

# The timecourse of attention to statistical regularities in new visual environments.

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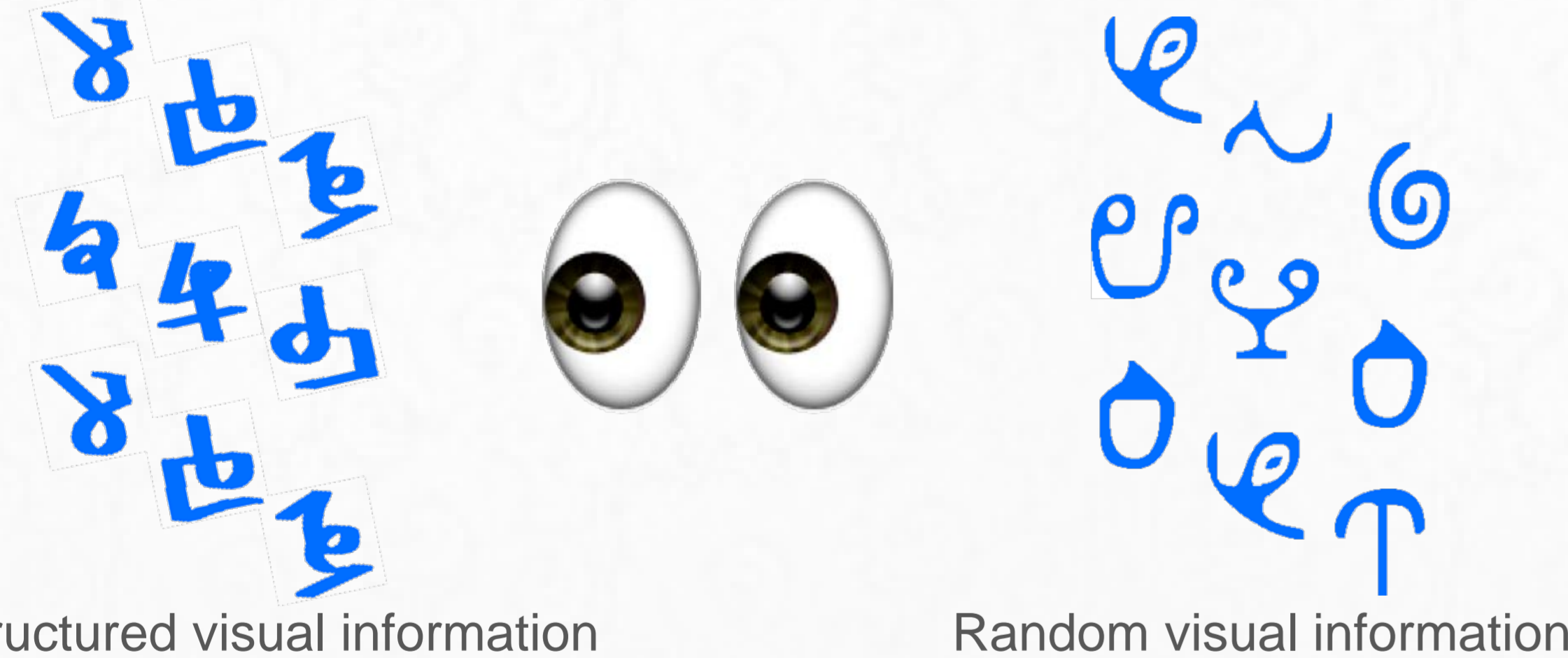
## Background

### Visual Statistical Learning

- Individuals implicitly learn how visual stimuli in the environment co-occur i.e. statistical regularities
  - Requires attention<sup>1,2</sup>
- Attention is spontaneously biased towards such regularities - faster detection of targets in structured locations<sup>3</sup>
- Here we explore this bias using a measure of overt attention i.e. eye-tracking
- What is the timecourse of this attentional bias?
  - Does the bias go away after sufficient learning?

