A zero parameter quantitative prediction from the V1 Saliency Hypothesis and its match with experimental data

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Background: The V1 Saliency Hypothesis (Li 1999, 2002)
A bottom-up saliency map in the primary visual cortex

Physiological mechanisms:
The V1 Saliency Hypothesis

Understanding the hypothesis by a metaphor ---
A conventional psychological view
The V1 Hypothesis
Visual saliency
The neural field of the visual attention
A zero parameter quantitative prediction: an illustration from a toy V1

V1 responses are stochastic, so RT data is probabilistic:
In fact, V1 responses are stochastic, so RT data is probabilistic:
Therefore, we can predict a probability distribution $P_{RT}$:

A qualitative prediction, confirmed (Zhaoping, 2009, 2011)

A theoretical hypothesis that V1 creates a bottom-up saliency map:

Reference:
Li Z. (2002) A saliency map in primary visual cortex

A quantitative prediction from the actual V1
V1 did not have CO cells, so the above cannot be used to predict $P_{RT}(CO)$

Unfortunately, V1 has CO cells, so the above cannot be used to predict $P_{RT}(CO)$

Fortunately, V1 has no CMO cells, we can then analogously show that $P_{RT}(CMO) \sim P_{RT}(CO)$

Furthermore, V1 has CMO cells (Shipp, private communication 2011)

Our data are sufficient to distinguish incorrect predictions from data

Incorrect prediction 1: $RT_{CMO} = min (RT_C, RT_O, RT)$
Incorrect prediction 2: $RT_{CMO} = min (RT_C, RT_O, RT)$

Summary:
(1) A theoretical hypothesis that V1 creates a bottom-up saliency map can lead to a quantitative prediction of the RTs in visual search task without any free parameters.

(2) The prediction matches qualitatively to the behavioral data.

Reference:
Li Z. (2002) A saliency map in primary visual cortex

TICS, 6: 9-16
Zhaoping (2008)

Attention capture by eye of origin singletons even without awareness — a hallmark of a bottom-up saliency map in the primary visual cortex.

KOene AR and Zhaoping L. (2007) Feature-specific interactions in saliency from combined feature domains. Evidence for a bottom-up saliency map in VI.


Neural activities in V1 create a bottom-up saliency map.