A fundamental difference between primate and mouse object vision

Caltech

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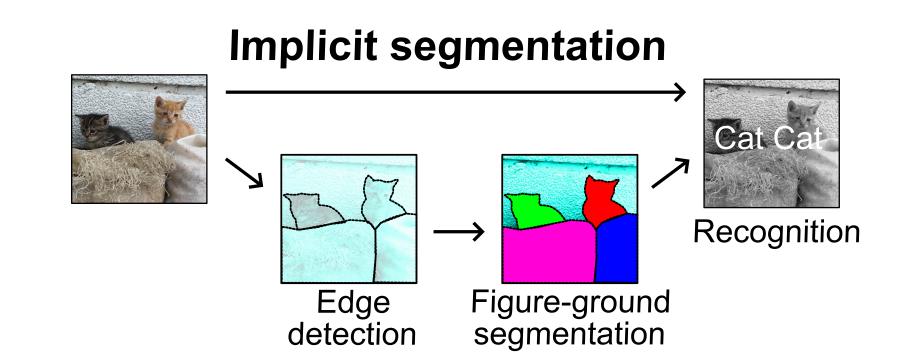
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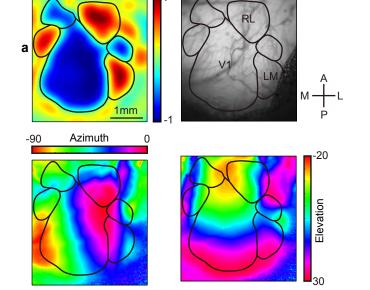
hhm

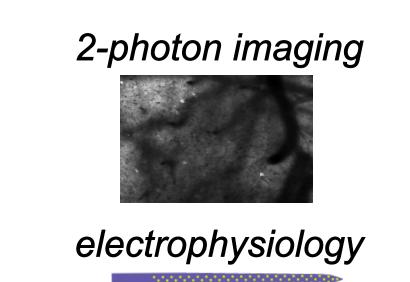
Background

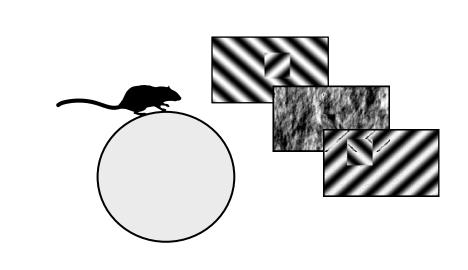
Two avenues for recognizing objects



Explicit segmentation

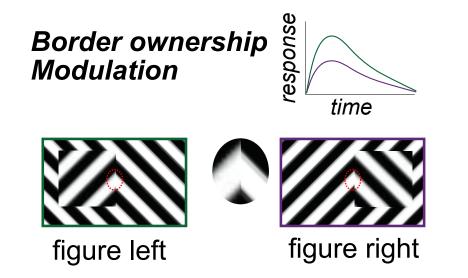


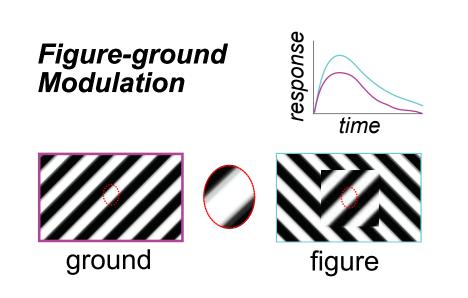




- ► How does the mouse visual system segment visual objects?
- What constitutes a visual object for a mouse?