## Hypotheses

Overt attentional (gaze) biases towards structure

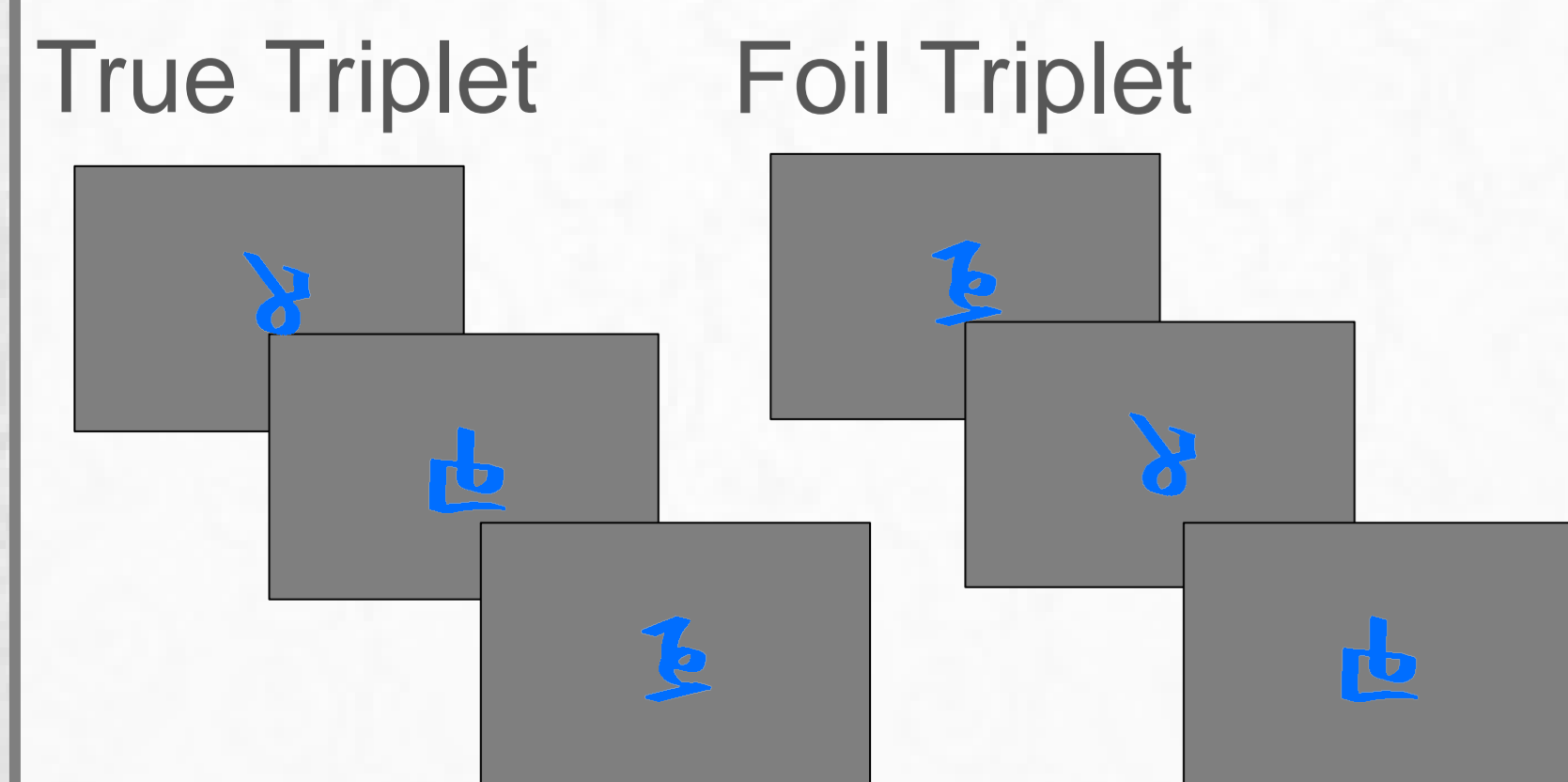


Structured visual information

Random visual information

## Methods

Familiarity Task  
Which pattern feels more familiar?



