

# Hierarchical effects of contrast and motion coherence in early visual cortex

## 1. Introduction

An existing model of **contrast** discrimination suggests early visual cortex is sufficient to explain behavioral performance<sup>1</sup>.

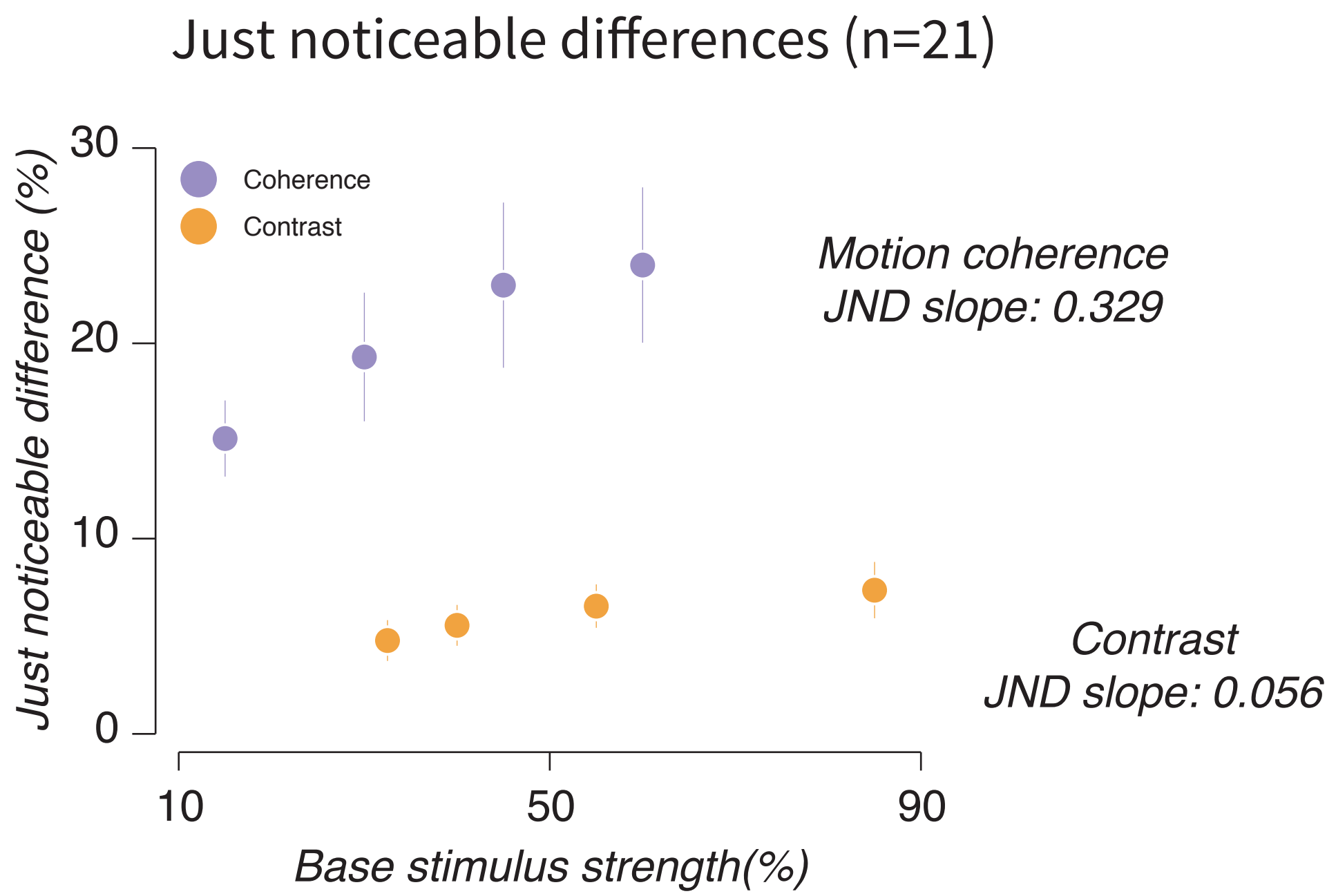
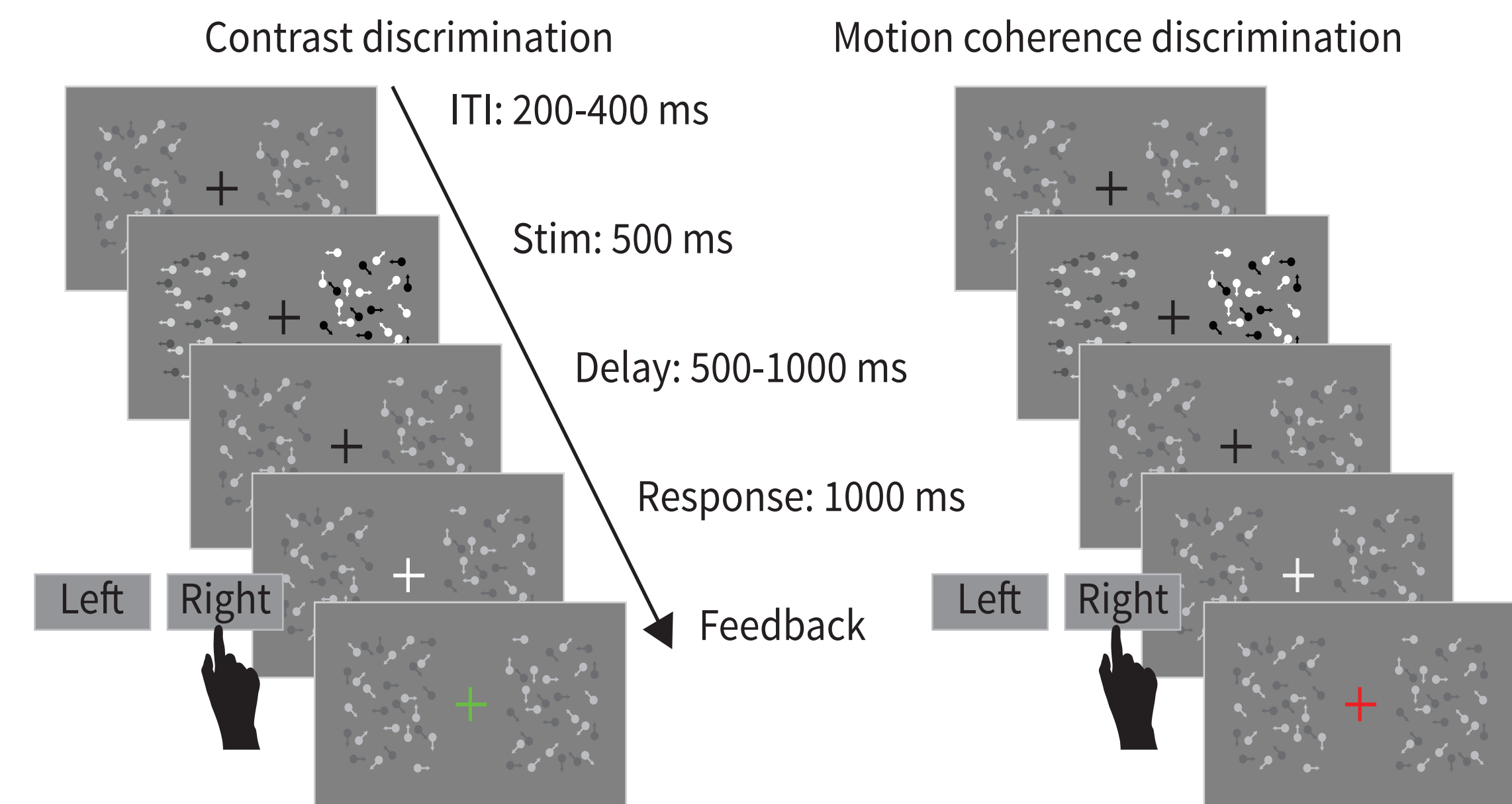