Figure-ground and border-ownership modulation

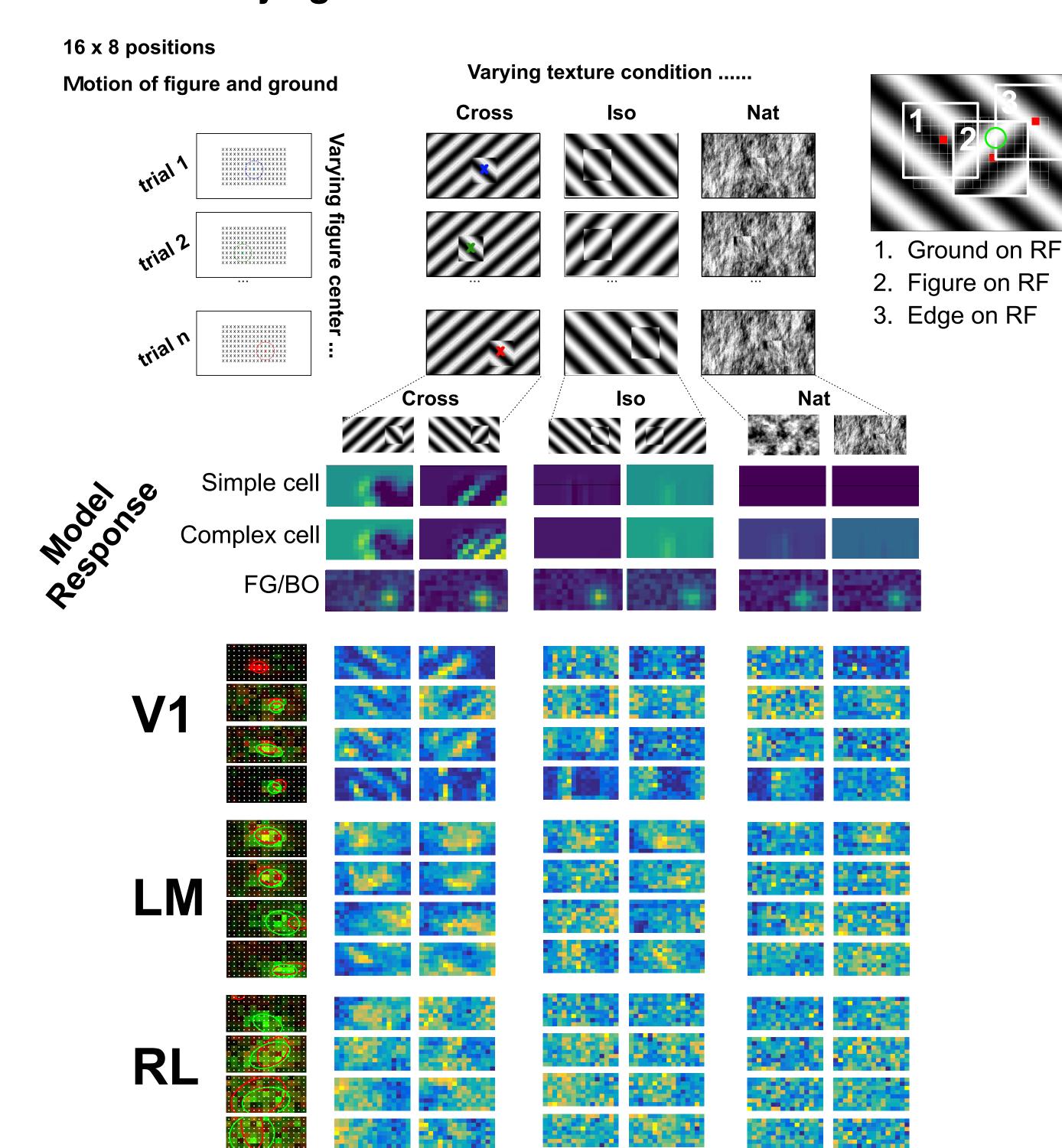




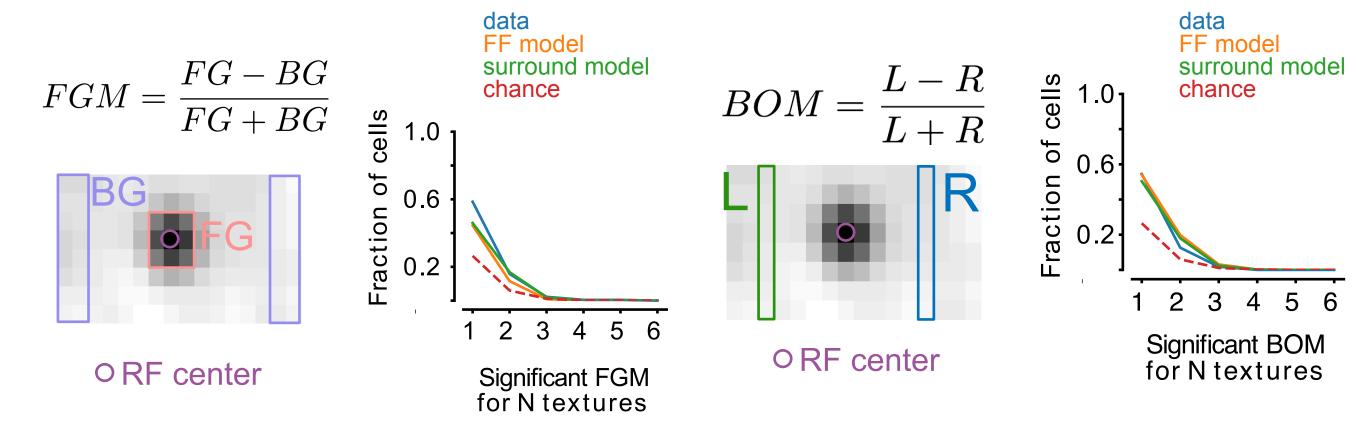
Evidence for such modulation has been reported across primate thalamus, primary, and higher order visual cortices.

*Qiu and von der Heydt, 2007 // Zhou, Freedman, and von der Heydt 