

A simple saliency model accounts for complex results of crowding experiments

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Introduction

Traditionally, visual crowding has been explained by a spatial pooling of information over large receptive fields in the visual periphery, with radius about half of target eccentricity (Bouma's law).

Several studies have found that crowding zones can be very different from these predicted by Bouma's law and difficult to explain by simple pooling models. Crowding may be reduced by increasing number of flankers within a "crowding zone", and depends heavily on identities, homogeneity/heterogeneity, and spatial configuration of flankers.

In this study, I simulate these "complex" results using a simple saliency model.

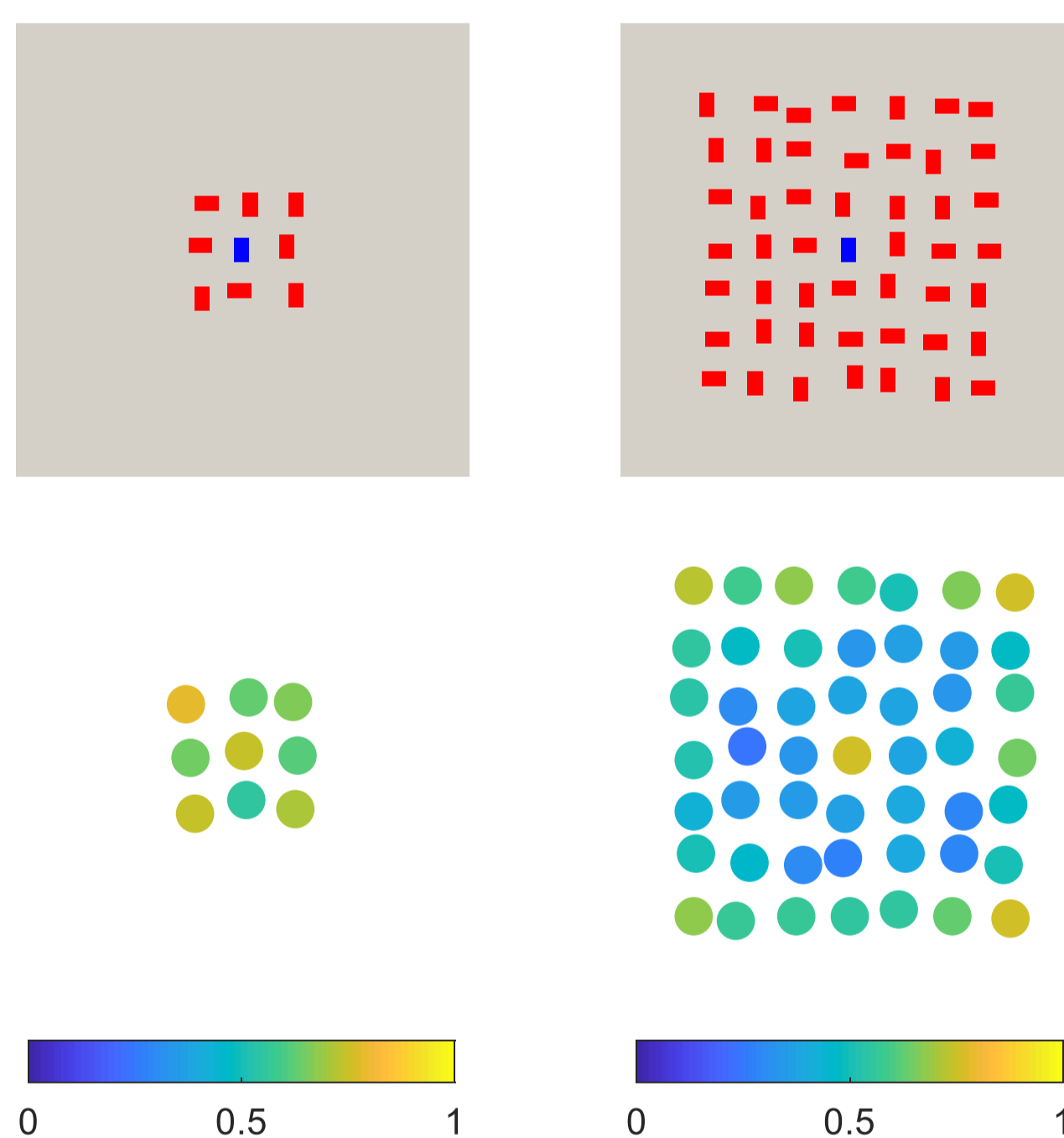
Methods

The main mechanism is a feature-dependent lateral inhibition. Inhibitory interactions between visual items depend on their similarity along feature dimensions (e.g. color, orientation) as well as spatial proximity. I use this mechanism to calculate visual saliency of the target and flanking objects for several complex displays from published crowding experiments.

