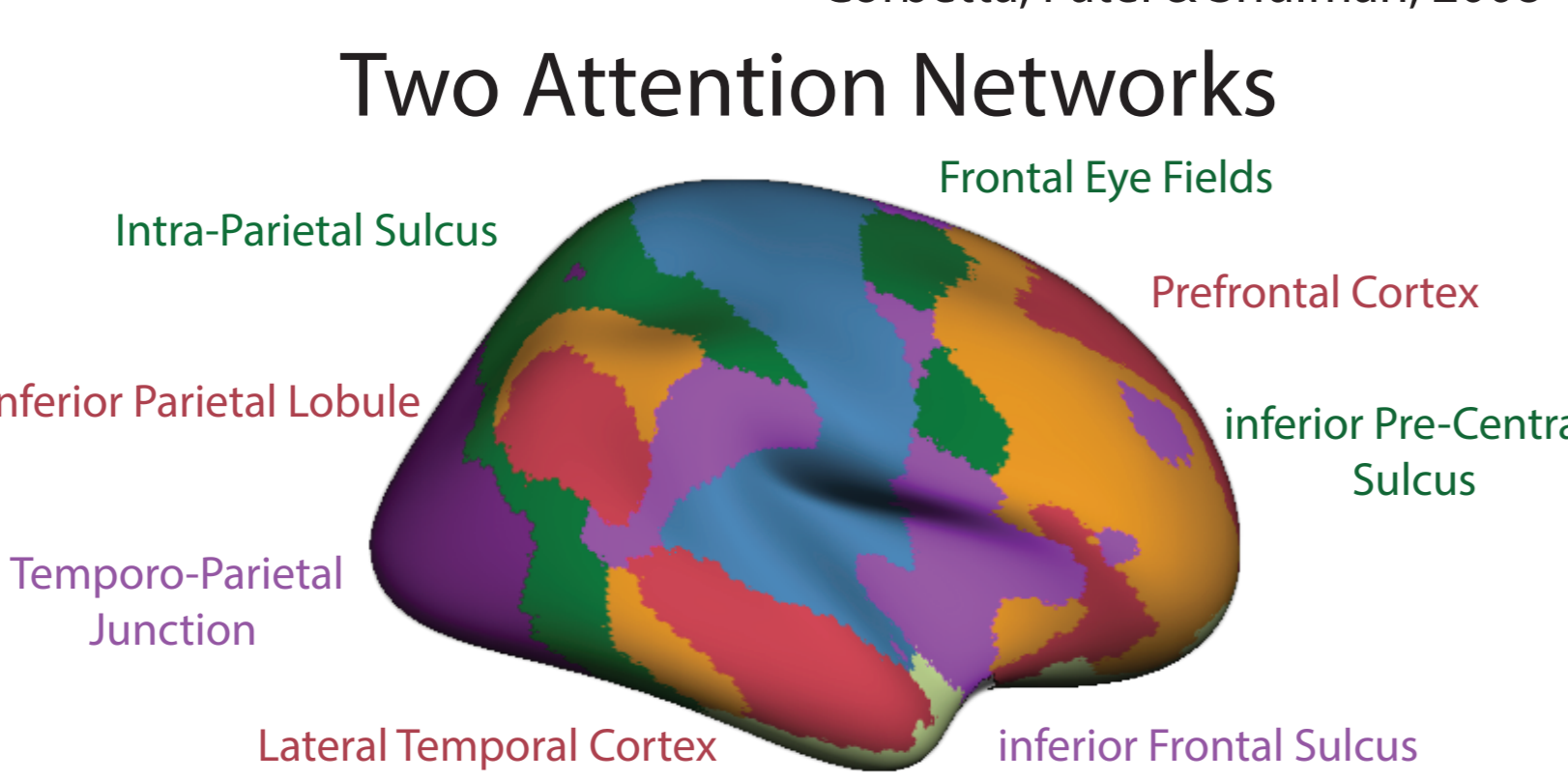
## Introduction: Meditation & Attention

Meditation experience improves performance on attentionally demanding tasks (Valentine & Sweet 1999; Jha, Krompinger & Baime 2007; Lutz et al. 2009; MacLean et al. 2010; Elliott, Wallace & Giesbrecht 2014) and acutely alters patterns of neural activity measured with BOLD fMRI (Lazar et al. 2000; Brefczynski-Lewis et al. 2007; Brewer et al. 2011; Hasenkamp et al. 2012; Garrison et al. 2014).



