

# The effects of local context in visual search: a connectionist model and behavioral study of contextual cueing

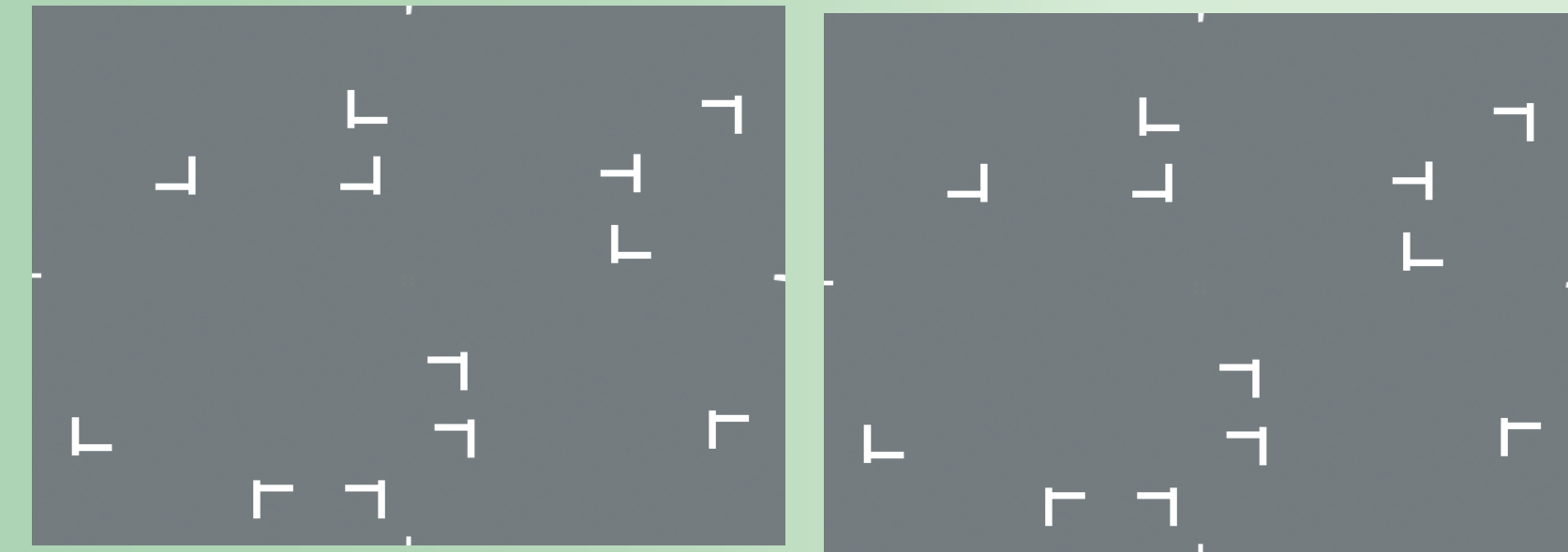
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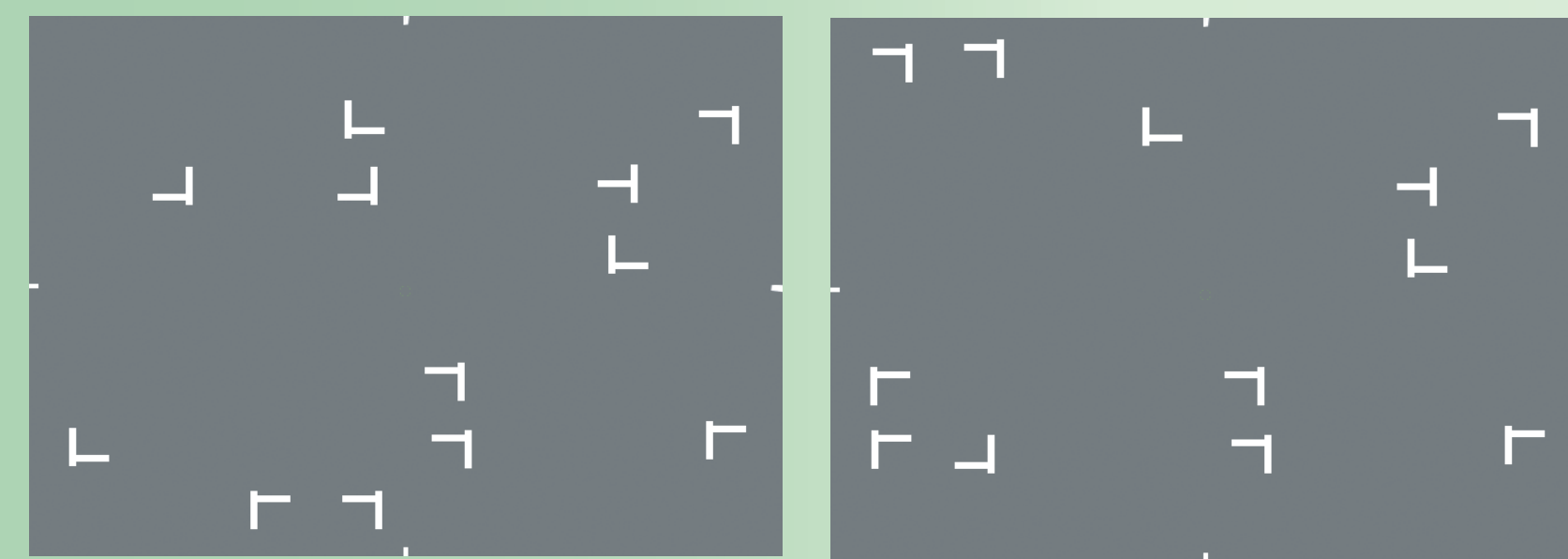
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## Introduction