2000 // Jeurrisen, Self, Roelfsema 201 Jehee, Lamme, & Roelfsema, 2007 // Lamme 1995

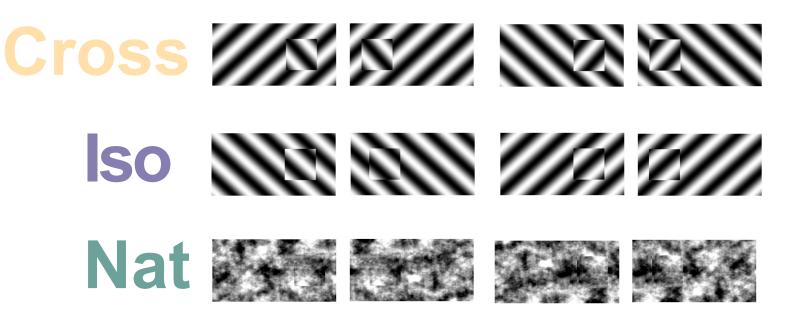
Stimuli for assaying FG and BO modulation

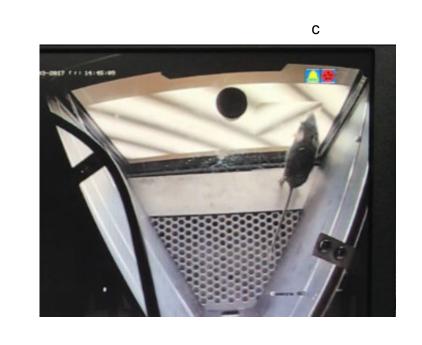


Texture-invariant FG/BO response modulation in single neurons is lacking in rodent visual cortex