EyeLink 1000 Desk-Mounted Eye Tracker

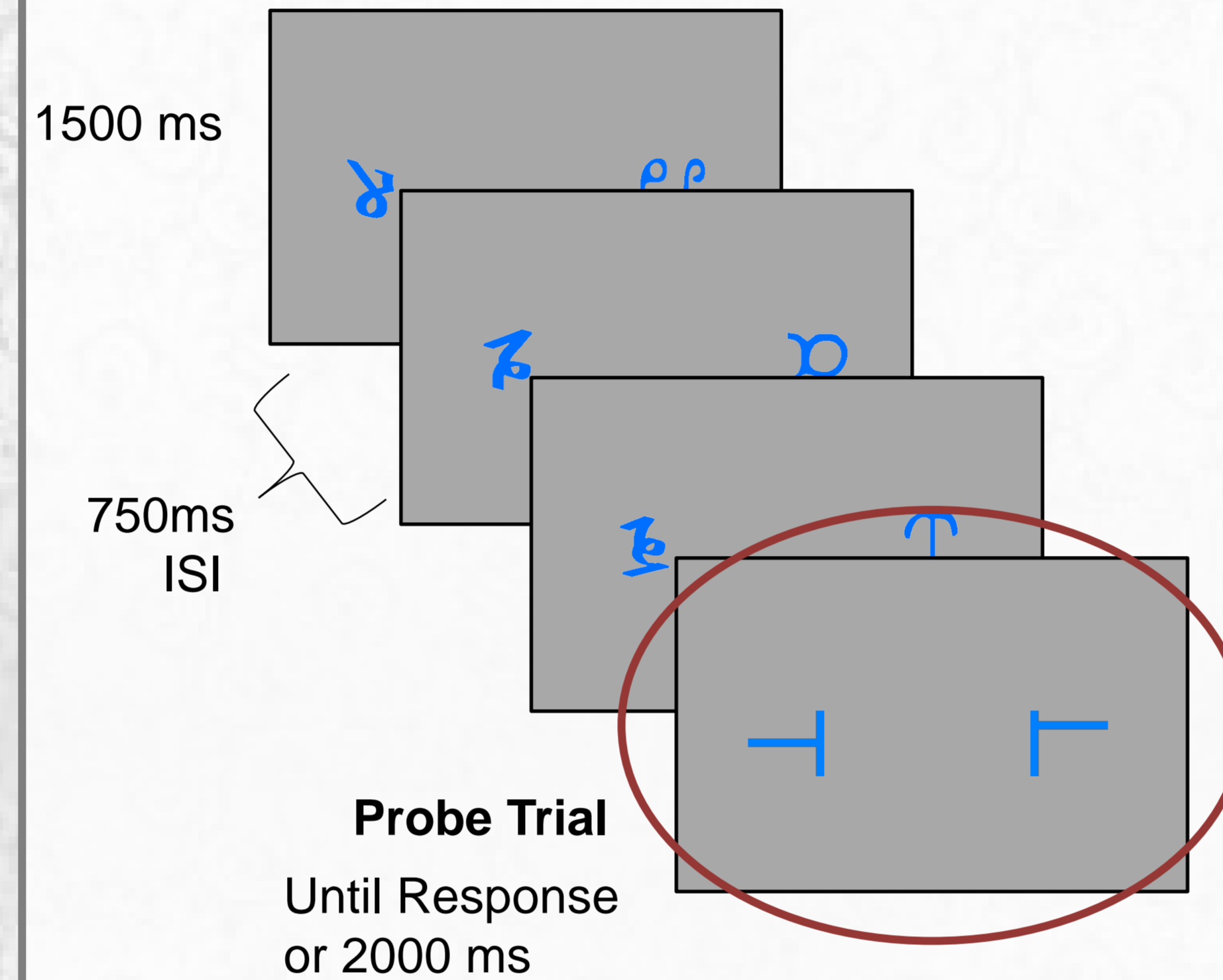


Sample at 500 Hz

## Methods

### Visual