Perception of depth and asynchrony during eye movements

Reiko Aruga[1)], Hideo Saito[1)], Hideyuki Ando[2)], Junji Watanabe[3)]

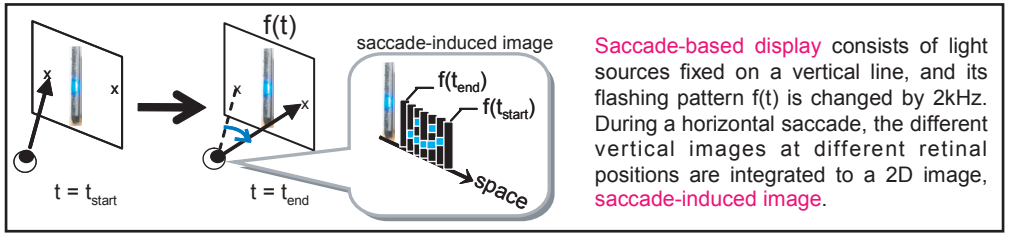
[1)]Graduate School of Science and Technology, Keio Univ. [2)] Graduate School of Information Science and Technology, Osaka Univ.

[3)] Japan Society for the Promotion of Science / NTT Communication Science Laboratories

Introduction

We investigate the perceptions of two-dimensional(2D) images painted on the retina during eye movements (saccade-induced images).

- The images were presented using "Saccade-based display". (See below)
- Saccade-induced images are: - painted sequentially.
  - only on the retina.

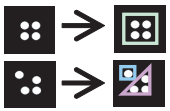


Saccade-based display consists of light sources fixed on a vertical line, and its flashing pattern f(t) is changed by 2kHz. During a horizontal saccade, the different vertical images at different retinal positions are integrated to a 2D image, saccade-induced image.

How are the saccade-induced images arranged in space and time?

☞ We found that:

1. The spatially separated elements could be grouped even during saccades.



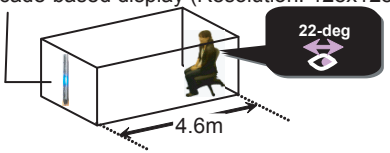
2. The different perceptual groups could be arranged (a) on different depth planes, and (b) at different timings.

(a) Depth perception (b) Asynchronous perception

Method

-Apparatus

Saccade-based display (Resolution: 128x128 dots)



(In a completely dark room)

-Procedure

- Sketched the perceived groups.
- Evaluated the magnitude of perceived depth (DP) and asynchrony (AS).

DP: The number of perceived depth planes

AS: 2 (All circles are clearly asynchronous)
1 (Some circles are not simultaneous)
0 (All circles are simultaneous)

-Visual Stimuli

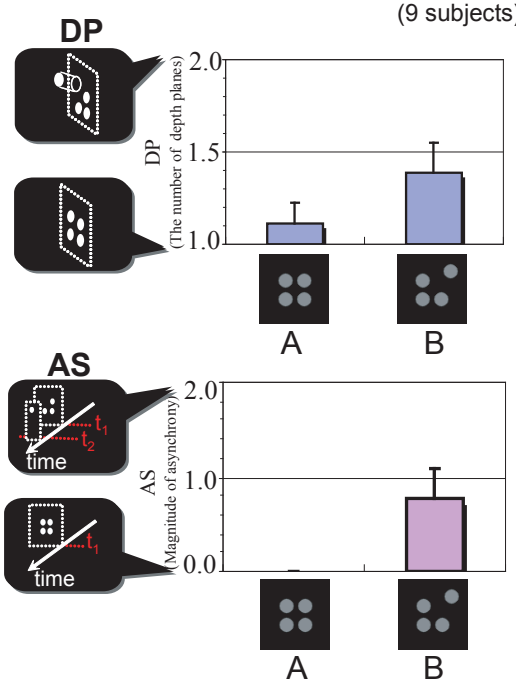
Exp.1 Circles are grouped based on proximity.

Exp.2 Circles are grouped based on closure.

Result

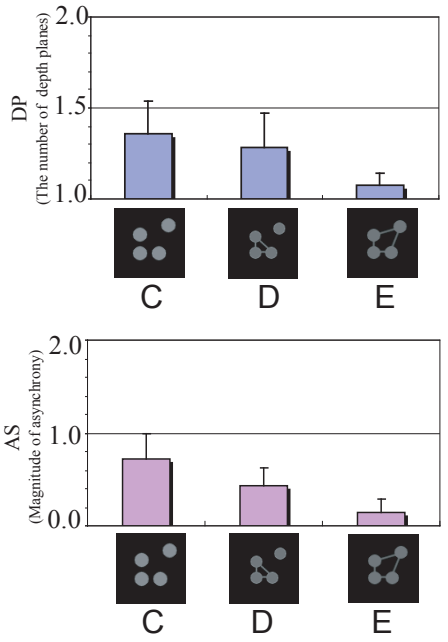
Mean and standard error of reported DP and AS.

Exp.1 Grouping by proximity (9 subjects)



- Asymmetric image B tends to be perceived on multiple depth planes and at multiple timings, depending on the perceptual grouping.

Exp.2 Grouping by closure (7 subjects)



- The interpretation of spatio-temporal arrangements could follow the cognitive grouping.

Discussion

1. When the conditions allow the saccade-induced image to be clearly visible, the spatio-temporal arrangement can be perceived during saccades.
2. The perceptual grouping during saccades can influence the reconstructed spatio-temporal arrangement of saccade-induced images.

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