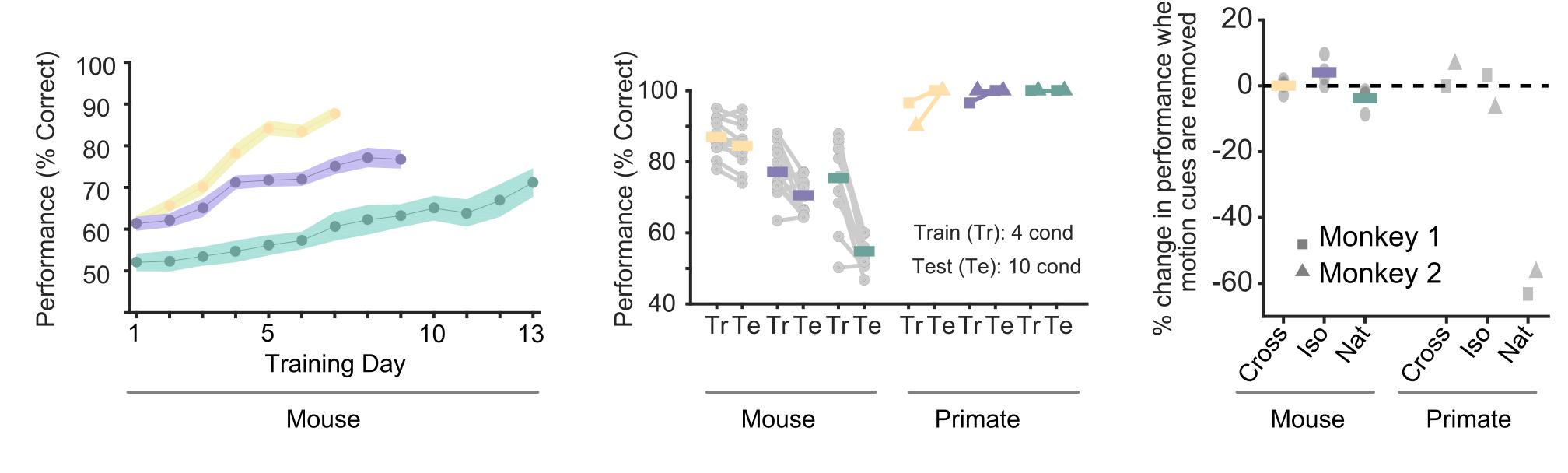


Mice can perform a texture-invariant object localization task using a touchscreen