Statistical Learning

**Task:** On probe trials, determine the direction of the rotated "T"s



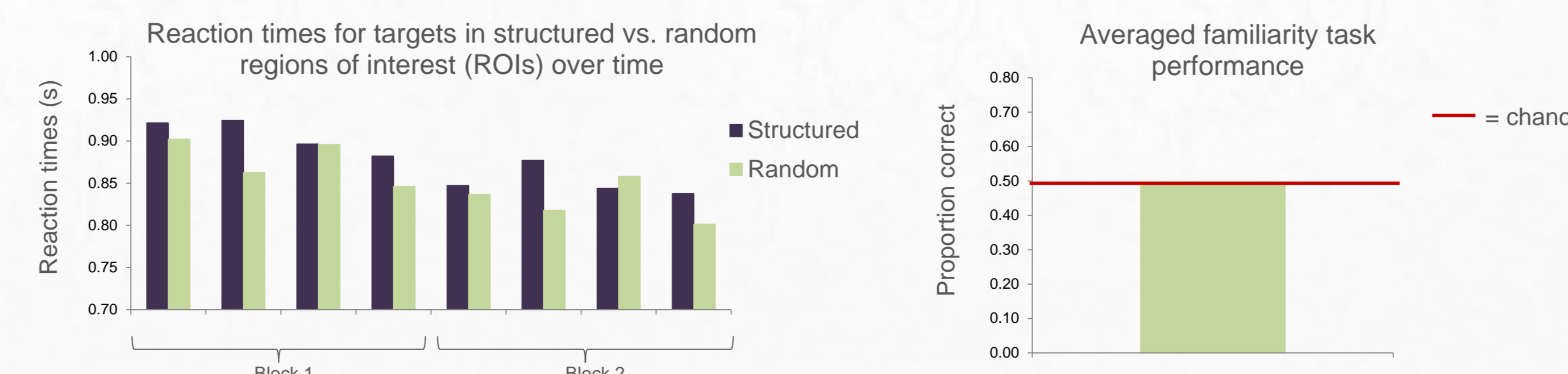