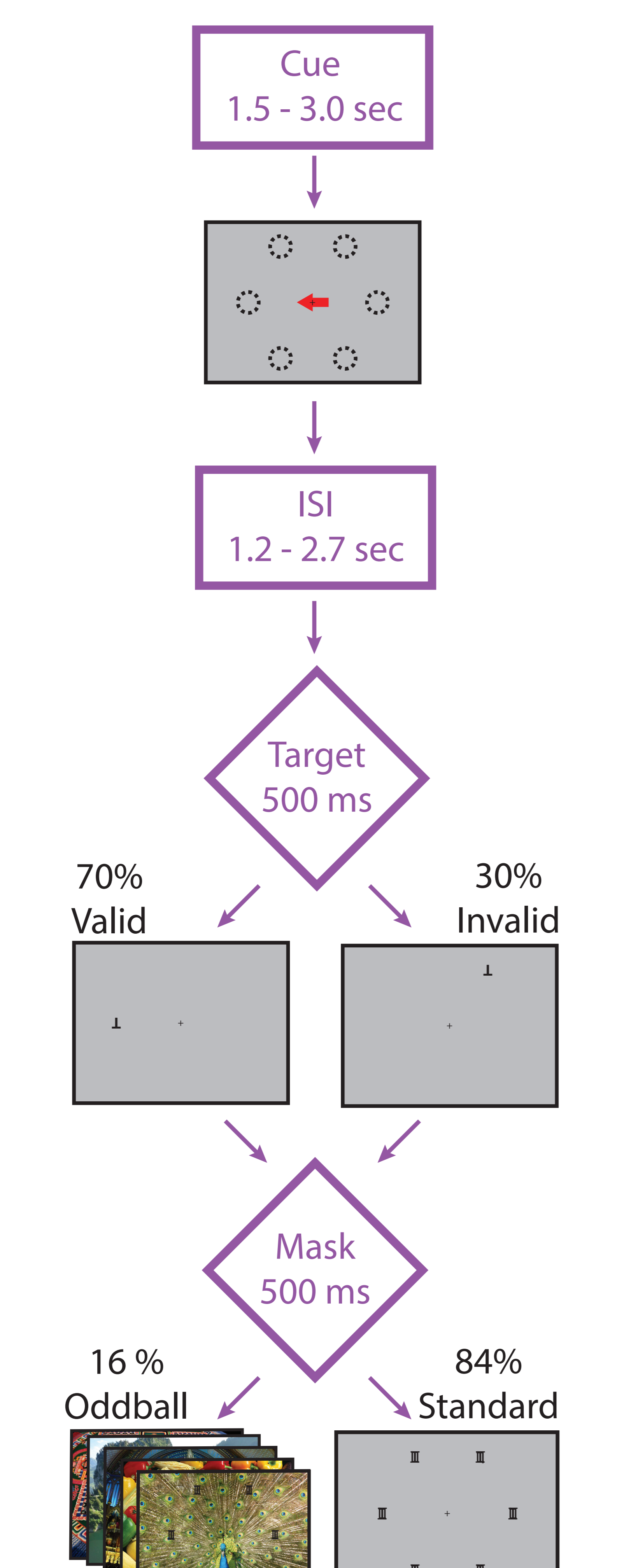
