

Visual Aftereffects Affected by Habitual Attention or Goal-driven Attention?

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Introduction

Habitual attention is bottom-up processing: people learn unconsciously from previous experience with certain stimuli. Goal-driven attention is top-down processing: people consciously guide their attention towards what/where they are interested in. These two spatial attentions have been intensively investigated by many researchers that both can affect performance on various visual tasks such as visual search and contrast sensitivity¹. But it is still unclear if they are two distinct systems that affect our perception or other levels of functioning differently. The previous study conducted in our lab shows that goal-driven attention facilitates working memory in a dual-task setting: the attentional advantage towards one location gained from a visual search task can enhance scene memory in the same location. But habitual attention cannot.

This study aims to understand how habitual attention and goal-driven attention can affect lower level of perception, visual aftereffects produced by Gabor patches in particular.

Material and Methods

Two condition groups:

- Habitual attention group: 11 subjects (10 females, 1 male, age from 18 to 24)
- Goal-driven attention group: 8 subjects (7 females, 1 male, age from 18 to 22)

The scripts were coded with Psychtoolbox in Matlab.

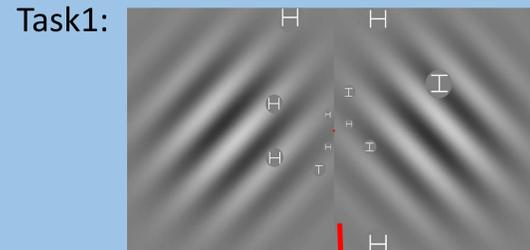
We use EyeLink1000 eye tracker to manipulate participants' eye movements. Because perception of Gabor patches is retinotopic, we require participants to fixate at the center of the screen so that the patches produce the best aftereffect. Trials in which participants made saccades were thrown out to ensure data validity.

Paradigm: 20 trials X 20 blocks

- Task1: Search for the T among Hs.
To induce attention towards certain side of the visual field and produce the aftereffects on both sides.
- Task2: detect a low-contrast Gabor patch on either side of the screen; Gabor locations (L/R) and tilt orientations (different/same) randomly selected (4 kinds of possible displays).

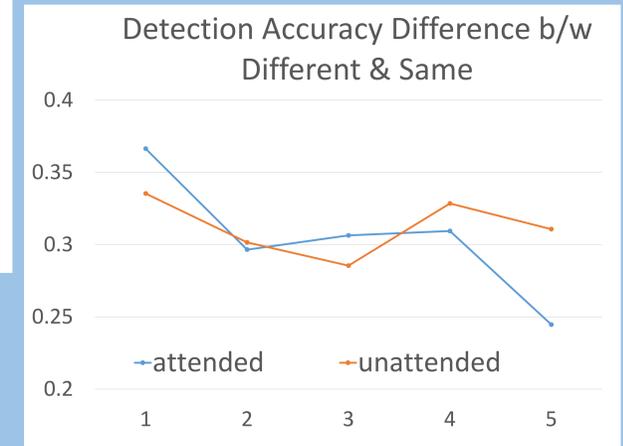
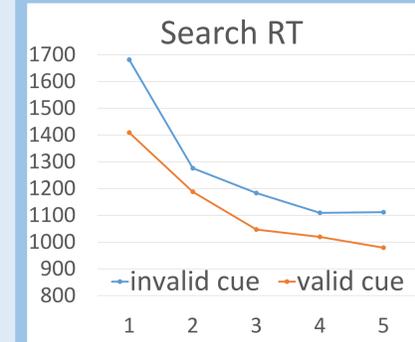
Exp1. Habitual attention: randomly select a visual field to have the target T on 60% of the trials; participants unconsciously react faster when the T appears in the higher probability visual field.

Exp2. Goal-driven attention: randomly select a visual field to have the target T on 80% of the trials; participants are instructed directly to search the target-rich visual field first.

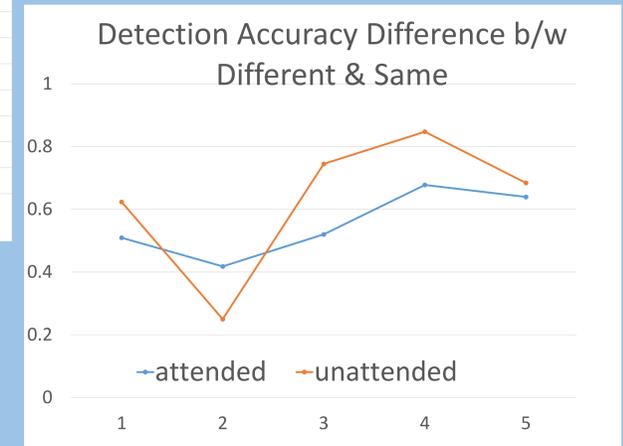
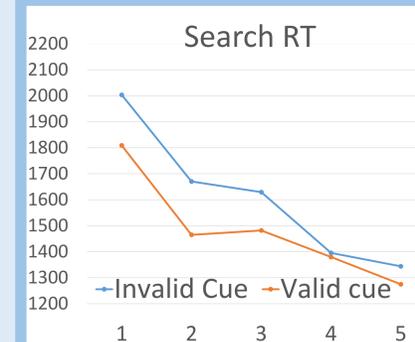


Results

Exp1. Habitual attention:



Exp2. Goal-driven attention:



Discussion

No effect is observed in both conditions, although previous research separately found significant effects of habitual attention and goal-driven attention on some sort of visual aftereffects^{2,3}. By looking at the detection data and the searching data closely, we know that the visual aftereffects worked well, but searching reaction time did not differ much especially in the goal-driven attention condition. As a result, the attentional advantage could wear off. Since we haven't finished testing, the goal is to emphasize more on the instructions to improve searching habit. Another possible reason why our experiment failed to produce significant effects could be that under this paradigm, the attentional advantage produced by searching indeed cannot transfer to the perception part.

Reference:

1. Cutrone, E. K., Heeger, D. J., & Carrasco, M. (2014).
2. Shulman, G. L. (1992).
3. Pascucci, D., & Turatto, M. (2013).

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