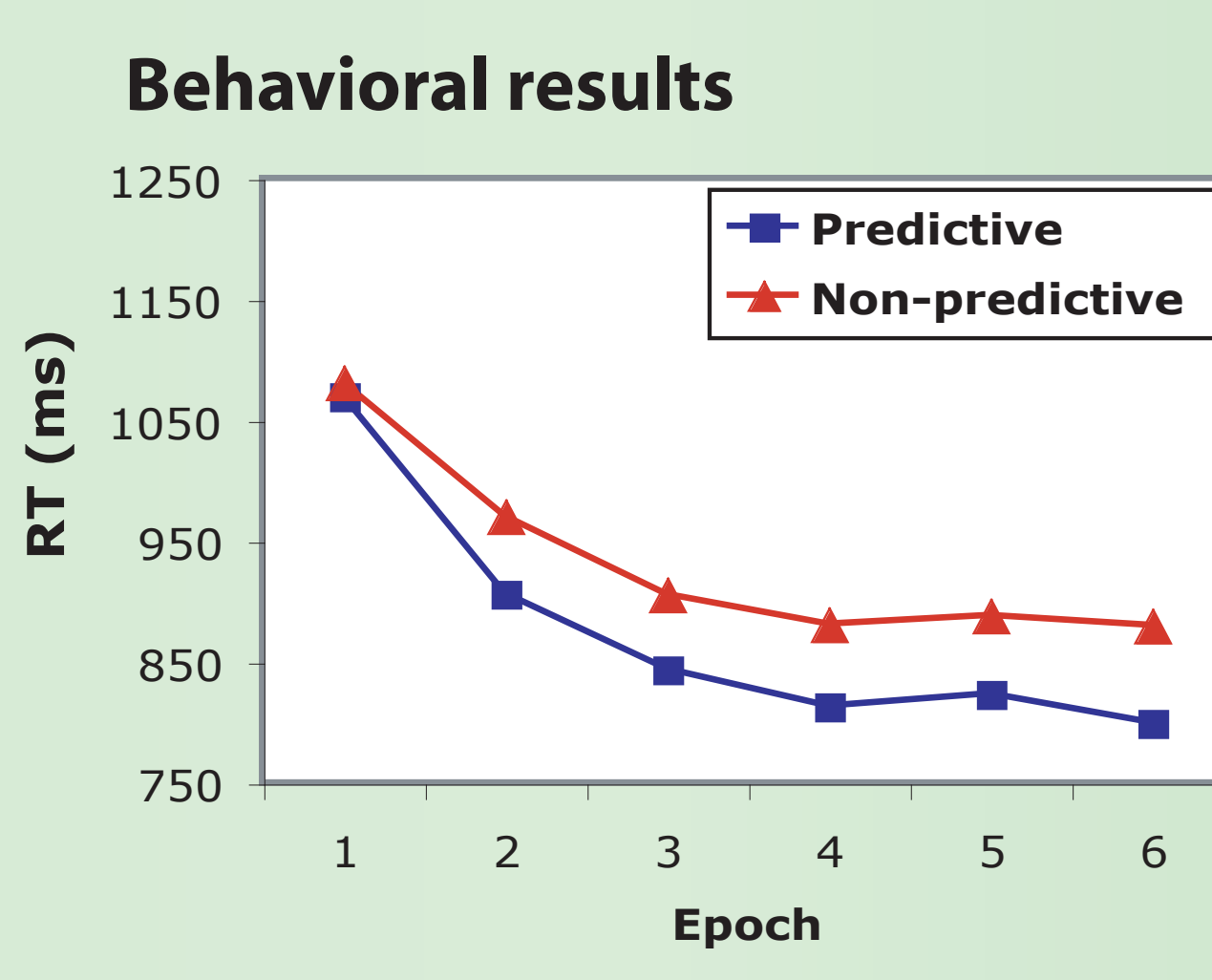
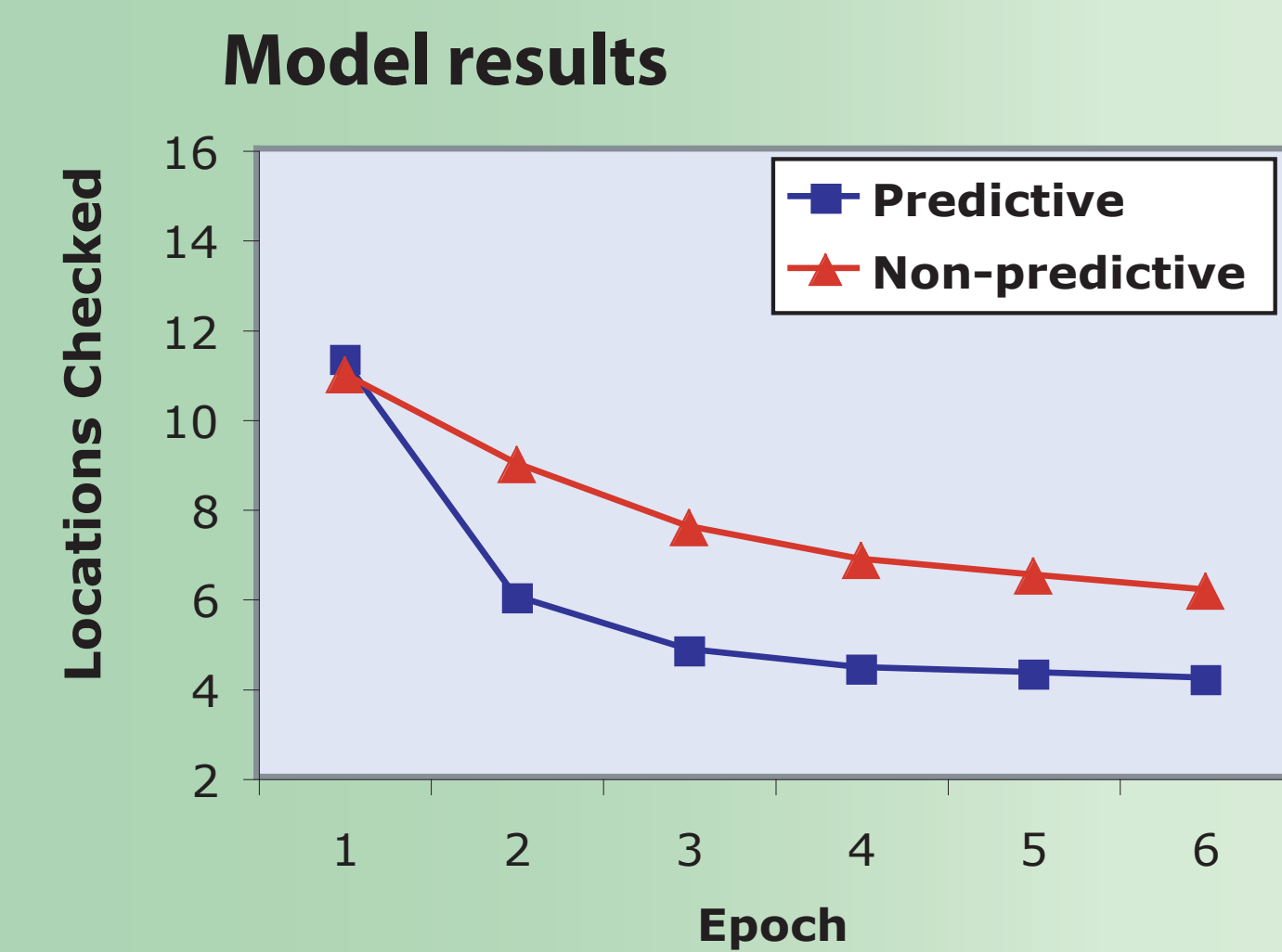
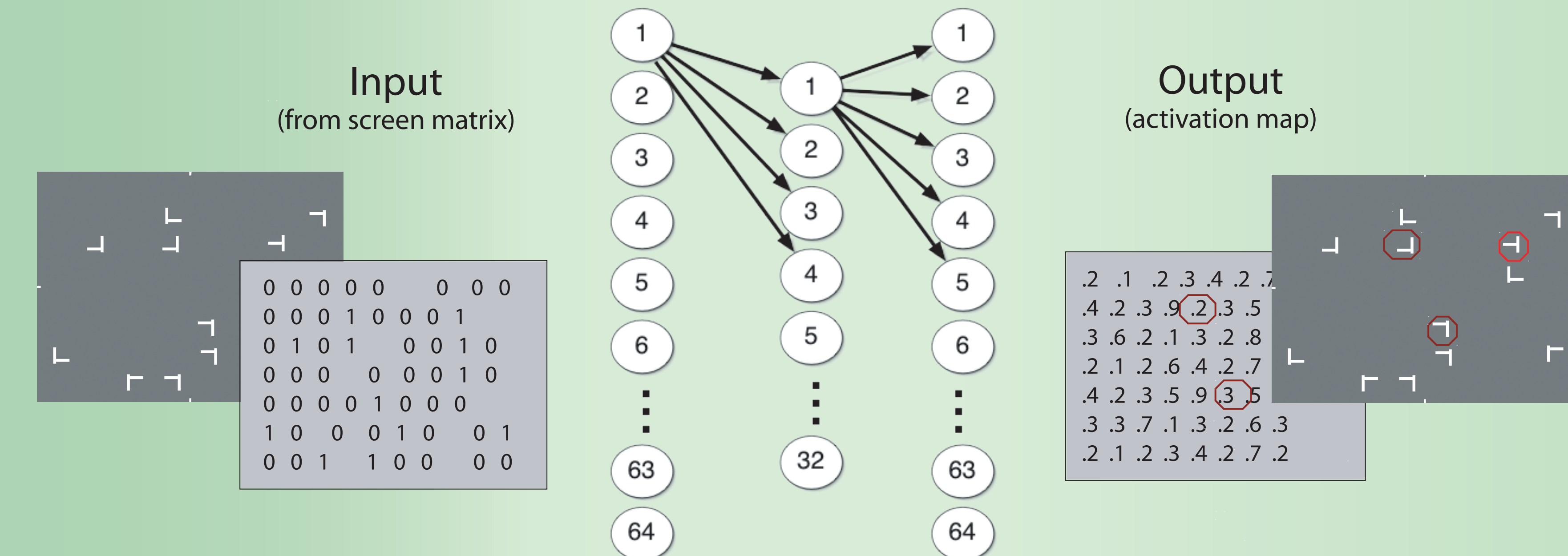


Contextual cueing: If the configuration of distractors is repeated so that it predicts the target location, subjects are faster at finding the target (Chun & Jiang, 1998).