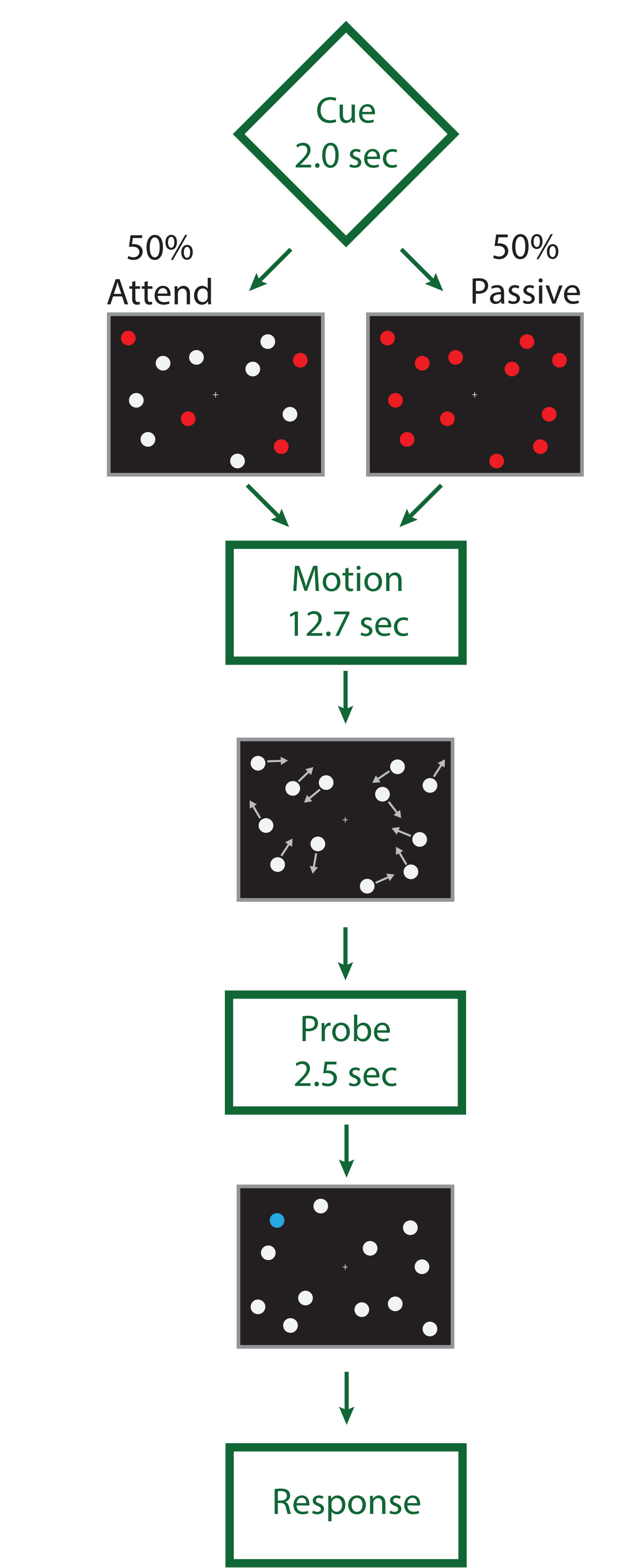
## Hypothesis