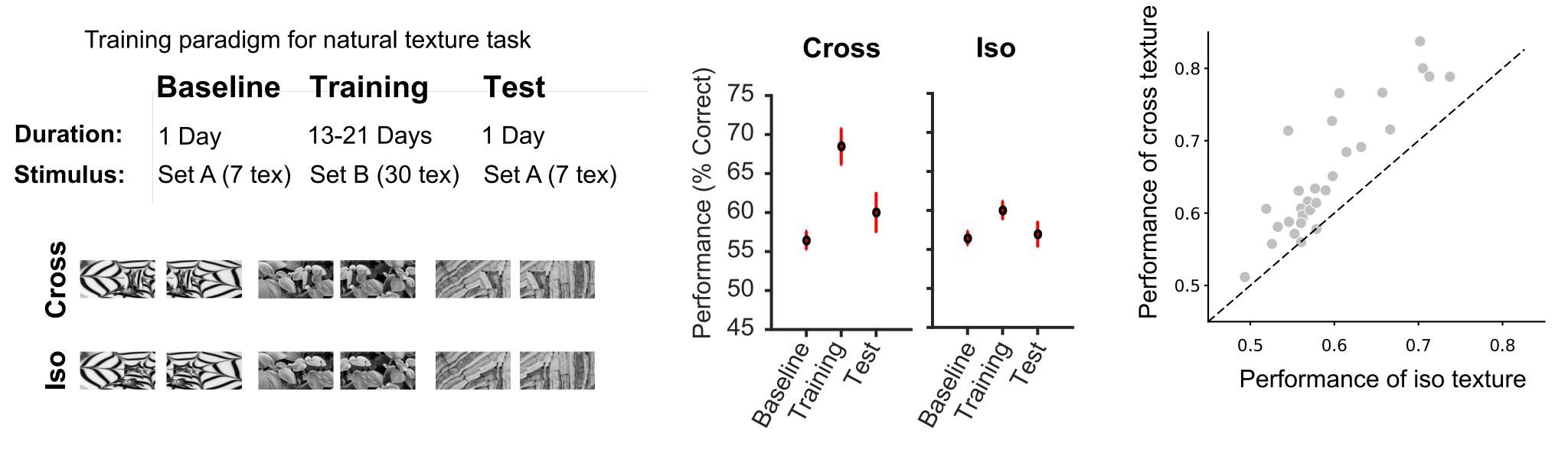




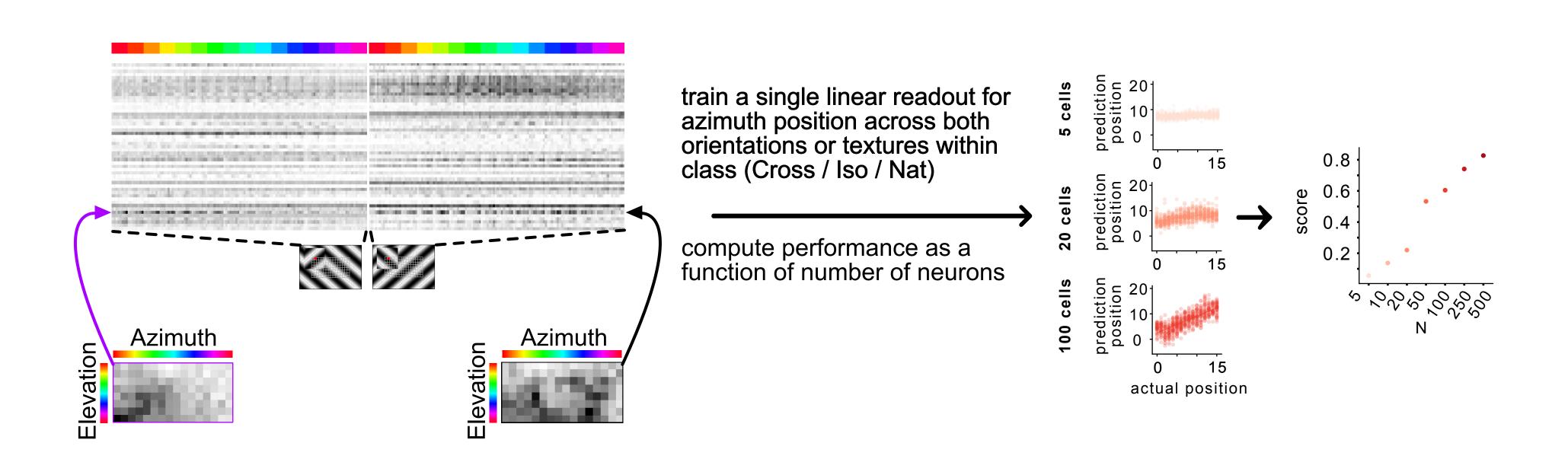
Mice show texture dependent performance and don't use motion in nat condition, suggesting a lookup table approach. Primates are texture independent and use motion cue in nat condition.