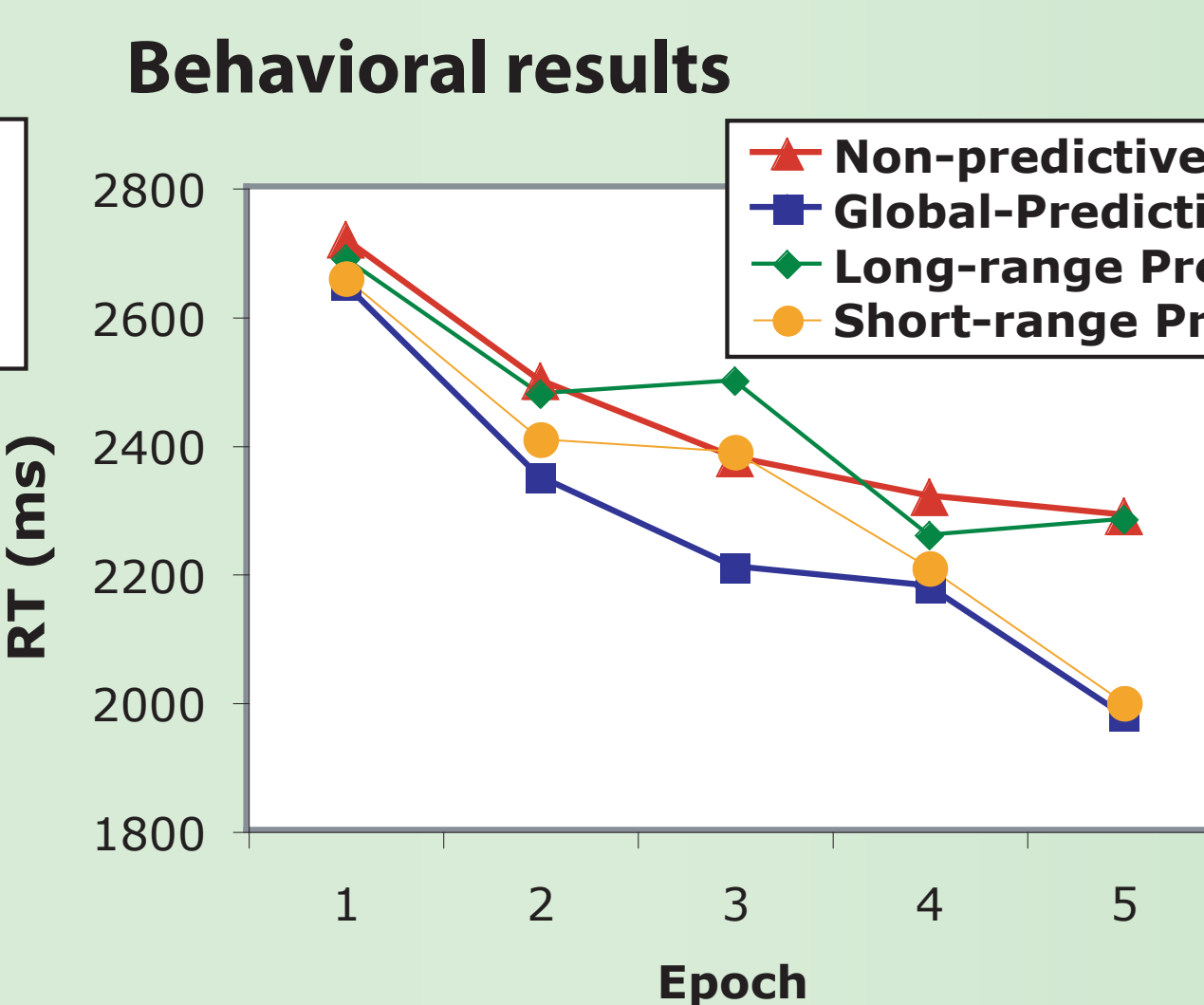
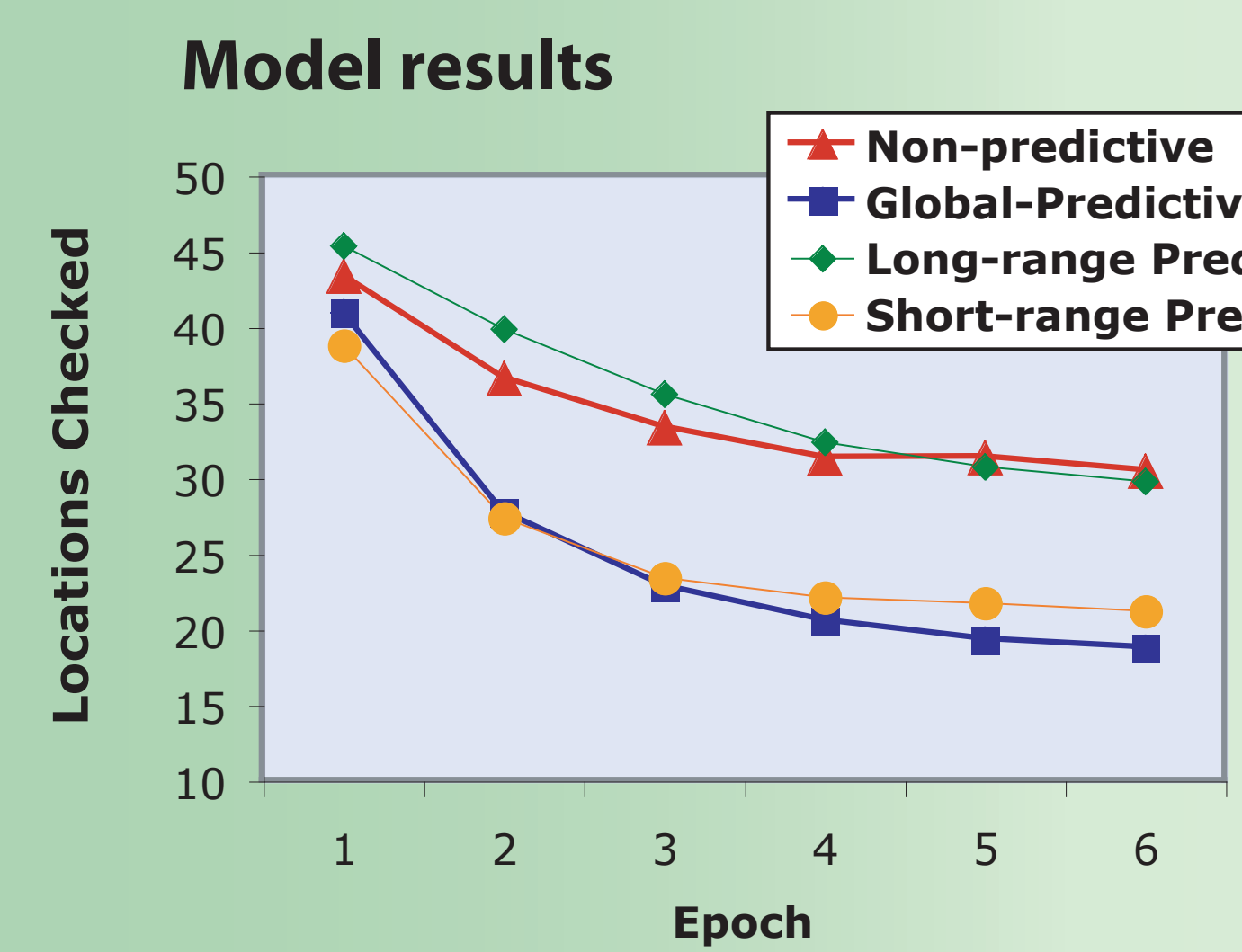


Effect still obtained if the half of the screen with the target is repeated, but not if the opposite half is repeated (Olson & Chun, 2002).