Focused attention meditation induces trait-level changes in cortical networks supporting attentional function.



## Sustained Task

## Capture Task



## Methods

**Scanning Parameters:**  
3 T Siemens Tim Trio  
Gradient echo EPI sequences  
TR = 2600 ms; TE = 30 ms; flip angle = 90°  
3.0 mm isotropic voxels; 42 quasi-axial slices  
Anatomy: 1.0mm isotropic T1 MP-RAGE

**Stimulus Properties:**  
16 trials (18.2 sec/trial) per run  
Attend/Passive alternate trials  
4 Runs, 64 trials/subject

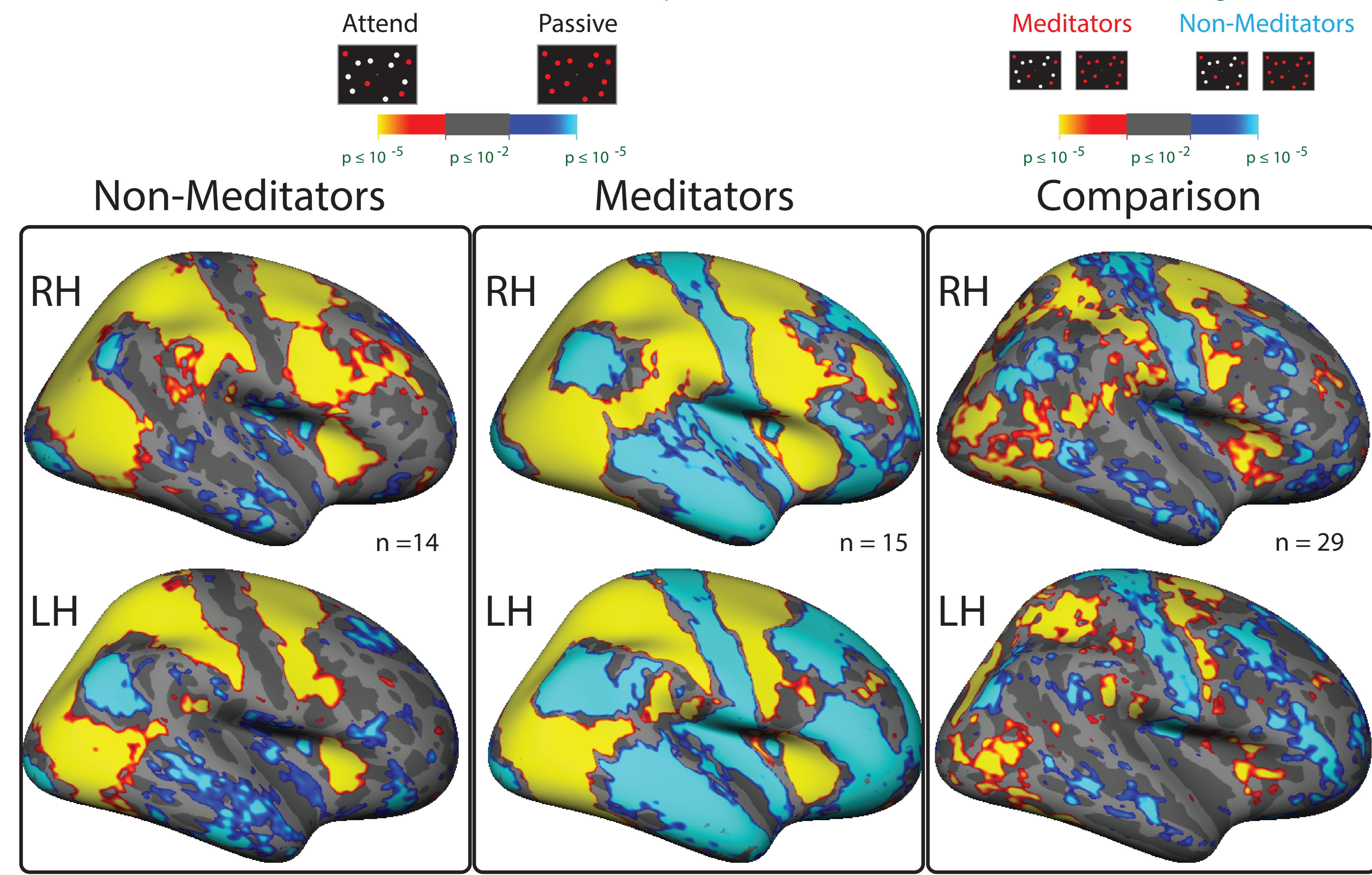
**Recruitment:**  
Vipassana meditators snowball sampled  
Control subjects matched on:  
age, gender, education, hand & languages  
Control subjects recruited with "sham" expertise

**Demographics:**  
16 Vipassana meditators (5 female)  
Mean hours/week = 14 ± 4

48 trials (7.8 sec/trial) per run  
Cue validity = 70%  
8 Oddball trials per run (1/6 trials)  
4 Runs, 192 trials/subject