Can that model be used to jointly explain **motion coherence** discrimination?

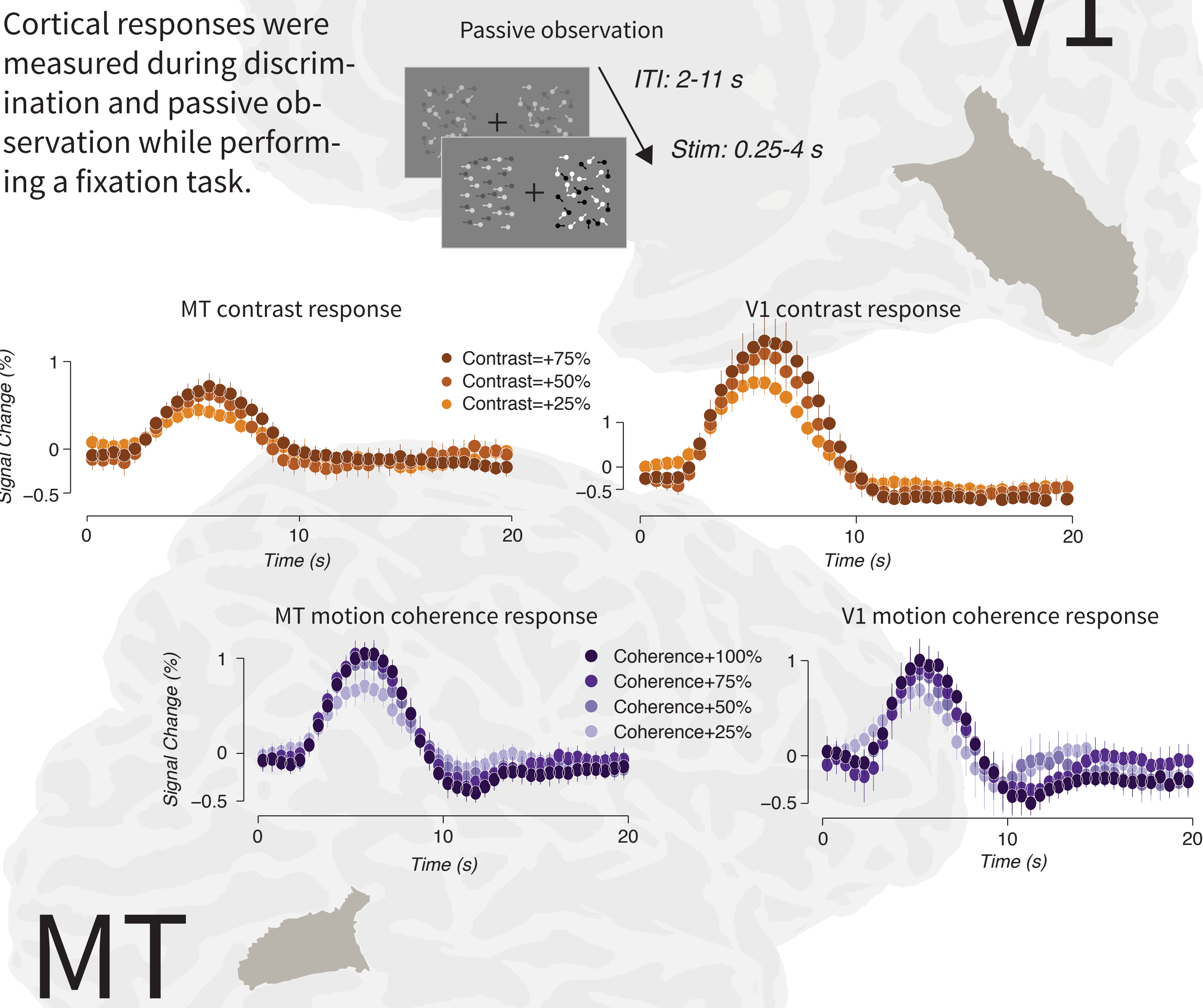


## 2. Discrimination task