We modeled this contextual cueing results using a connectionist architecture, with a 3-layer back-propagation network using spatial fields to limit connectivity.



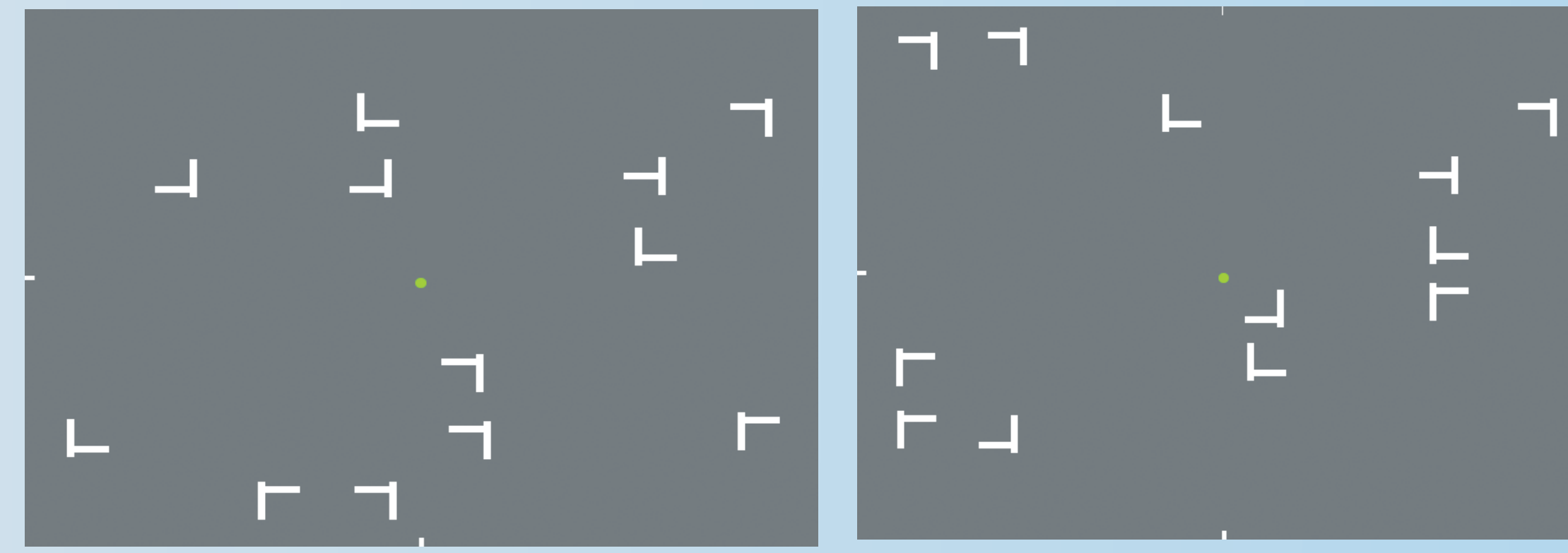
Chun & Jiang, 1998 globally predictive displays



Olson & Chun, 2002 half-screen predictive displays

Short-range predictive: target was on the same side of the screen as the repeated context  
Long-range predictive: target was on the side opposite the invariant context.

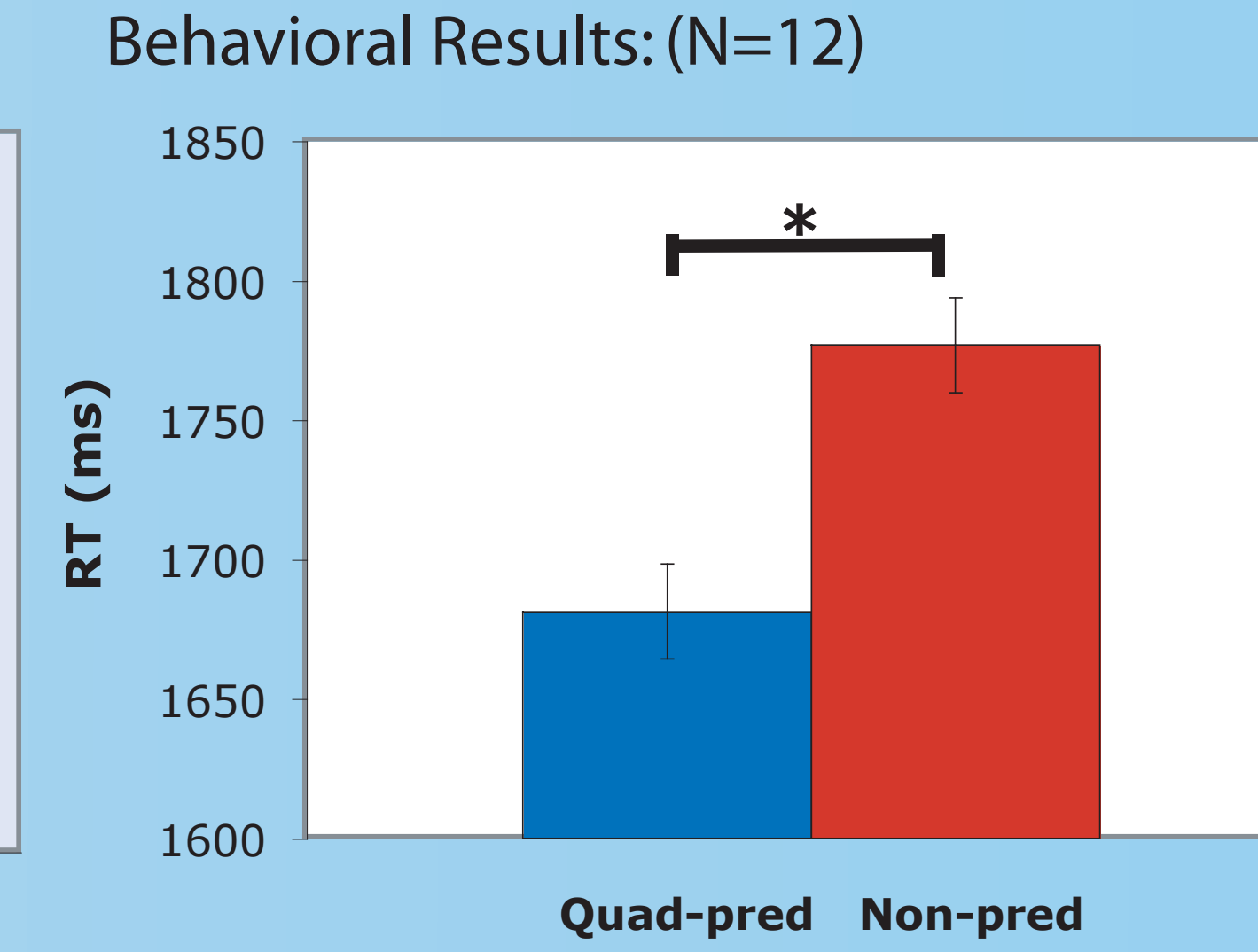
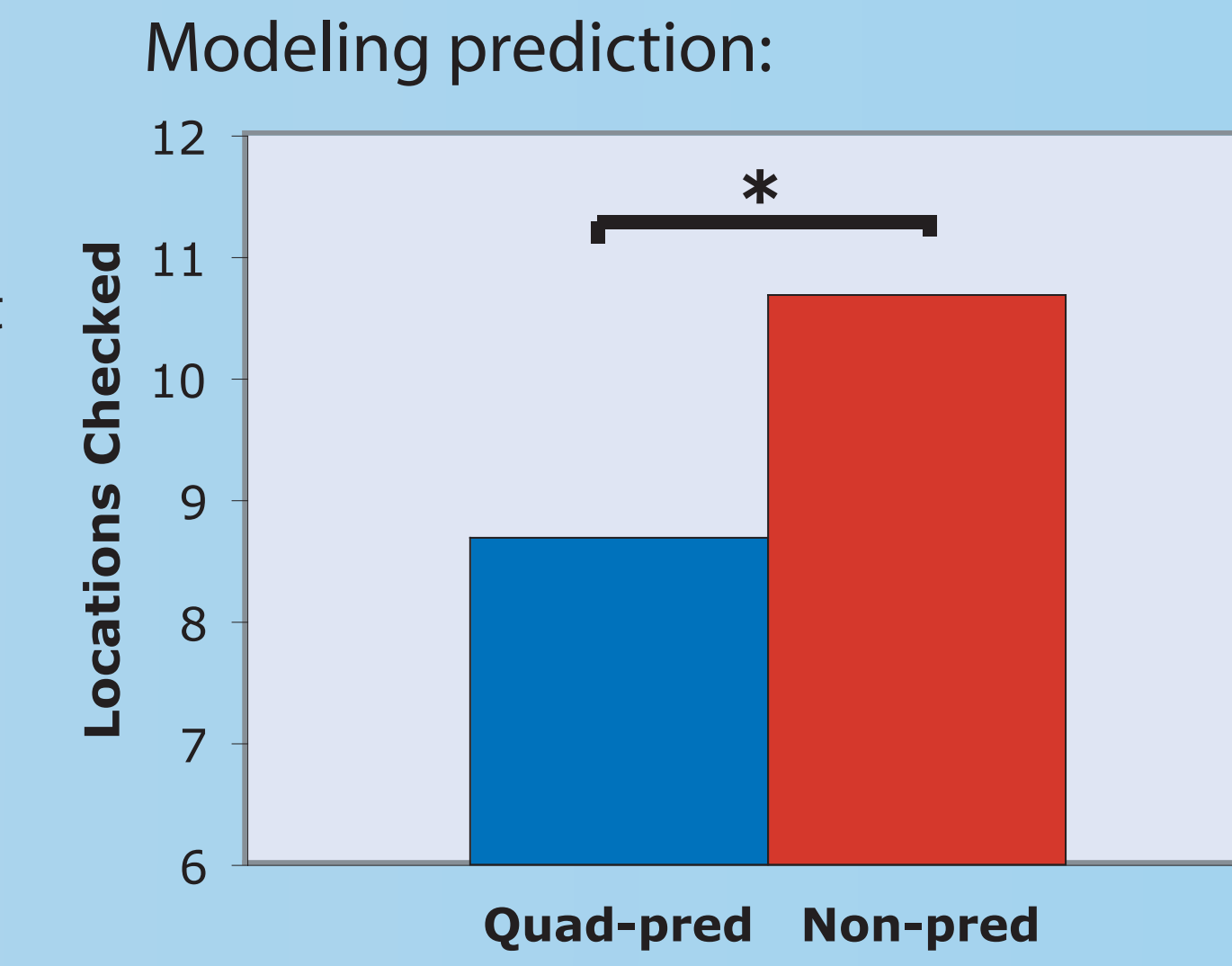
## Exp. 1: What if only the local distractors are predictive of target location?