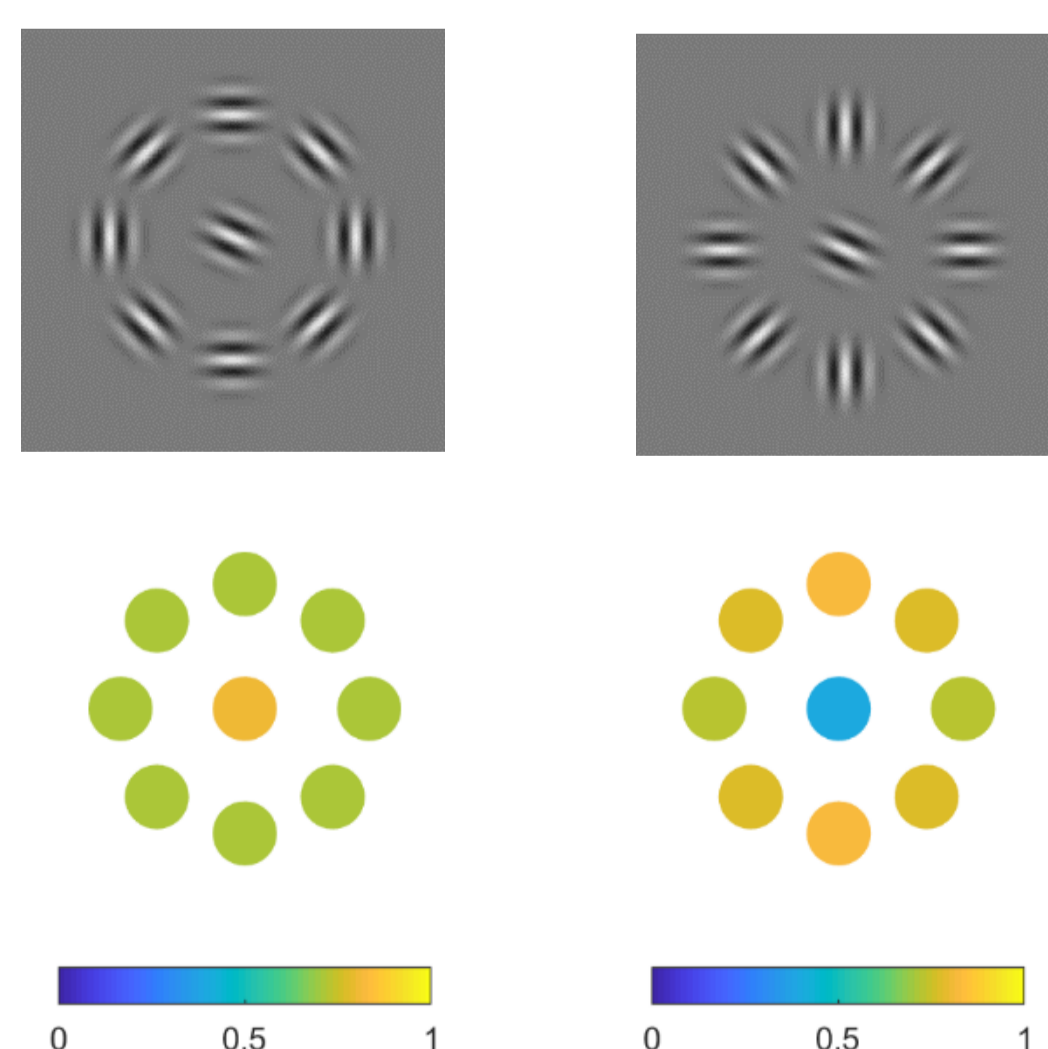
Results

Examples of saliency maps (Põder, 2020)

