Categorical Contextual Cueing in Visual Search

Stephen C. Walenchok[1], Michael C. Hout[2], and Stephen D. Goldinger[1]

[1]*Arizona State University* [2]*New Mexico State University*

Using Context to Guide Search

- When searching for an object in a scene, we rely on meaningful relations between objects, or the *global context* of that scene (Biederman, 1972; Biederman, et al., 1982). For example, when searching for a bicycle, we scour the street rather than the tops of buildings or the sky.

- Learning this global context comes with experience. In visual search, people can implicitly learn repeated spatial configurations of distractors over many trials and use this information to quickly find targets (Chung & Jiang, 1998).

- People can also benefit from this *contextual cueing* when specific types of distractors are paired with specific targets, independent of spatial consistency (Chun & Jiang, 1999). This implicit learning can result in high quality visual memory for the details of distractors, facilitating future search (Hout & Goldinger, 2010; 2012).

The Present Investigation

- Experience with previous global contexts teaches people, for example, that bicycles are often encountered on the street. Could people also learn the global context of a "scene" in visual search and use this context to guide attention to the likely target location?

- Much like the street is a likely location for a bicycle, in the current task, specific categories of distractors predicted the likely target location (e.g., the target often occurred near categories of distractors such as *animals* or *dessert food*).
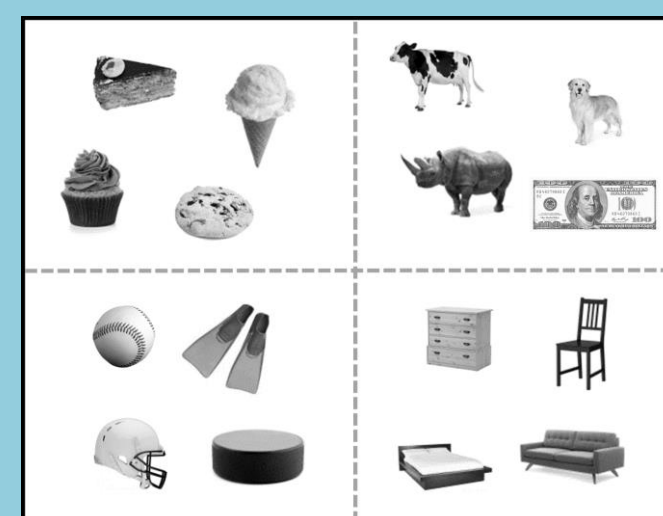
Method

Target:

- Each target's location "travels" with the predictive distractor category (e. g., *animals*, pictured here).
- Absolute location of the target within the predictive category's quadrant is always random.
- Target and distractor categories are non-overlapping.
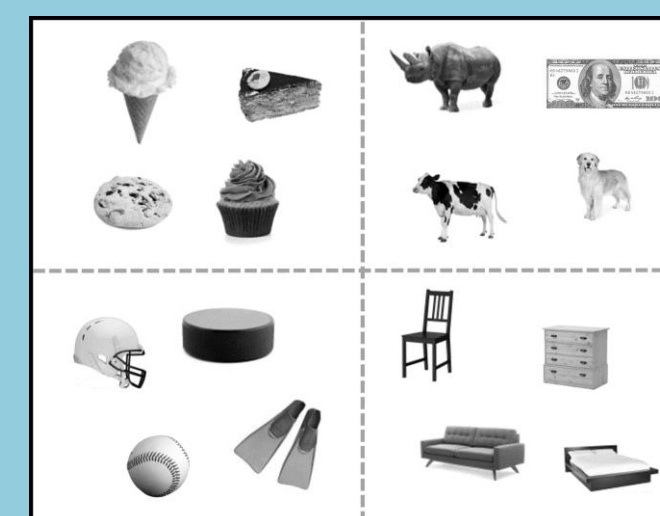
Conditions