Sample displays from Experiments 1-3: only the target (top-right) quadrant are repeated between blocks.

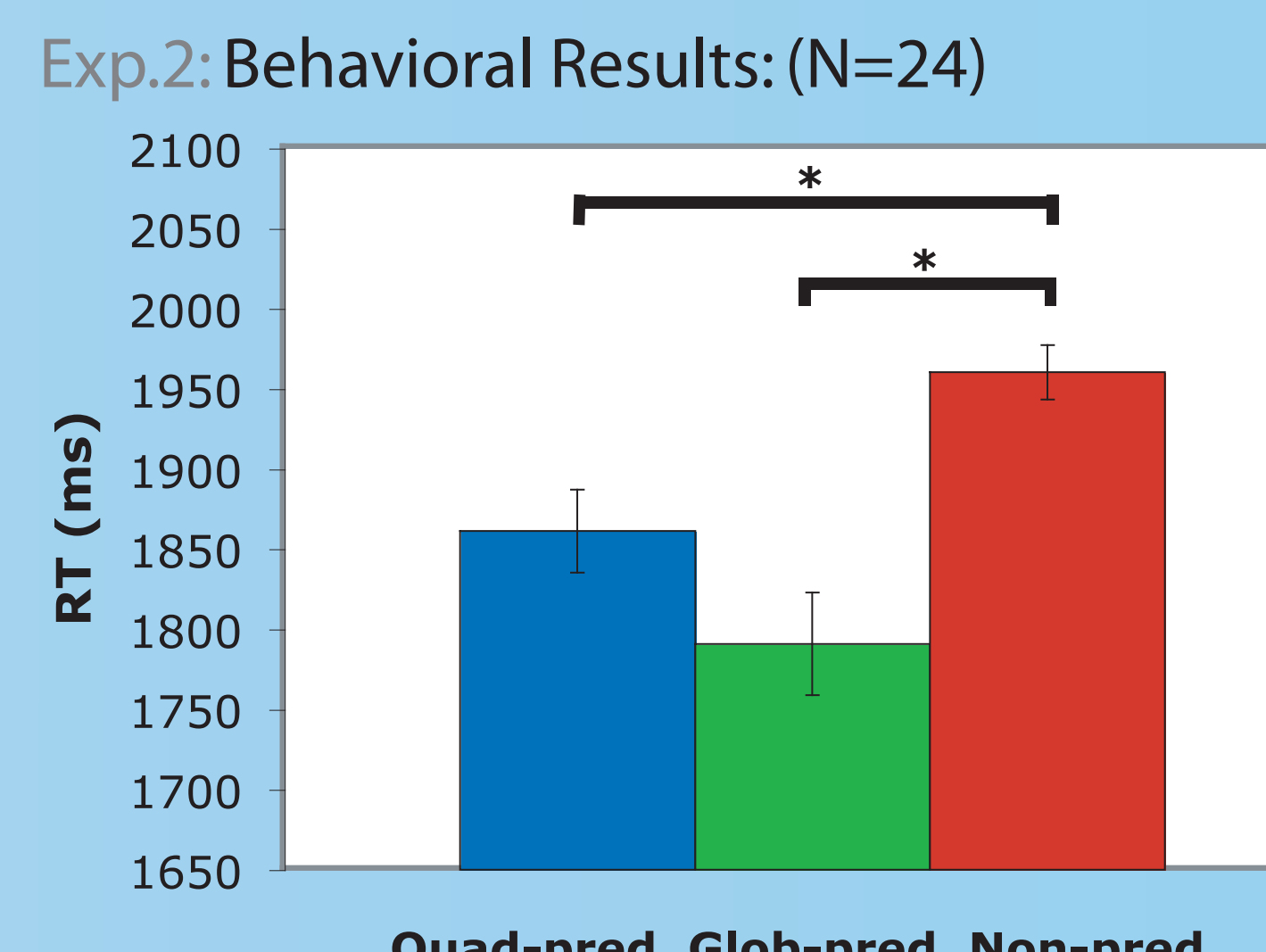
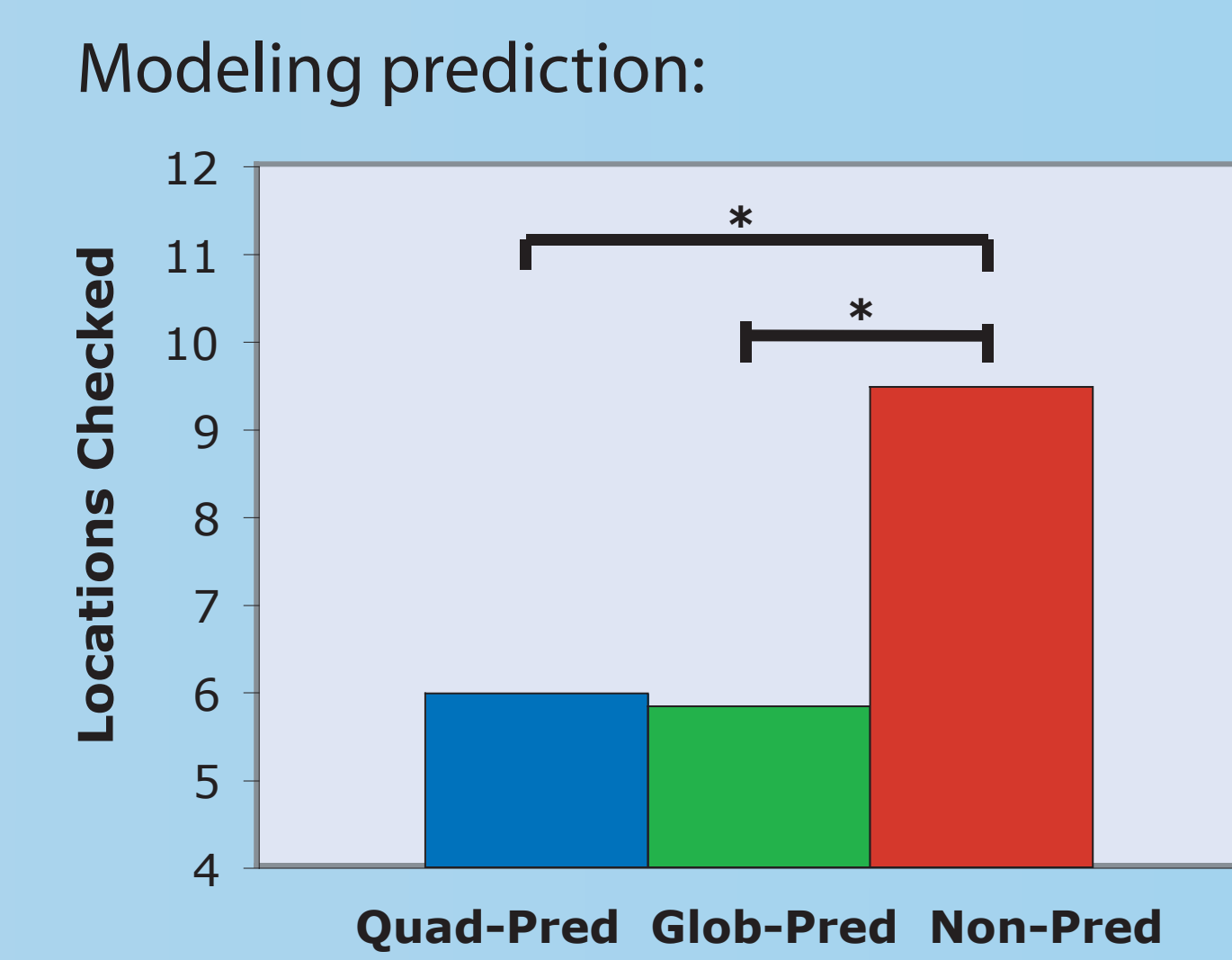
20 blocks of training on all quad-predictive contexts was followed by a 10 block test period that contained the quad-predictive displays along with non-predictive displays that used the same target locations.