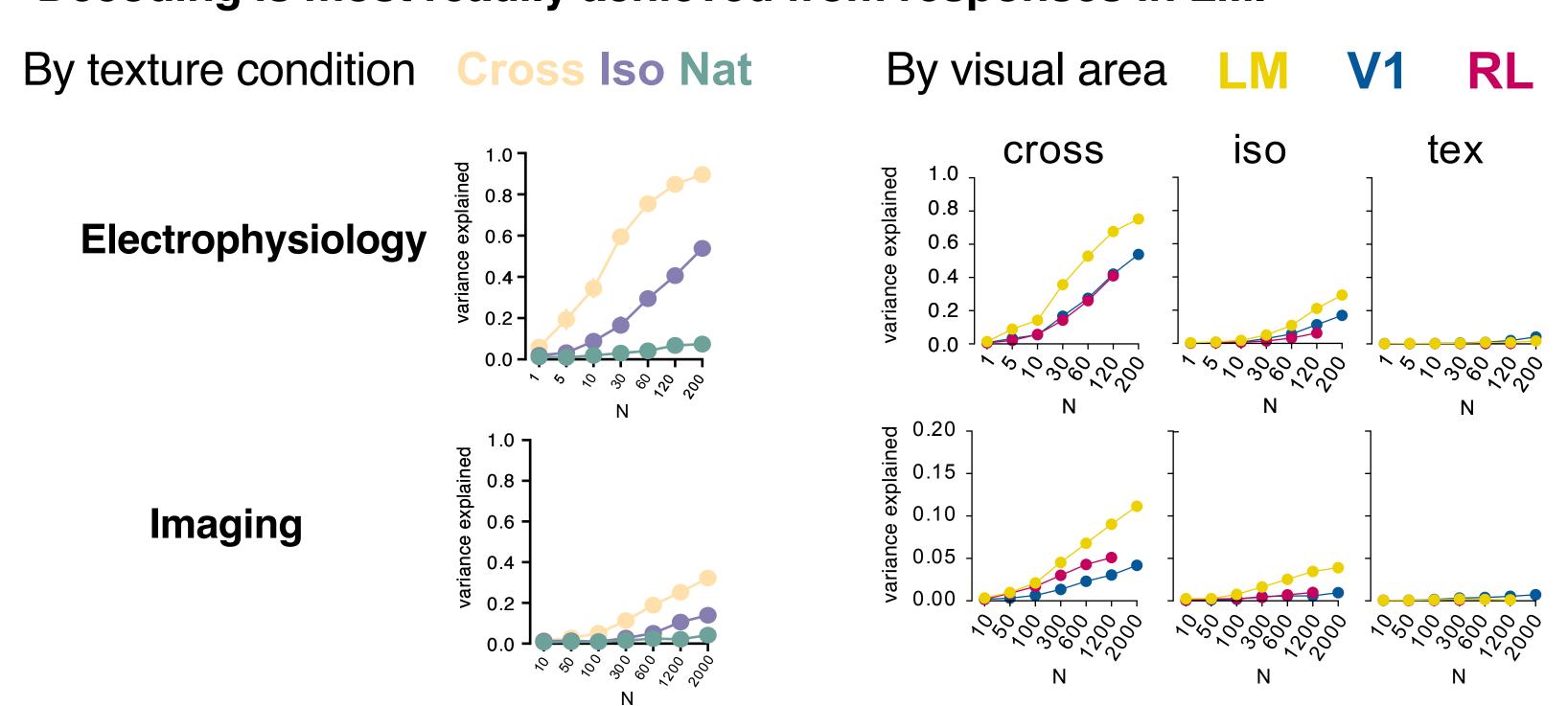
Performance on natural textures is improved by cross-orientations



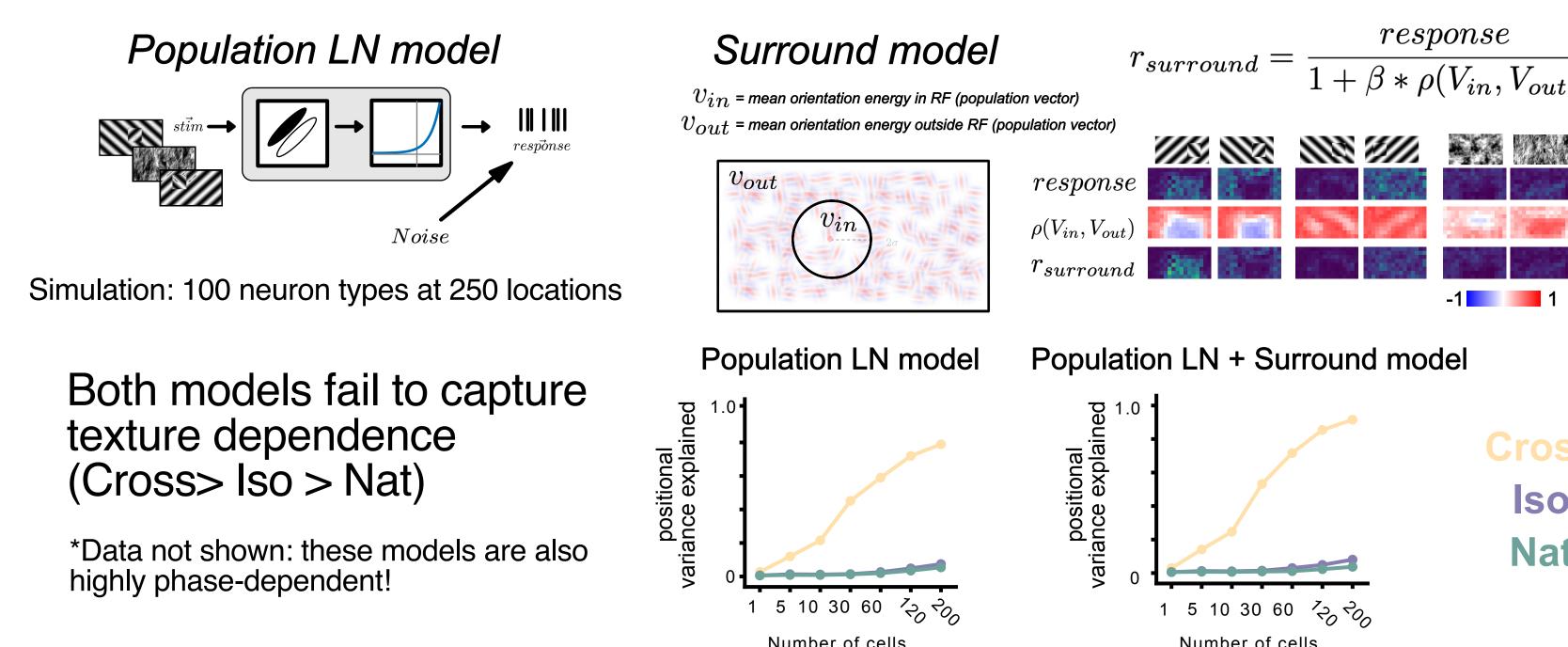
Reading out azimuth position across multiple textures using linear regression from a population of neurons