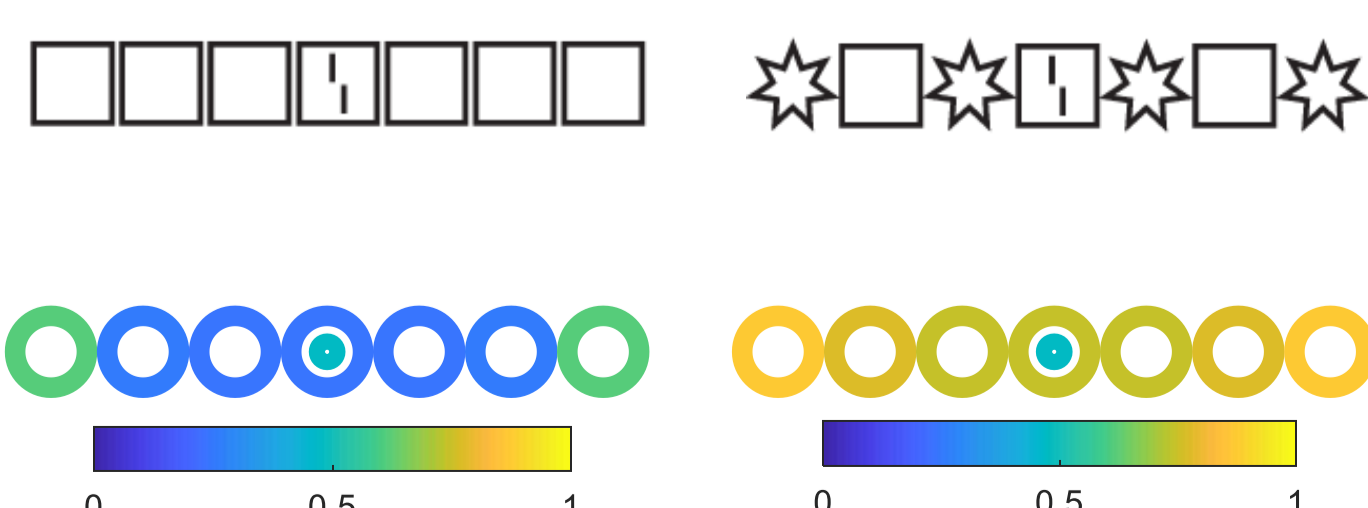
Stimuli from Põder (2006)



Livne & Sagi (2007)