Significant contextual cueing with only the local area (target quadrant) predictive.

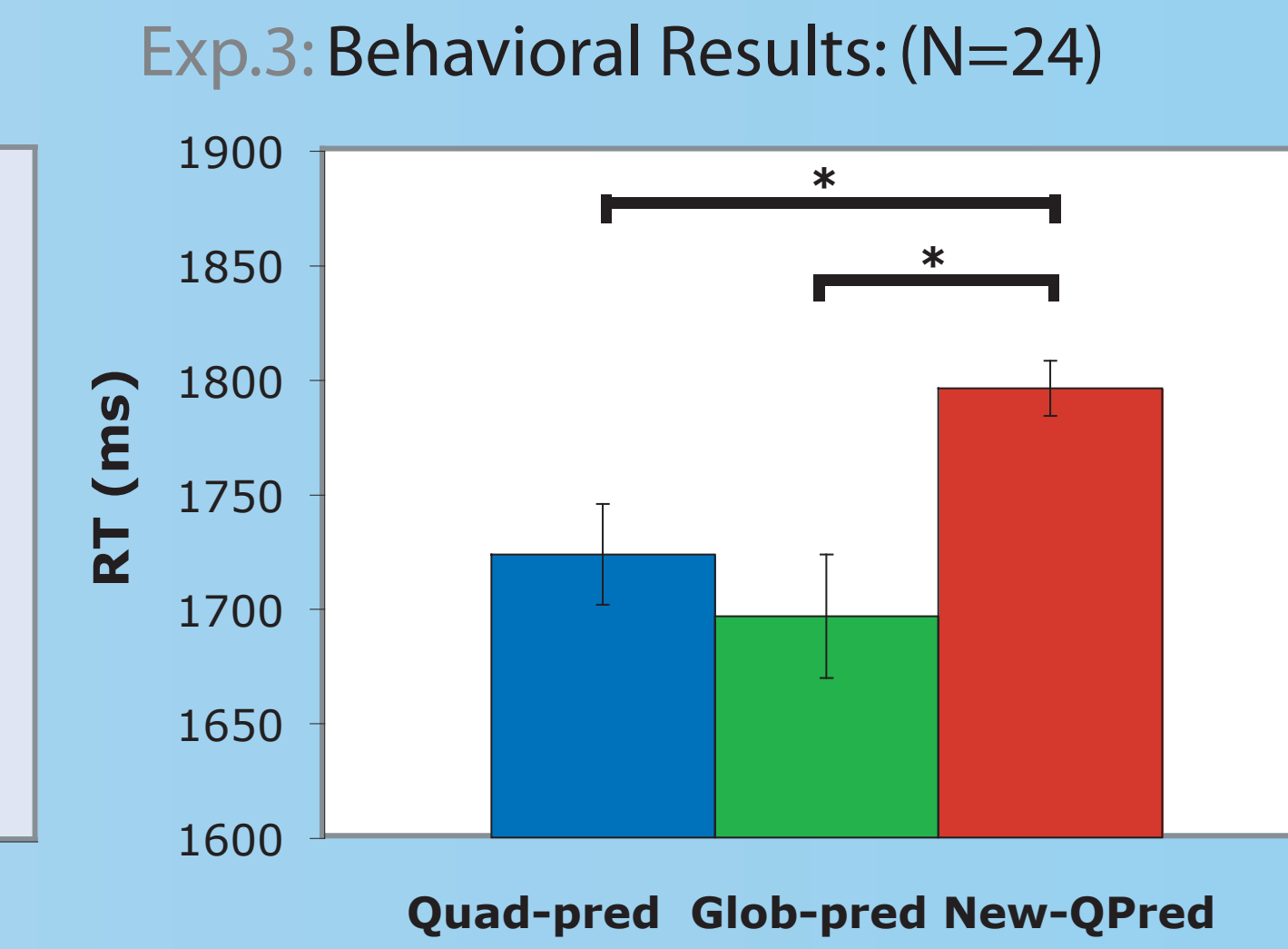
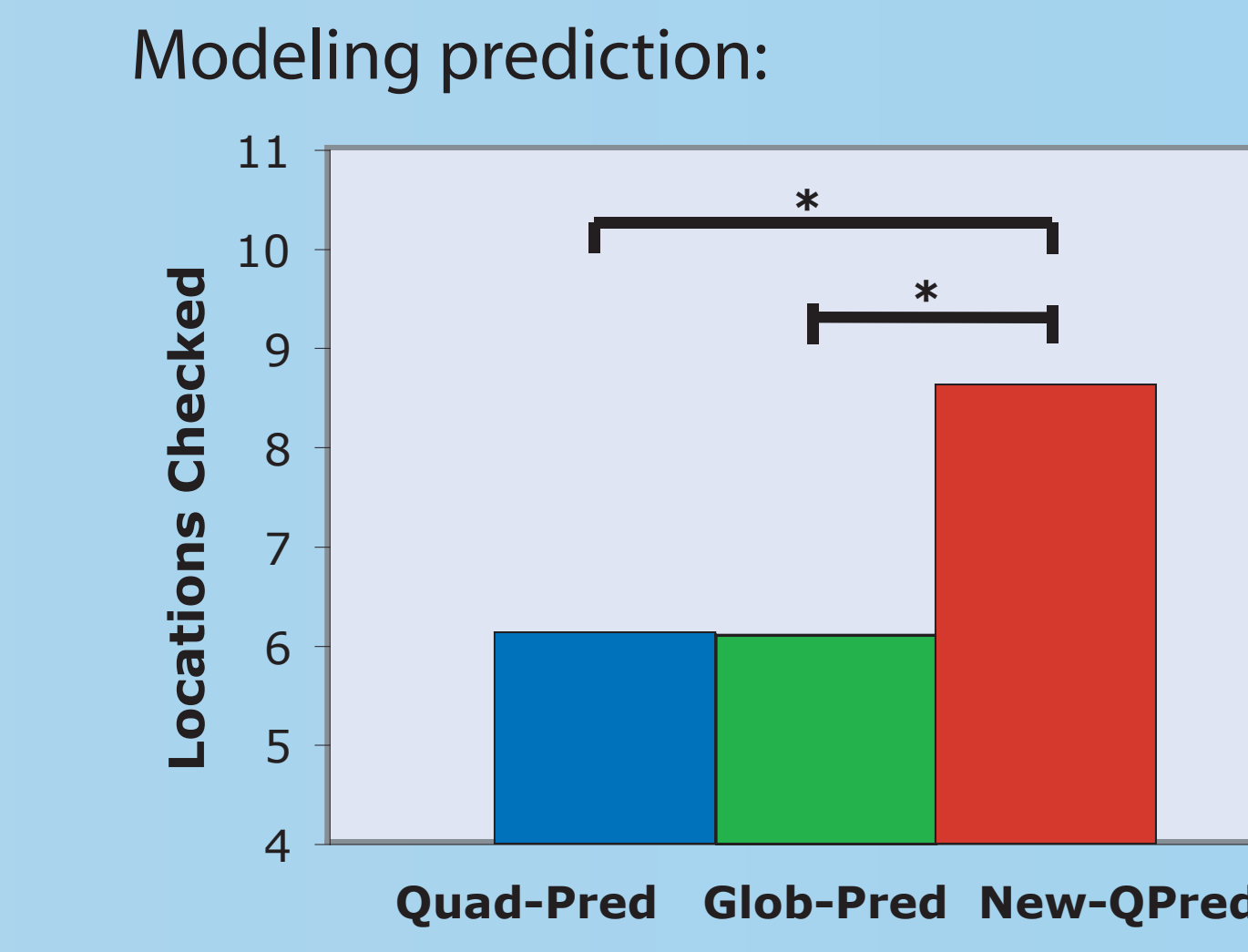