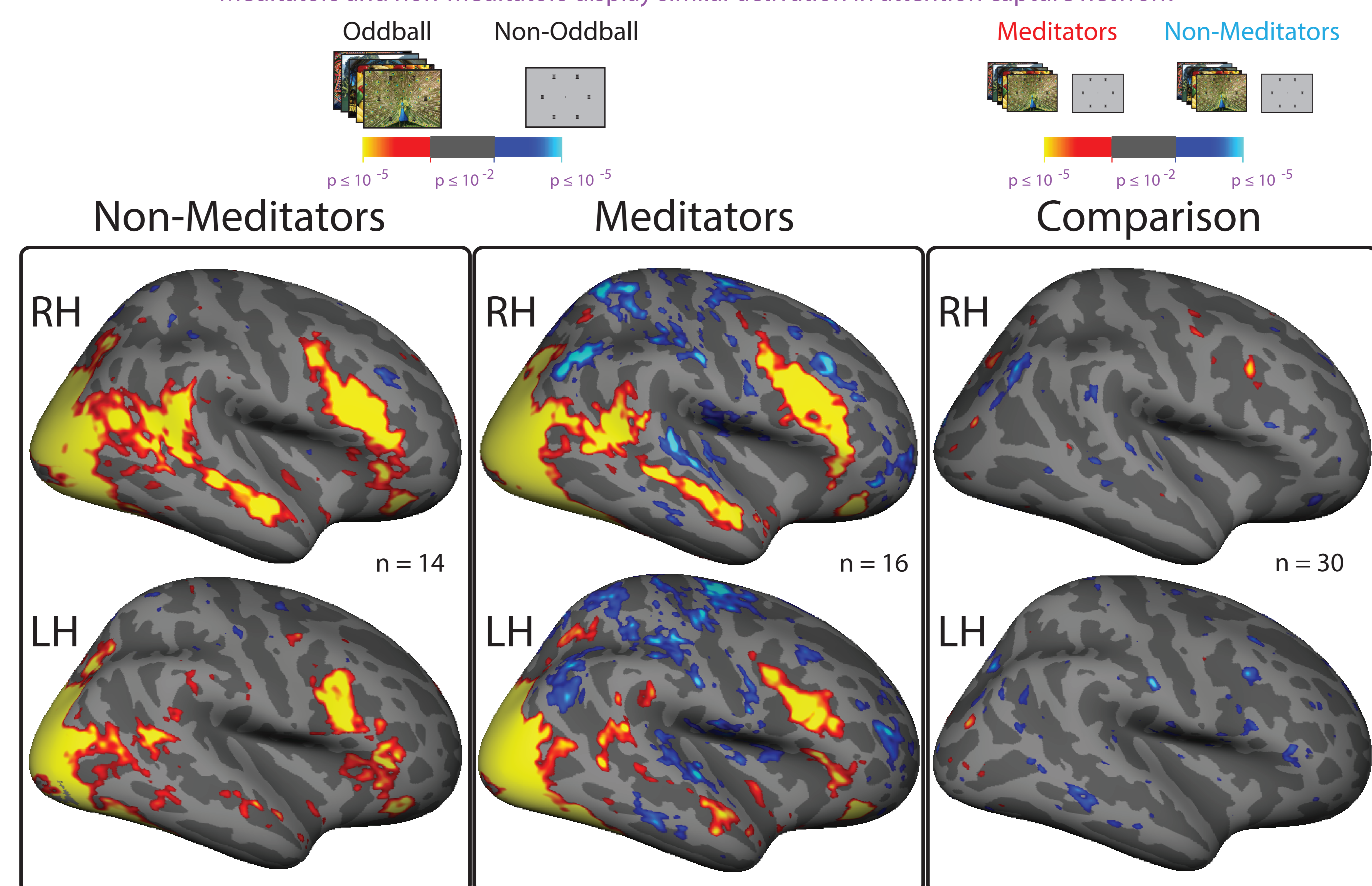
## Increased Sustained Attention Activity in Meditators

Meditators activate dorsal attention network and suppress default mode network more when sustaining attention.