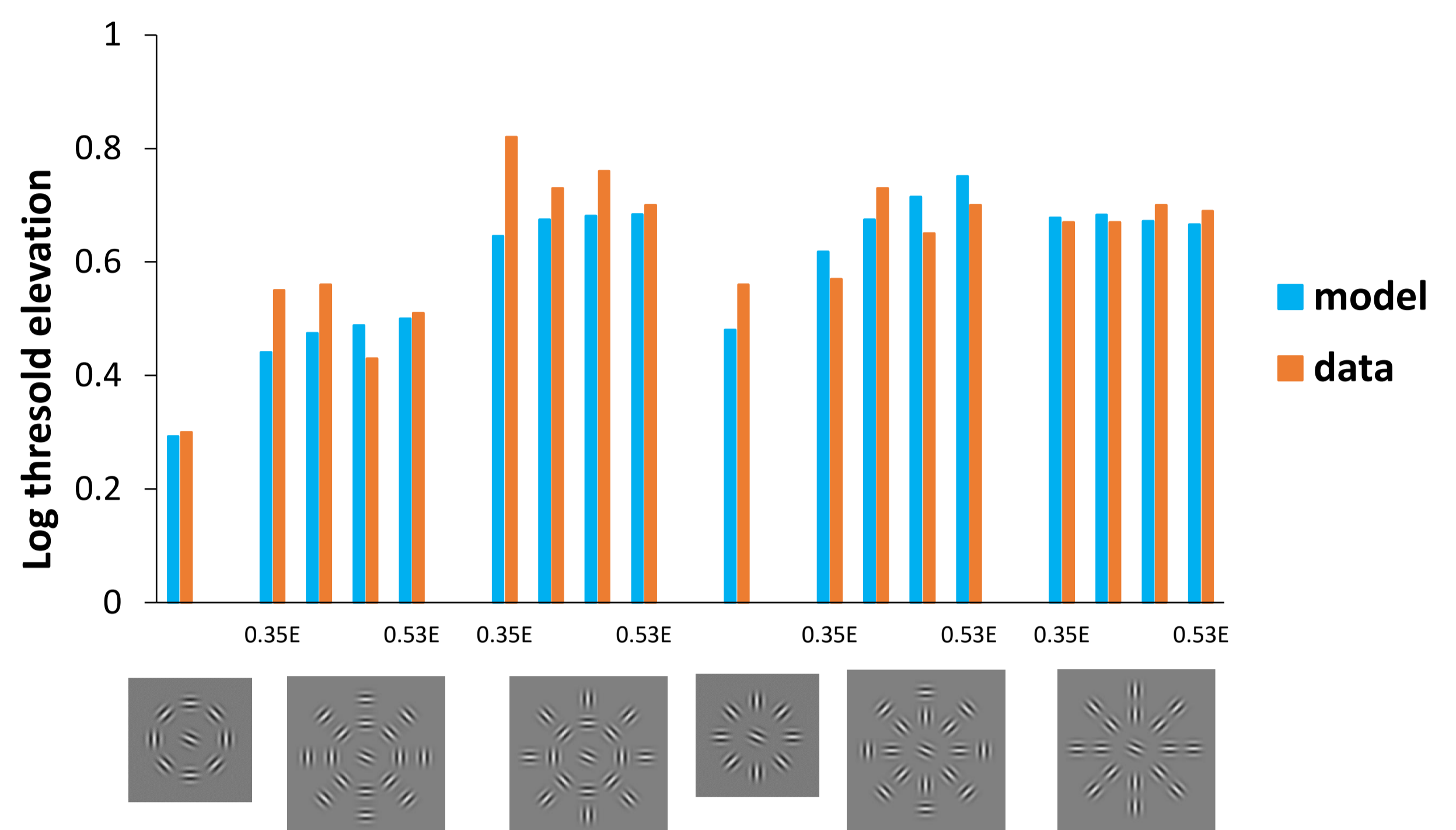


Manassi et al (2016)