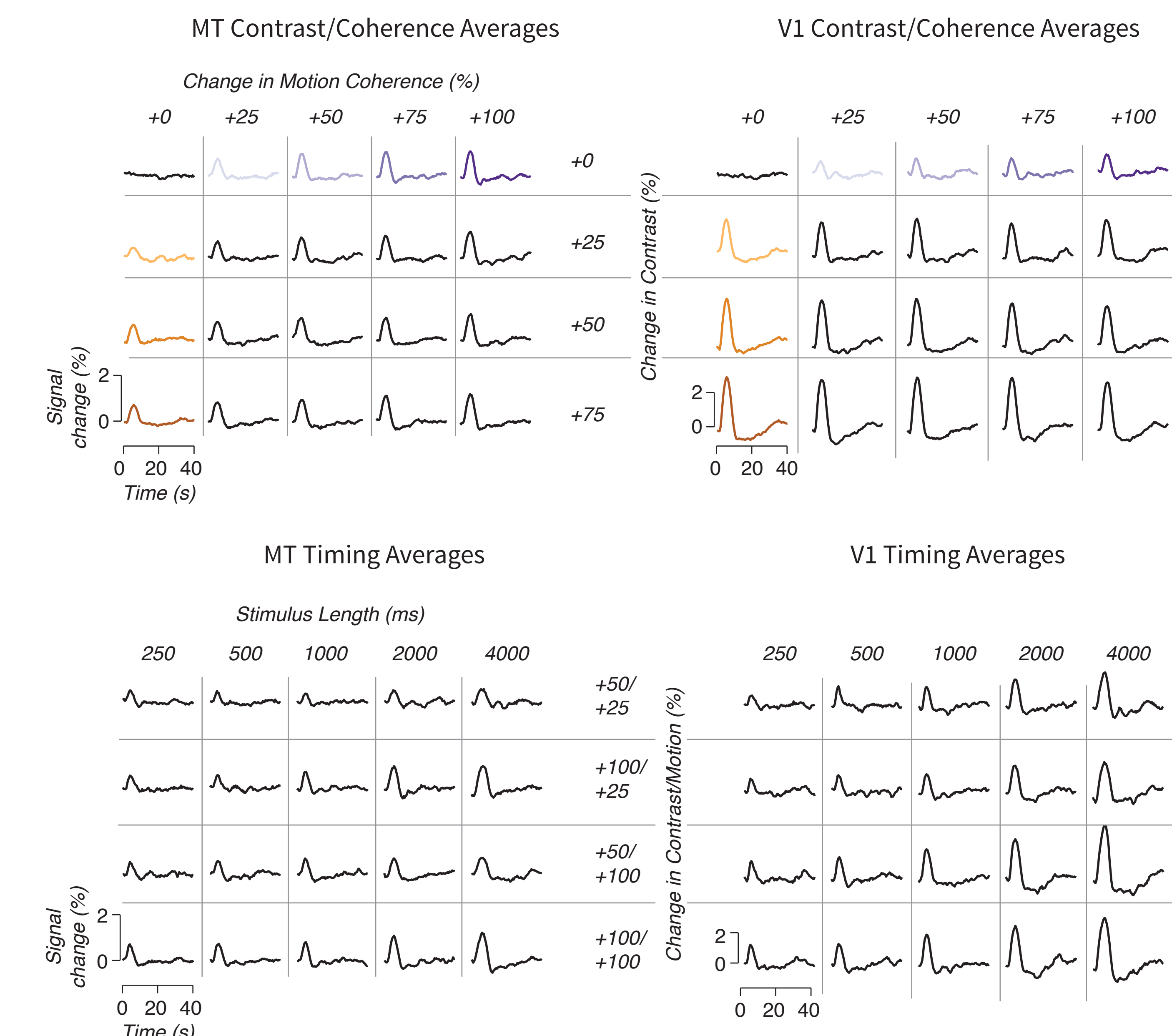
We collected data on how well participants could discriminate small increments in contrast and motion coherence.