1. Configuration*
(between-subjects)

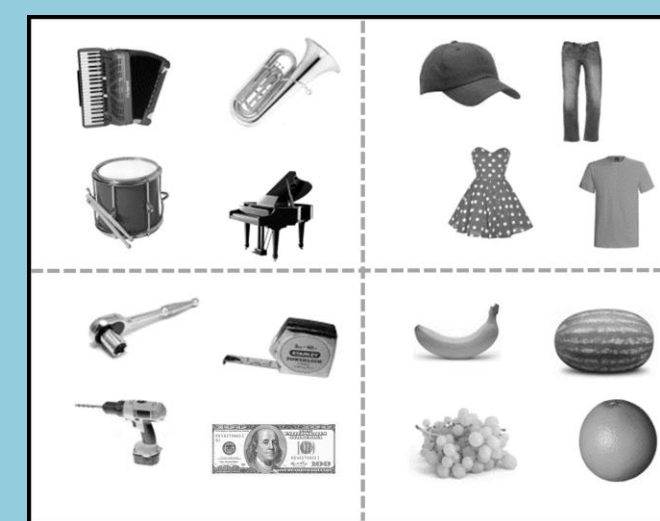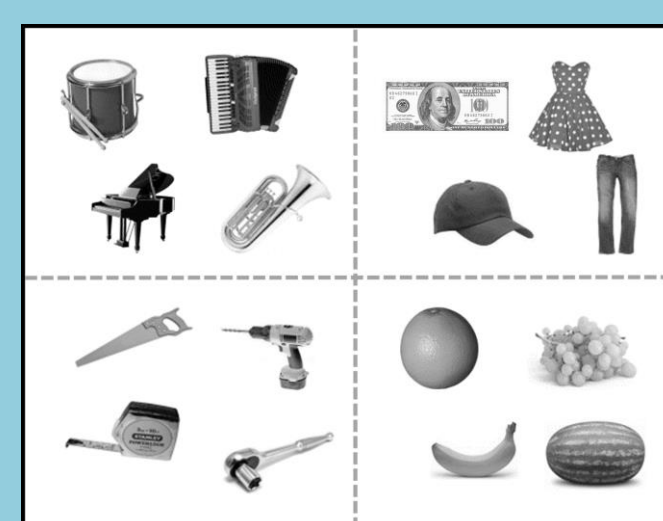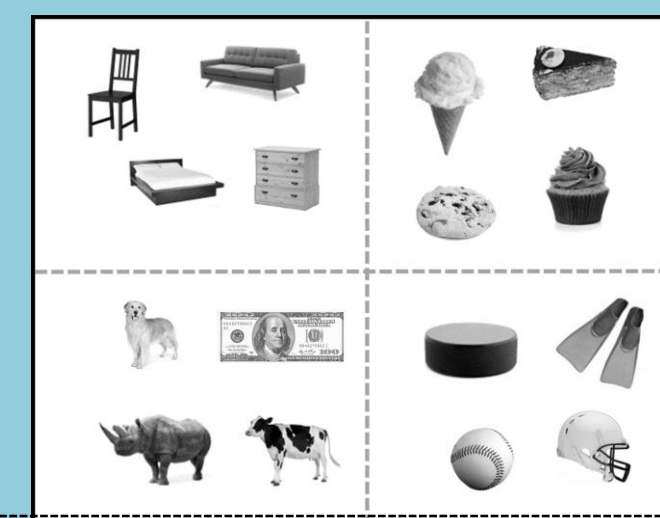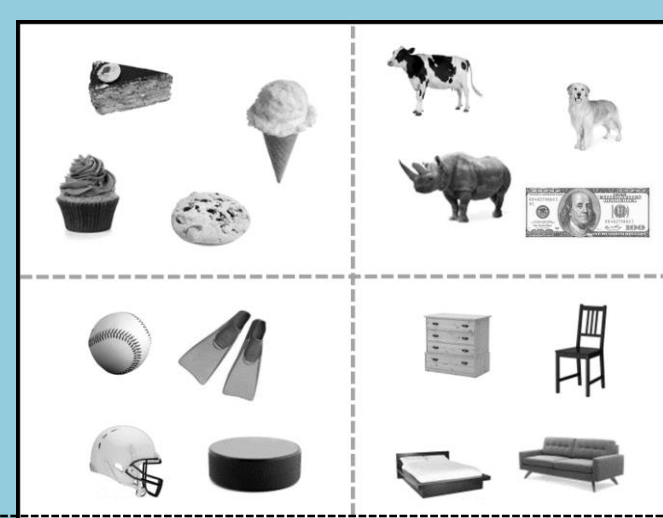Fixed category-to-quadrant assignment