## Exp. 2 & Exp. 3: Is global contextual cueing larger than local contextual cueing?

**Exp. 2:** Subjects were trained on half quad-predictive and half global-predictive displays. In the test phase, non-predictive displays were introduced. All other methods were the same as Experiment 1. Test block results shown to the right.

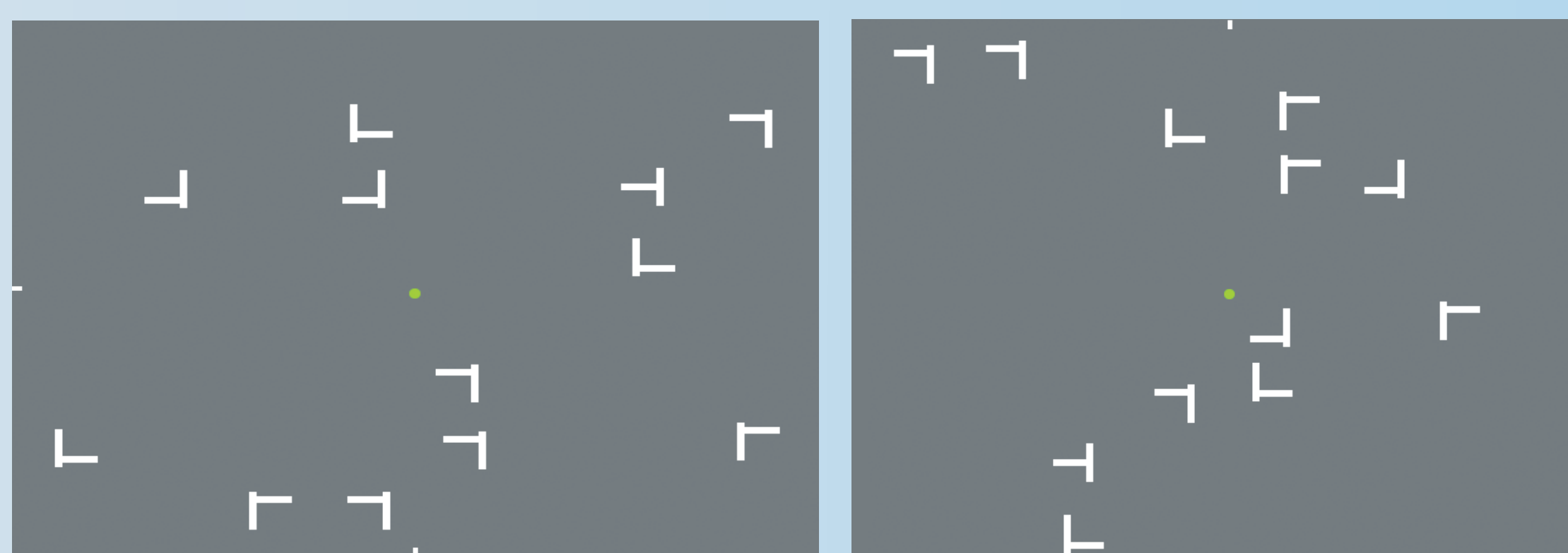


**Exp. 3:** Subjects were trained on all global-predictive displays. Half became quad-predictive in the test phase, along with the introduction of new quad-predictive displays. All other methods were the same as Experiment 1. Test block results to the right.