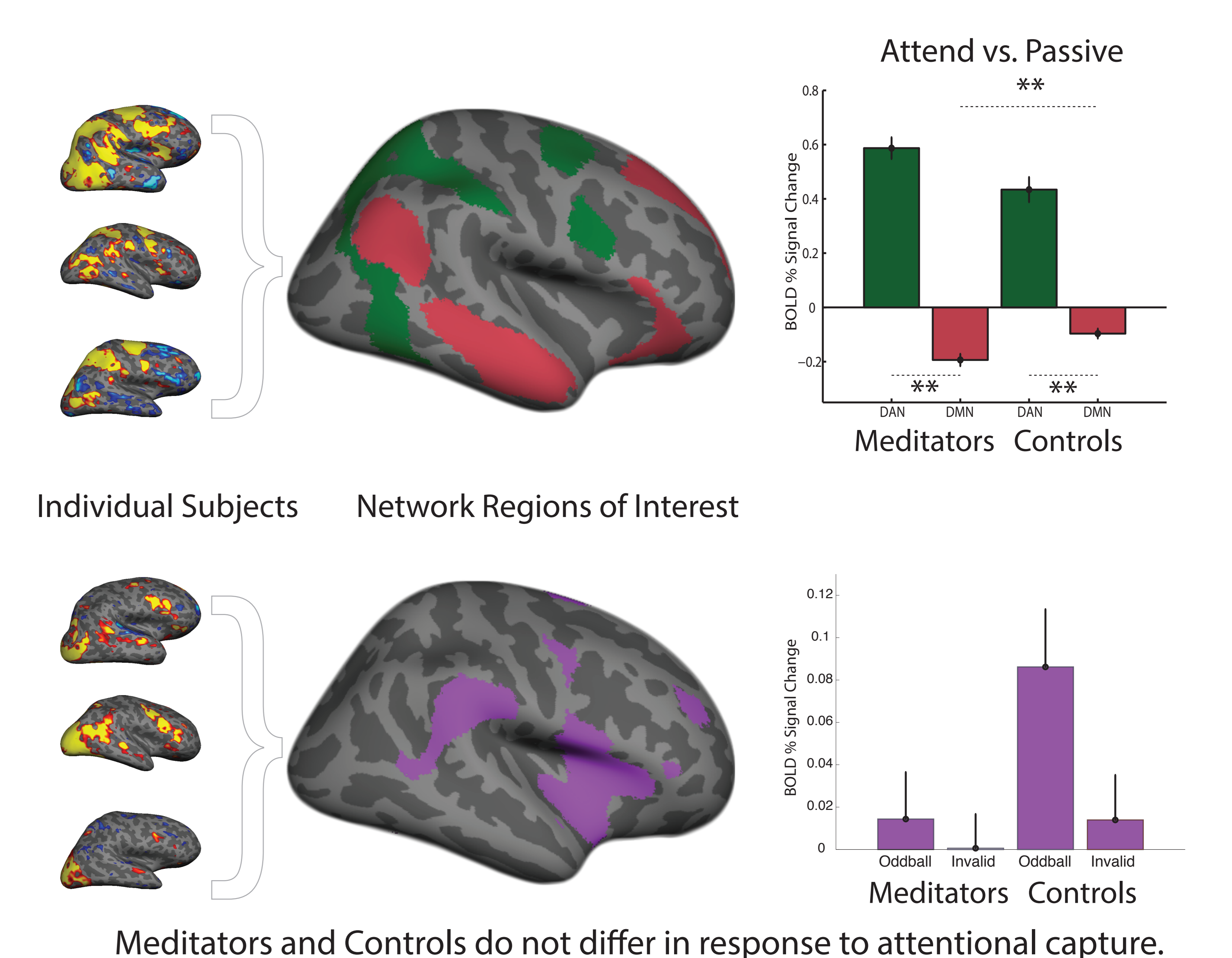
## Unaltered Attentional Capture Activity in Meditators

Meditators and non-meditators display similar activation in attention capture network



## Region of Interest Analyses

Meditators display greater suppression of Default Mode Network while attending.



## Conclusions

Here, we investigated activation in cortical attention networks while Vipassana meditators and matched controls conducted two demanding attention tasks. In a sustained attention task, **meditators demonstrated a greater separation between activity in the Dorsal Attention and Default Mode Networks while sustaining attention**, relative to controls. Conversely, **no differences were observed between meditators and controls during an attention capture task.**

- No Cost in Attentional Capture Associated With Meditation
- Greater DAN Activation and DMN Suppression in Meditators while Attending

**Up Next:**  
H: Meditation experience is associated with increased ability to sustain attention in time, not increased attentional capacity.

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