Trial *n*   Trial *n* + 1

Predictive Trials

Non-predictive trials

Random category-to-quadrant assignment

Predictive Trials

Non-predictive trials

2. Predictiveness (within-subjects)

3. Epoch: four blocks of 100 trials each
(within-subjects)

*Additional "Rotated" condition (not pictured) was also tested.
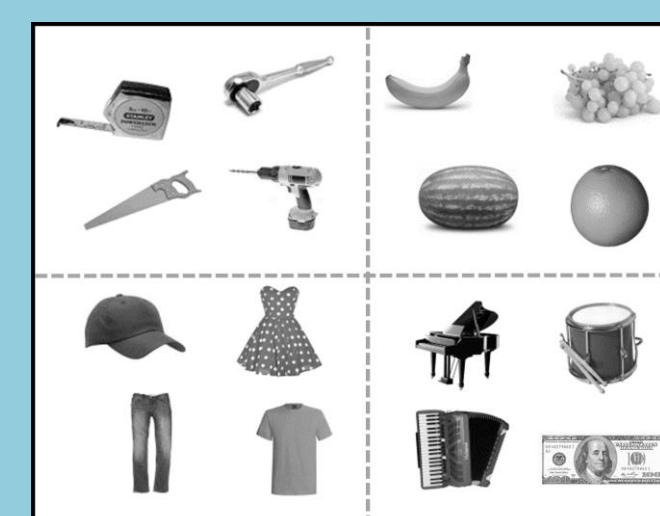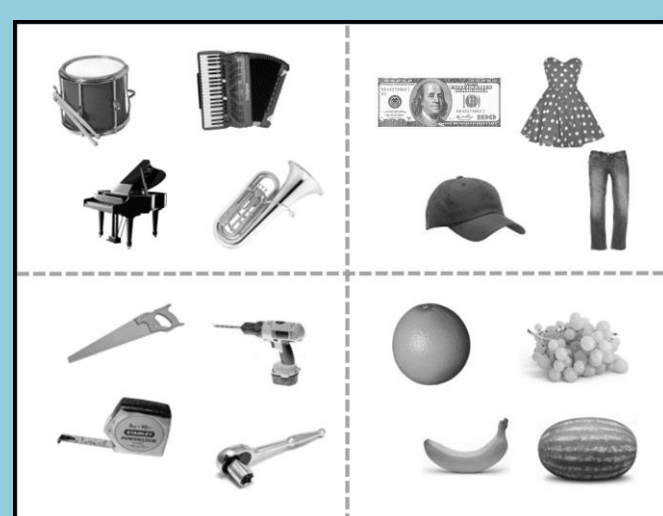
Procedure

Find this target:

Press SPACE to continue the trial.