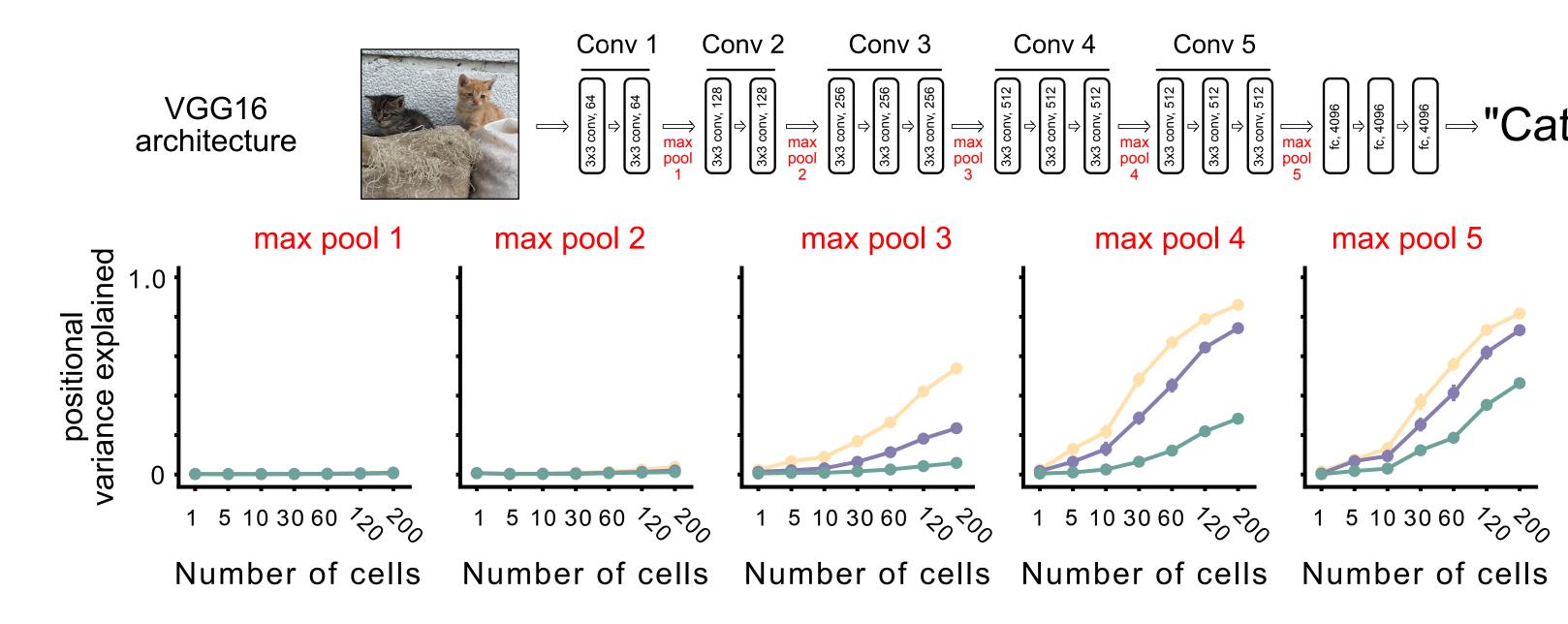
Readout of position using a linear decoder is best for cross-oriented textures, displaying a texture dependence similar to behavioral results. Decoding is most readily achieved from responses in LM.