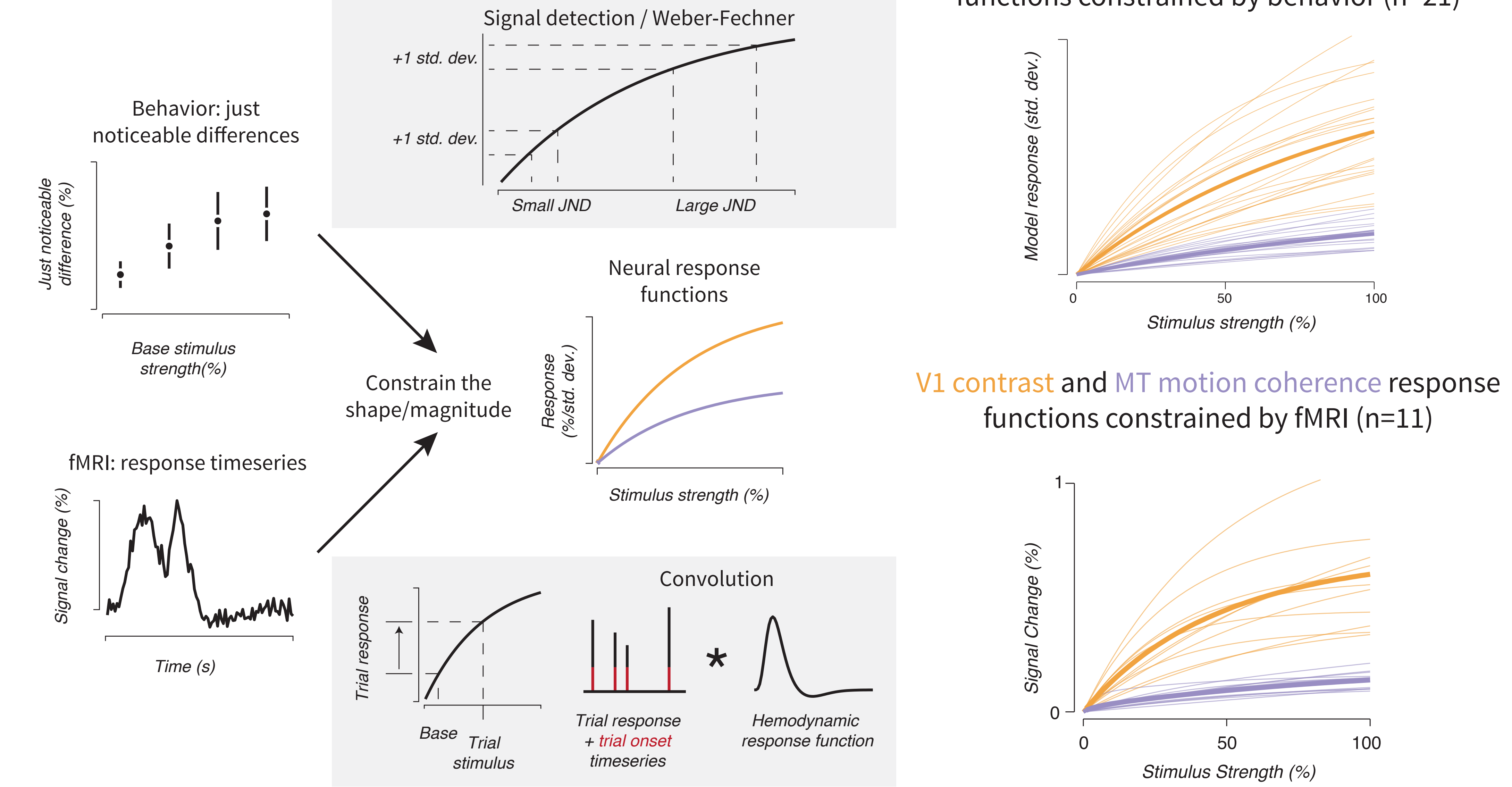
## 3. Cortical measurements (fMRI)