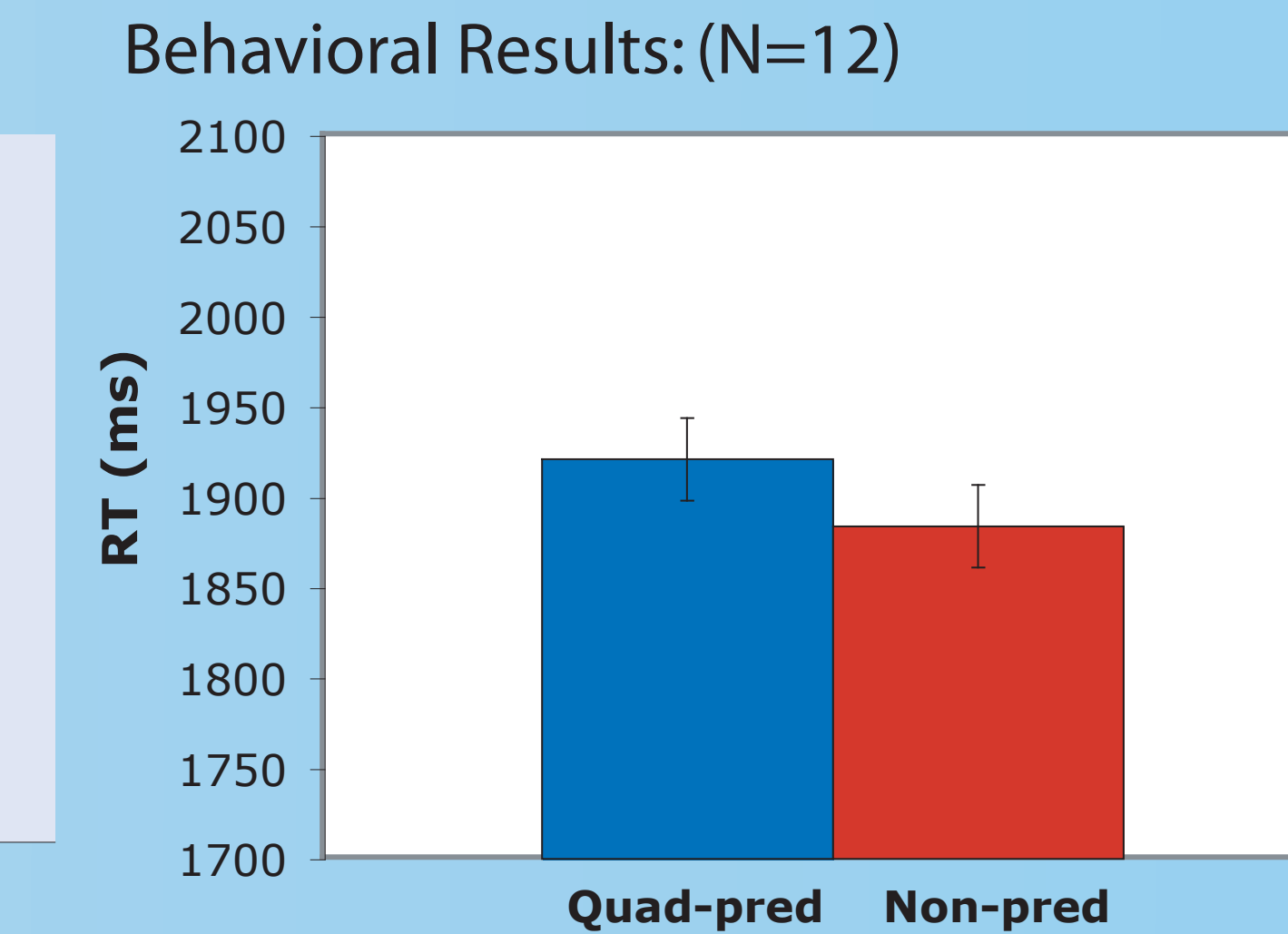
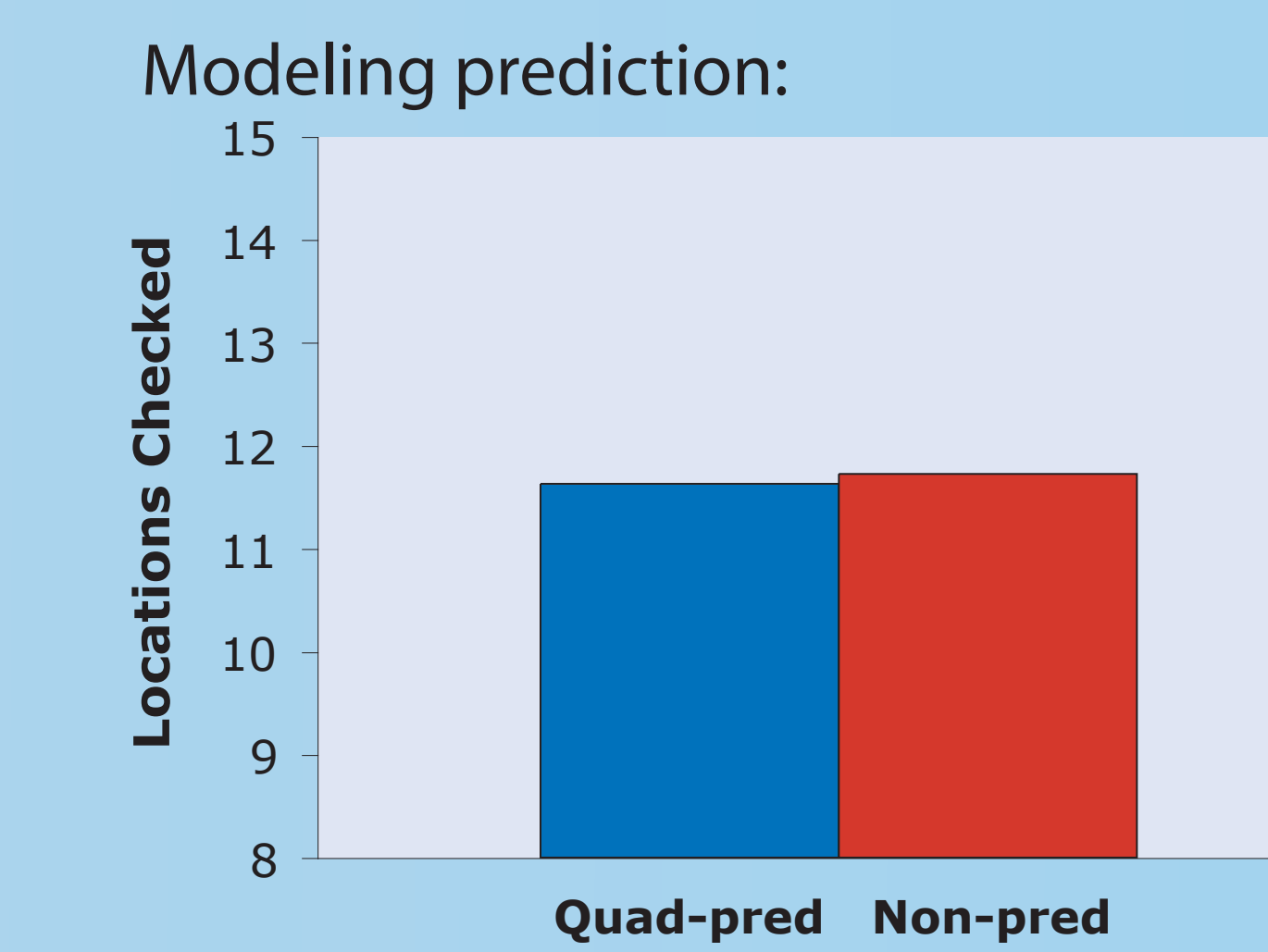
Global and local contextual cueing were statistically equivalent in both experiments.

## Exp. 4: Is local contextual cueing position-dependent?



Sample displays from Experiment 4. Notice that the display is predictive in the target (top-right, then bottom-left) quadrant, although the target quadrant moves between blocks. All other methods were the same as those used in Experiment 1.

Local contextual cueing is position-dependent.



## Conclusions

### Behavioral results:

- Contextual cueing is largely driven by the local distractors.
- Local contextual cueing is position-dependent.

### Modeling results:

- A neural network that learns associations with the local configuration is a good model of contextual cueing.
- Receptive fields are necessary to capture the spatial properties of contextual cueing.
- The receptive fields also predict local contextual cueing's position-dependence.

### References

- Chun, M.M. & Jiang, Y. (1998) Contextual cueing: Implicit learning and memory of visual context guides spatial attention. *Cognitive Psychology*, 36, pp 28-71
- Olson, I.R. & Chun, M.M. (2002) Perceptual constraints on implicit learning of spatial context. *Visual Cognition*, 9(3), pp 273-302