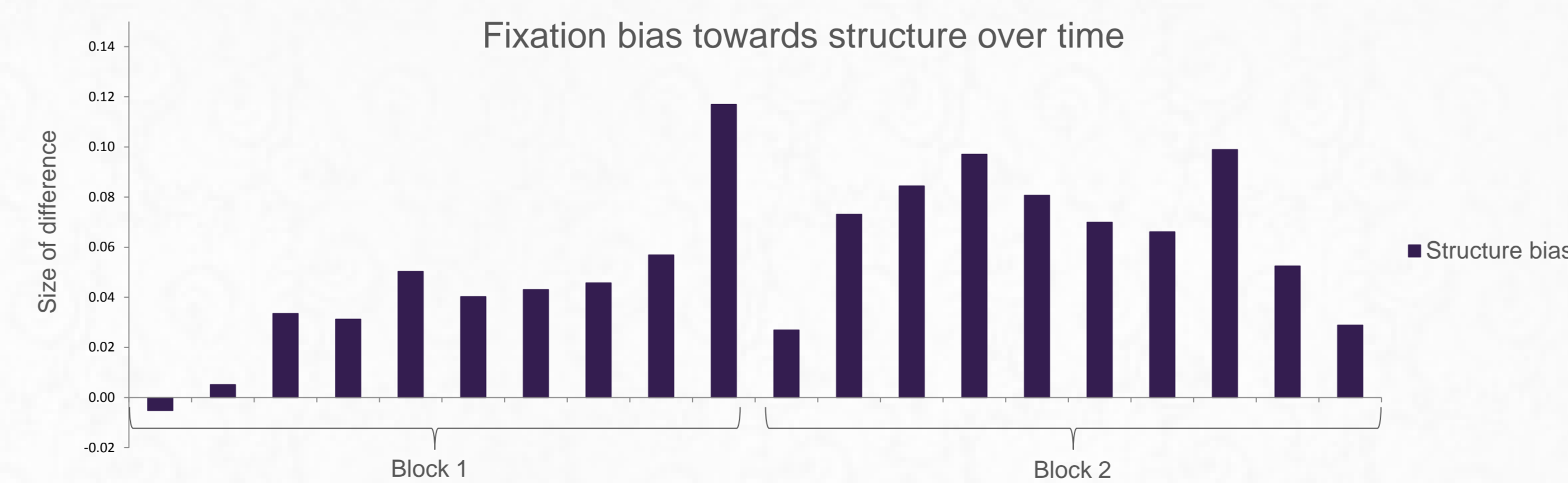
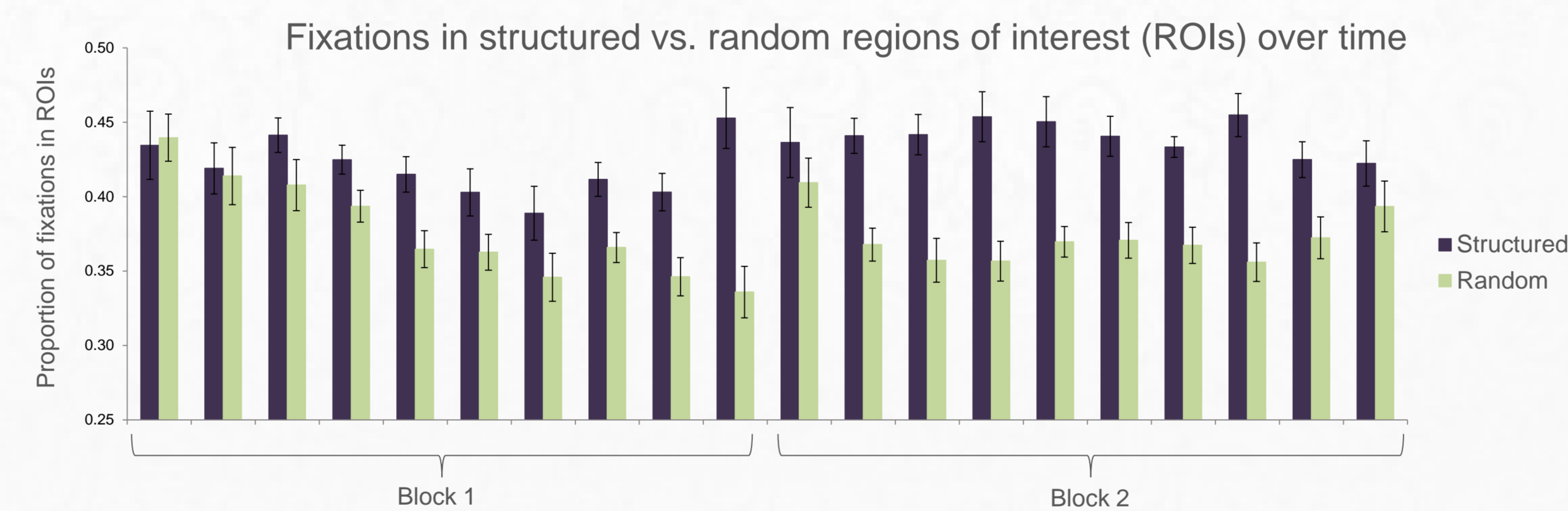
**Between:**  
Location of Structure