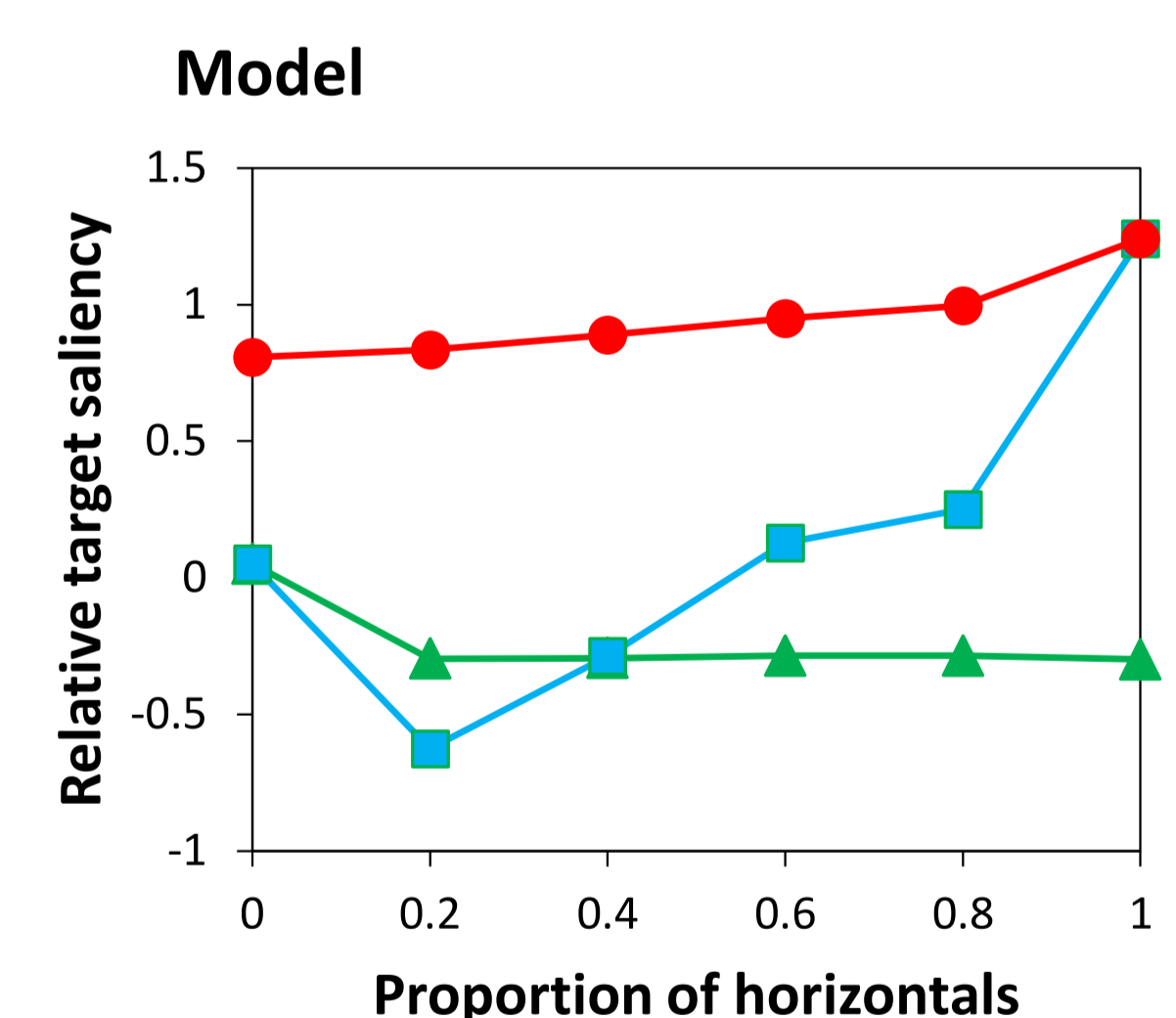
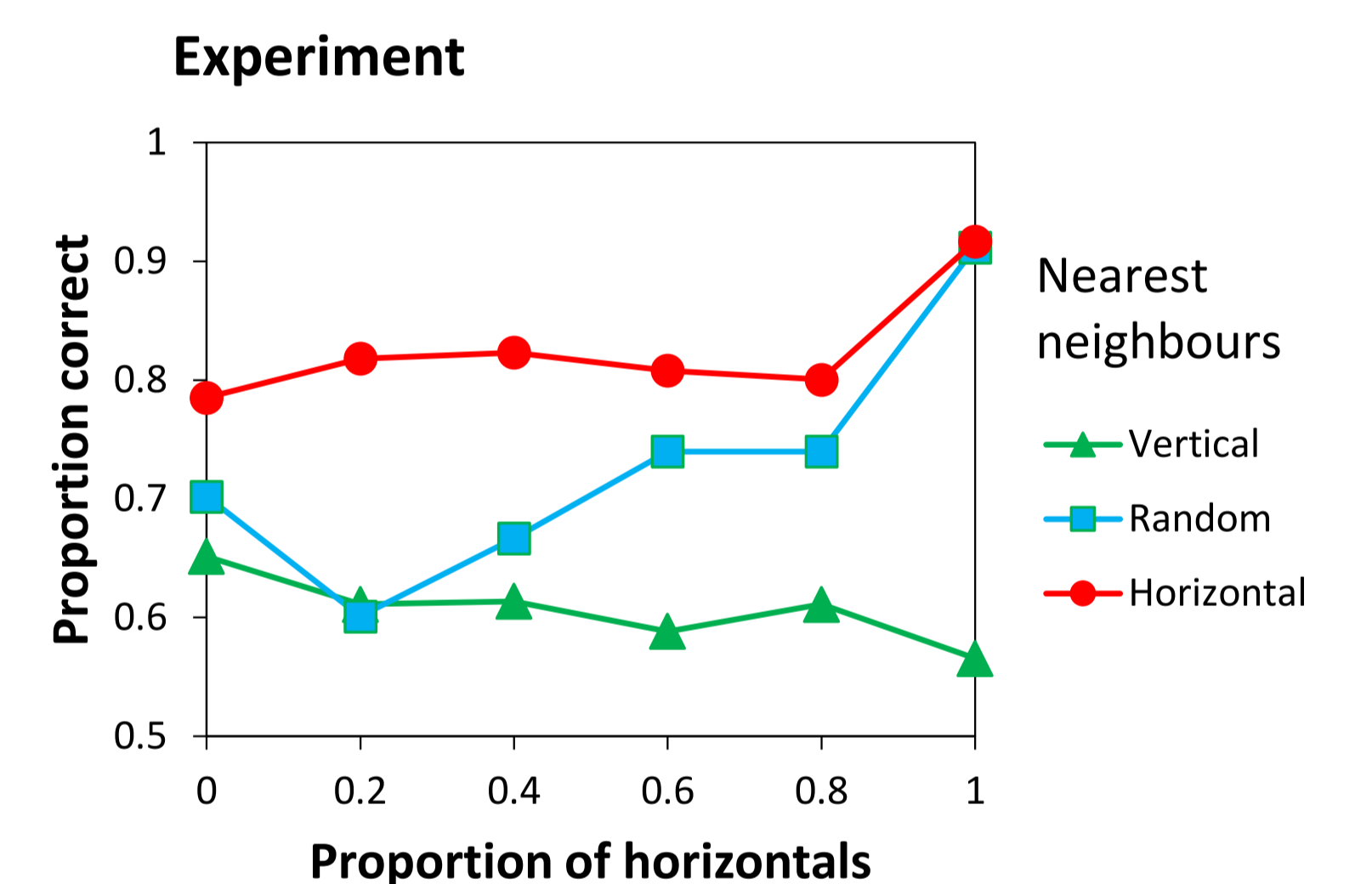
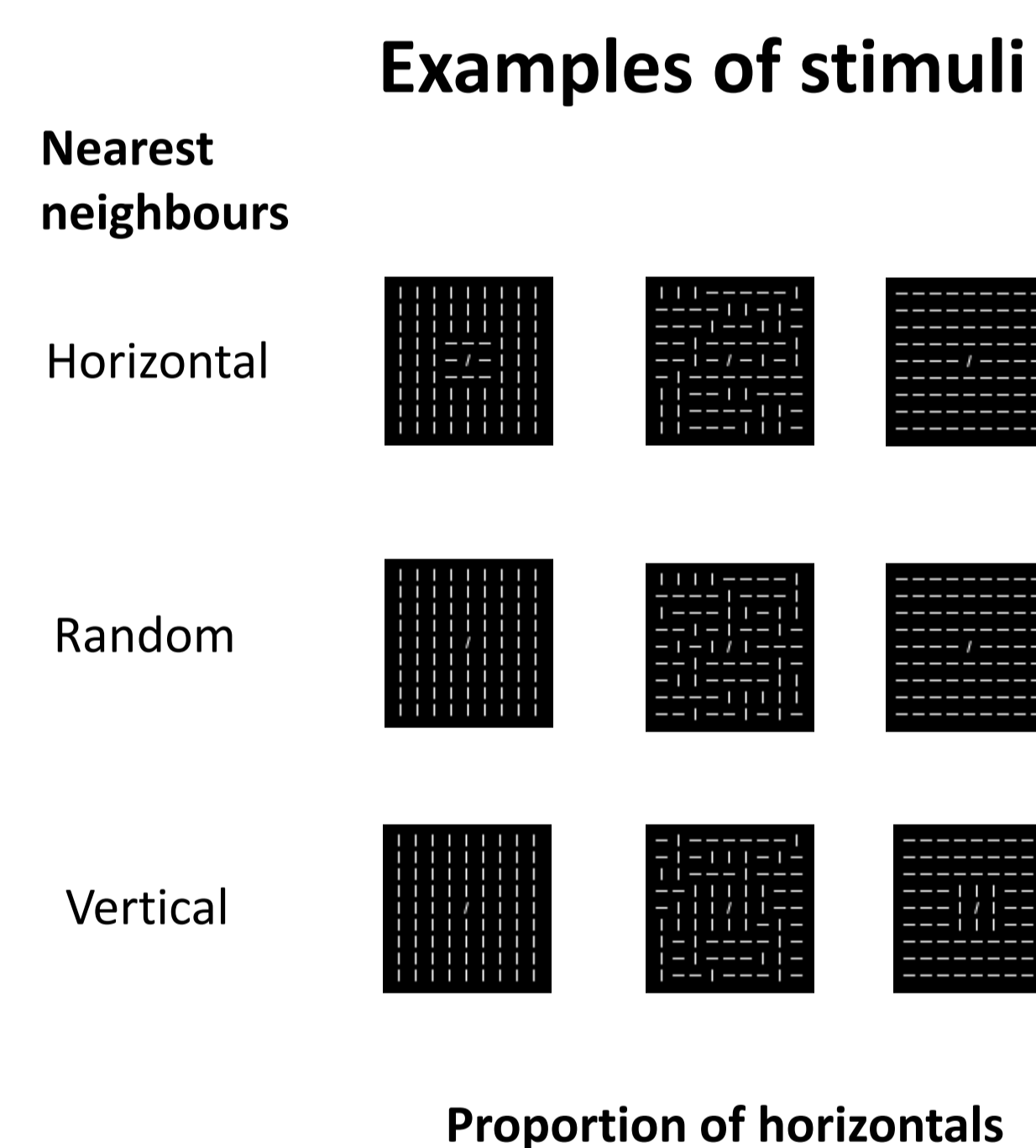


Combining saliency maps with crowding zones

Configurations of Gabors (Livne & Sagi, 2010)



Arrays of horizontal and vertical bars (Van der Burg et al, 2017)



Conclusion

Combining a saliency map with the traditional pooling model of crowding explains a large part of apparently puzzling results from previous studies.

References

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