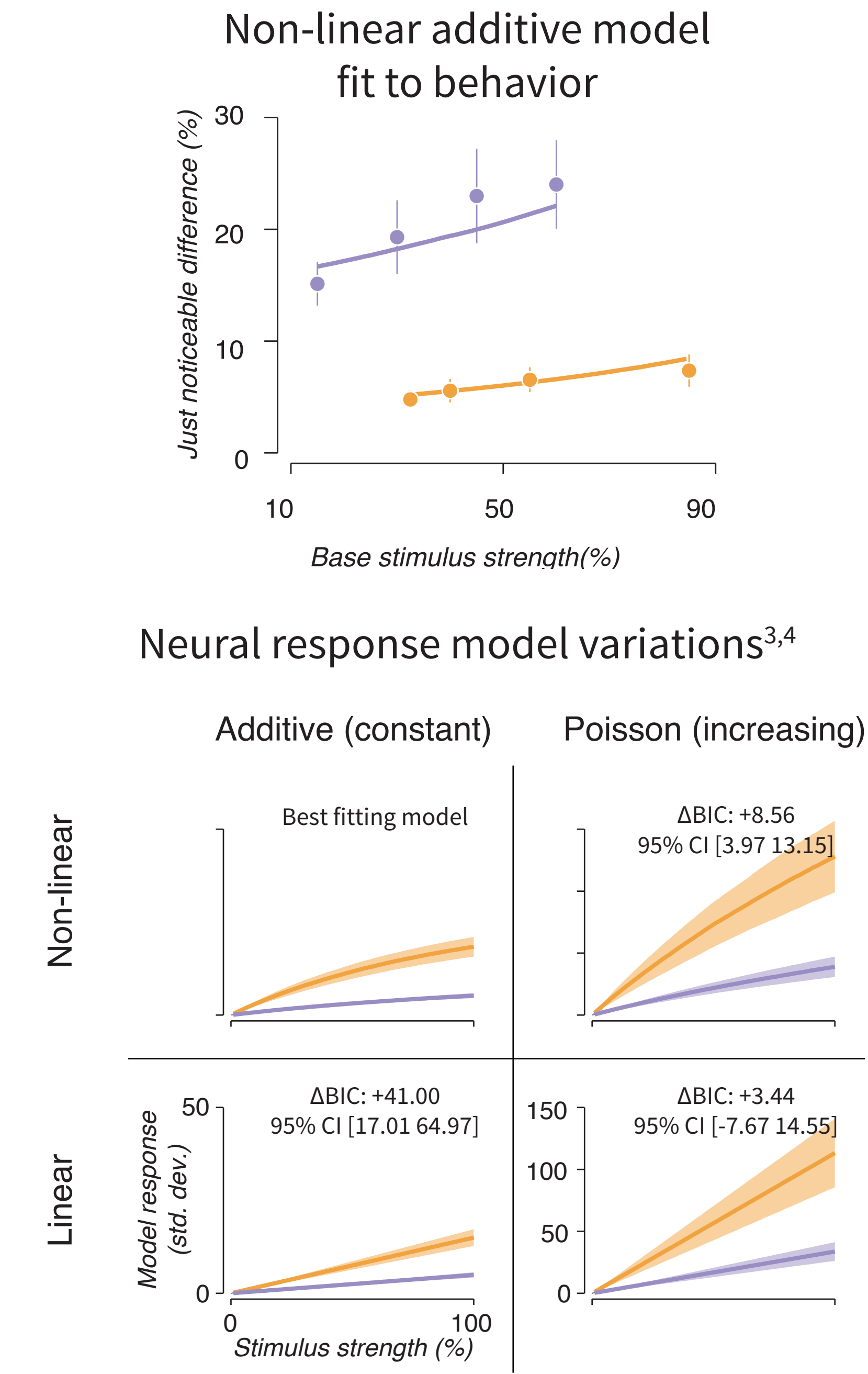
MT



## 4. Neural response model



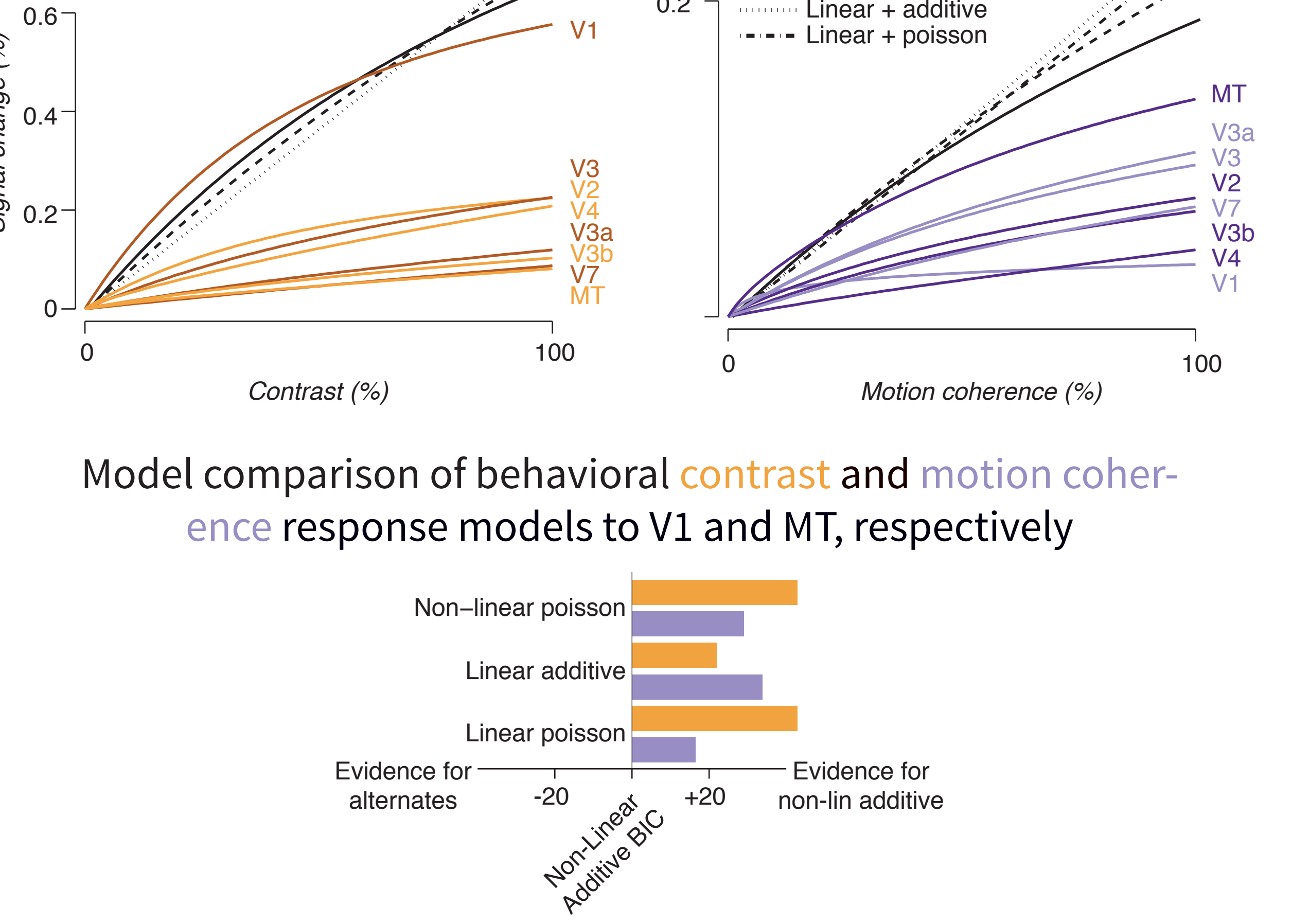
## 5. Model variations



## 6. Conclusion

The same model of neural responses works for discrimination of **contrast** using V1, and **motion coherence** using MT.

We fit a neural noise<sup>5</sup> parameter to scale response models into the same space.



All data shows bootstrapped mean  $\pm$  95% CI across subjects.  
Non-linear response functions were modeled using an exponential:

$$Response(s) = \alpha - \alpha e^{-\kappa s}$$

1. Boynton, G. M., Demb, J. B., Glover, G. H., & Heeger, D. J. *Vision Research* (1999).  
2. V5/MT is thought to respond linearly to increasing motion coherence (see also 4). Rees, G., Friston, K., & Koch, C. *Nature neuroscience* (2000).  
3. Simoncelli, E. P., & Heeger, D. J. *Vision Research* (1998).

4. Previous reported values for neural noise in a similar model of contrast discrimination were 0.064% and 0.016% for distributed and focal attention. Pestilli, F., Carrasco, M., Heeger, D. J., & Gardner, J. L. *Neuron* (2011).