Left	Right
L	R
L	R

**Within:**  
Location of Target

Index of overt attention  
→ Gaze location

## Results



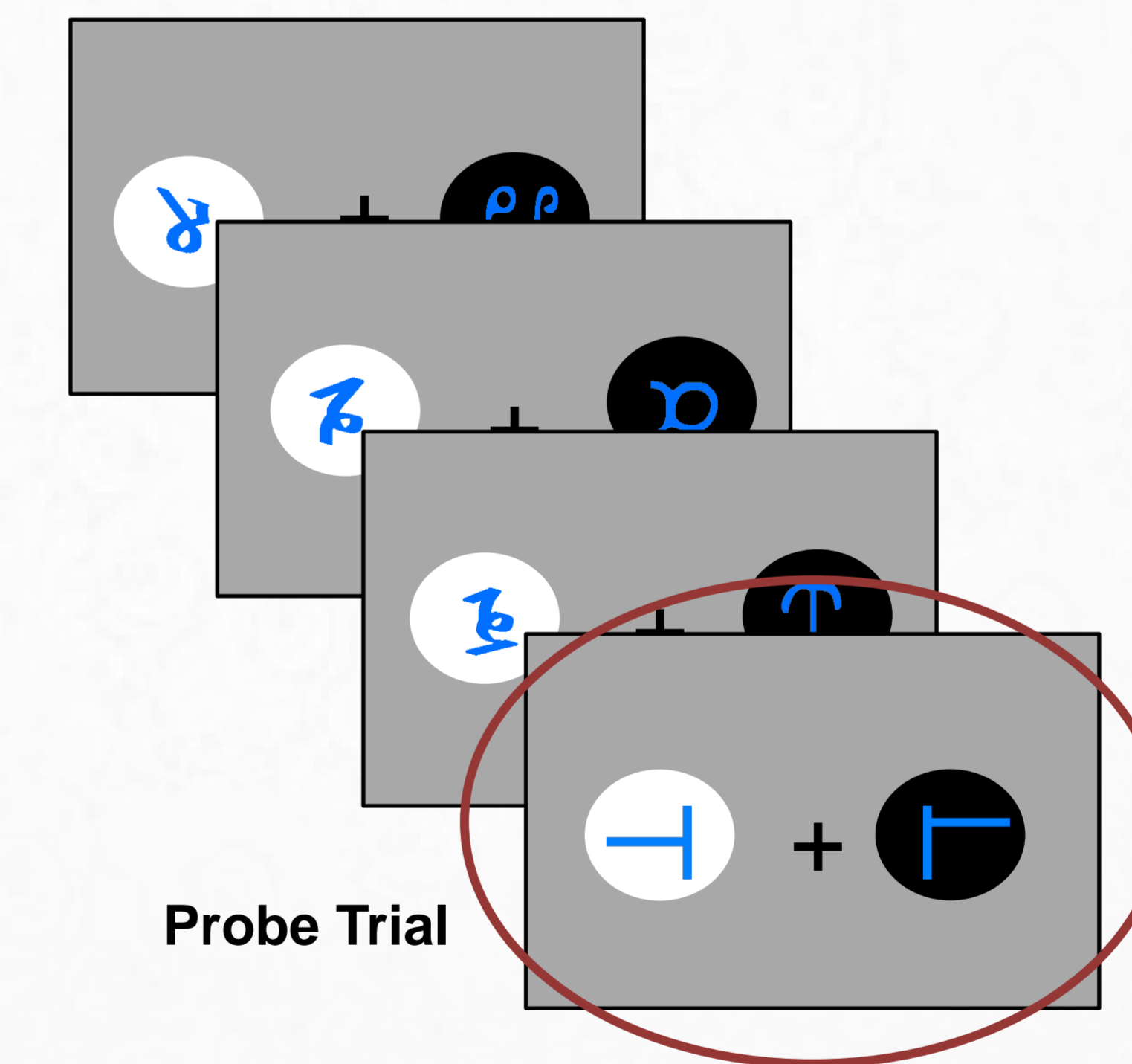
## Conclusions

- Overt gaze bias towards spatial location containing structured information (vs. random information)
- Strength of bias increases with previous exposure to structured information (Block 2: larger bias, emerges earlier)
- Bias diminishes with increased exposure to statistical regularities
  - Attention disengages from previously learned information

## Covert Measures

### Visual Statistical Learning

**Task:** On probe trials, determine the direction of the rotated "T"s



**Between:**  
Location of Structure  
ROI Luminance

Left	Right
Dark	Light
L	R
L	R
L	R

**Within:**  
Location of Target

Index of covert attention<sup>4</sup>  
→ Pupillary light reflex  
(constrict in light, dilate in dark)

## References

1. Turk-Browne, N.B., Jungé, J.A., & Scholl, B.J. (2005). The automaticity of visual statistical learning. *Journal of Experimental Psychology: General*, 134(4), 552-564.
2. Turk-Browne, N.B., Scholl, B.J., Chun, M.M., & Johnson, M.K. (2009). Neural evidence of statistical learning: Efficient detection of visual regularities without awareness. *Journal of Cognitive Neuroscience*, 21(10), 1934-1945.
3. Zhao, J., Al-Aidroos, N., & Turk-Browne, N.B. (2013). Attention is spontaneously biased towards regularities. *Psychological Science*, 24(5), 667-677.
4. Binda, P., Pereverzeva, M., & Murray, S.O. (2013a). Attention to bright surfaces enhances the pupillary light reflex. *The Journal of Neuroscience*, 33(5), 2199-2204.