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

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

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.

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

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

22 blocks of training on all quad-predictive conditions was followed by a 2 block test period that contained the quad-predictive display along with non-predictive displays that used the same target locations.

Modeling prediction:

Behavioral Results (N=12)

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 shown to the right.

Modeling prediction:

Behavioral Results (N=24)

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

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

Sample displays from Experiment 4 for Exp. 1 & Exp. 2. Results for Exp. 1 & Exp. 2 are shown in the next column.

Modeling prediction:

Behavioral Results (N=12)

Local contextual cueing is position-dependent.

Exp. 5: Model results vs. behavioral results

Modeling prediction:

Behavioral Results (N=12)

Modeling prediction:

Behavioral Results (N=24)

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.

Behavioral results:

• Contextual cueing is largely driven by the local distractors.

• Local contextual cueing is position-dependent.

References