+

7   8   3   1
6   5   2   4
11 10 15 16
12 9   13 14

Which number refers to the correct target location?
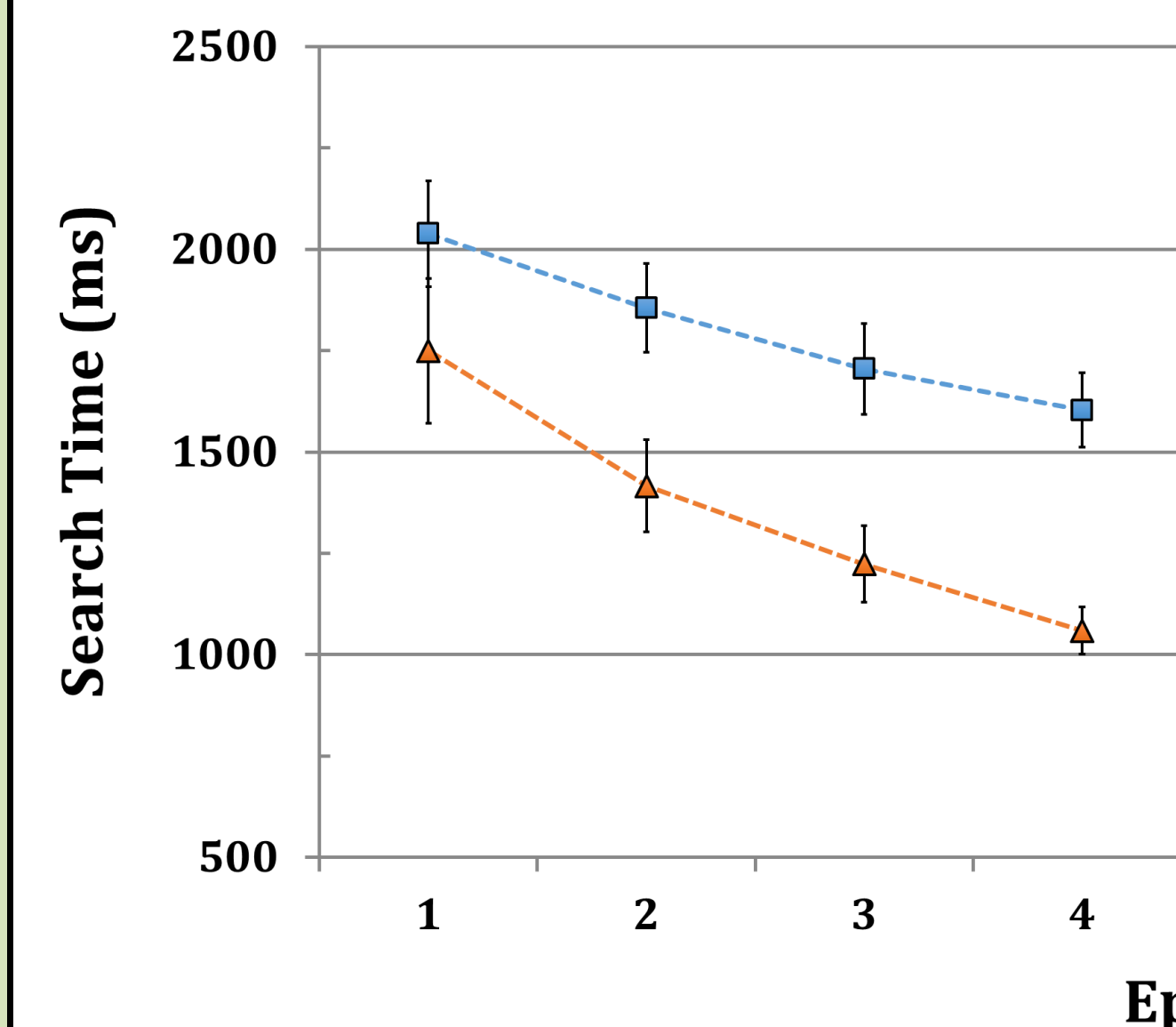
4   12
`f`   `j`