How much of the texture dependence (Cross > Iso > Nat) is explained by an LN model? Orientation tuned suppression?

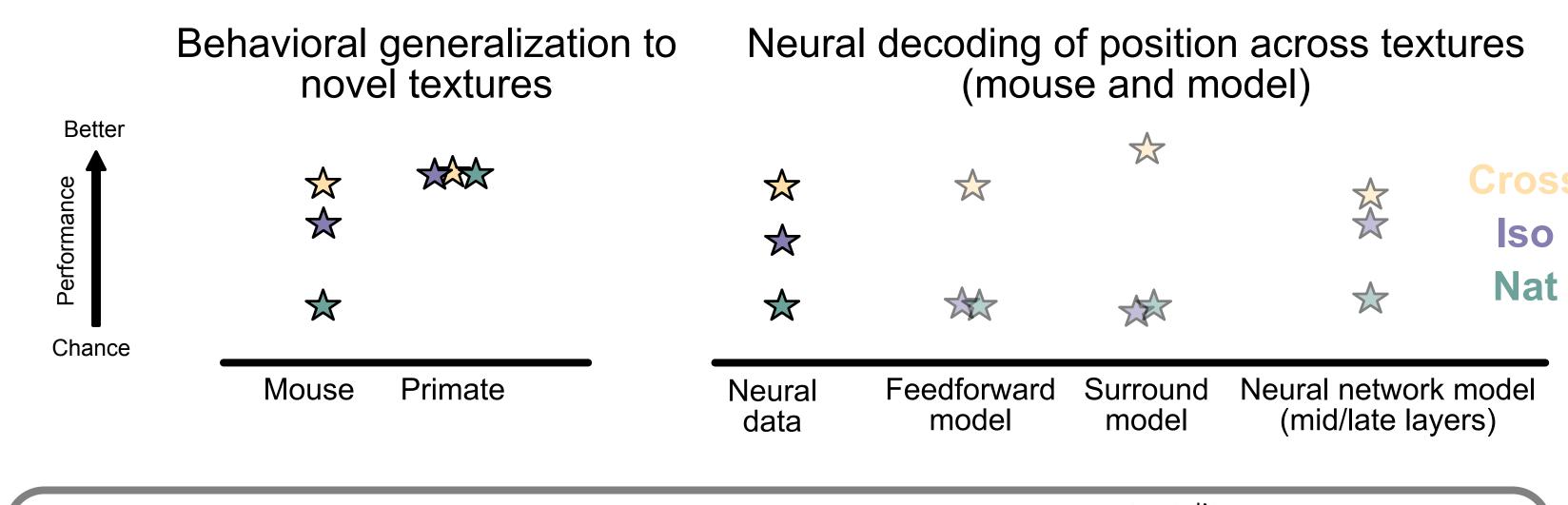


Mid to late layers of a deep network (VGG16) show texture dependence consistent with behavior



*Data not shown: this model generalizes better to arbitrary phases than feedforward or surround models

Summary



Many thanks to funders

BURROUGHS WELLCOME FUND