Results
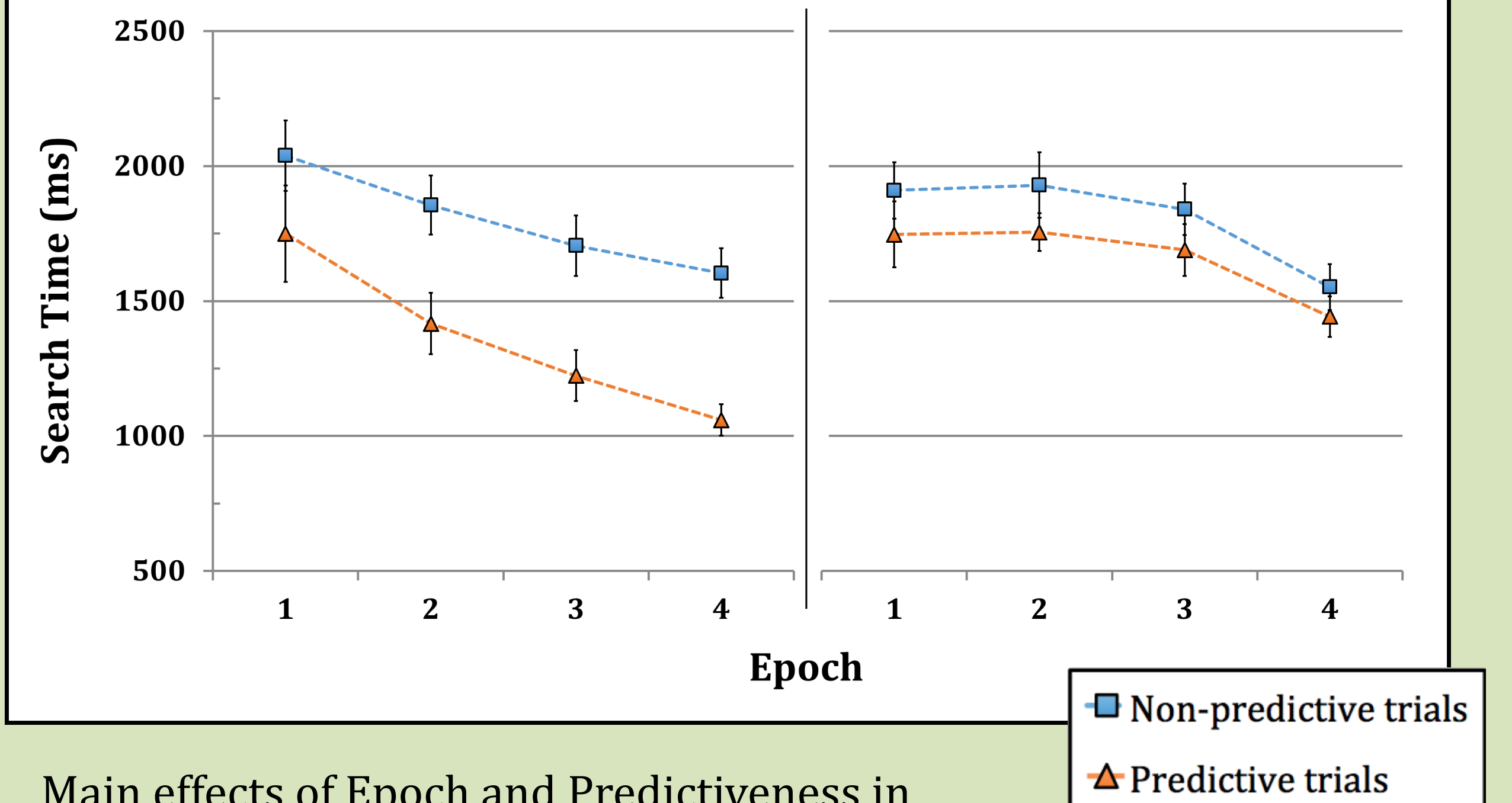
Main effects of Epoch and Predictiveness in both Fixed and Random conditions

Conclusions and Future Directions

- Within the Fixed condition, faster search times on Predictive trials may indicate a combination of categorical *and* spatial contextual cueing.

- Faster search times on Predictive trials in the Random condition indicate *categorical* cueing, although object-specific cueing cannot be ruled out.

- In order to rule out this object-specific cueing, a follow-up experiment was conducted in which specific distractors that comprised the target-predictive category were changed from trial-to-trial. Results were equivocal, likely due to the ease of finding the targets in this experiment (i.e., time spent looking at distractors was insufficient for encoding category information about those distractors).

- Future experiments will include increased search difficulty, and also a larger number of trials, in order to provide the optimal conditions for implicit learning of distractor categories.