

Visual Search on Small Display Area by Scrolling or Moving Windows

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INTRODUCTION

Search for the necessary information with mobile information terminals has visual peculiarity caused by:

A. searching for information on a small display

- Peripheral visual field is completely unavailable.

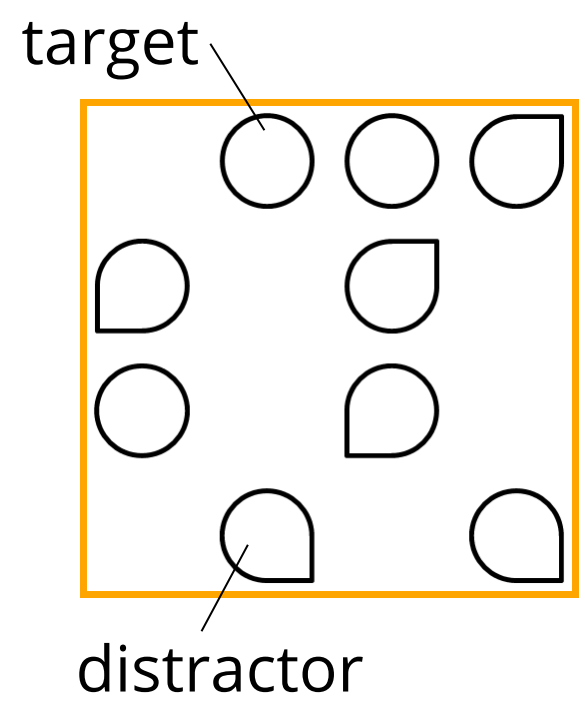
B. seeing by scrolling

- Visible clips of the images are overwritten on the display one after another.
- Coordinates of the visual image relative to the fixation point change with scrolling.

→ **Purpose** : What kind of effects do these factors have on visual search and visual perception?

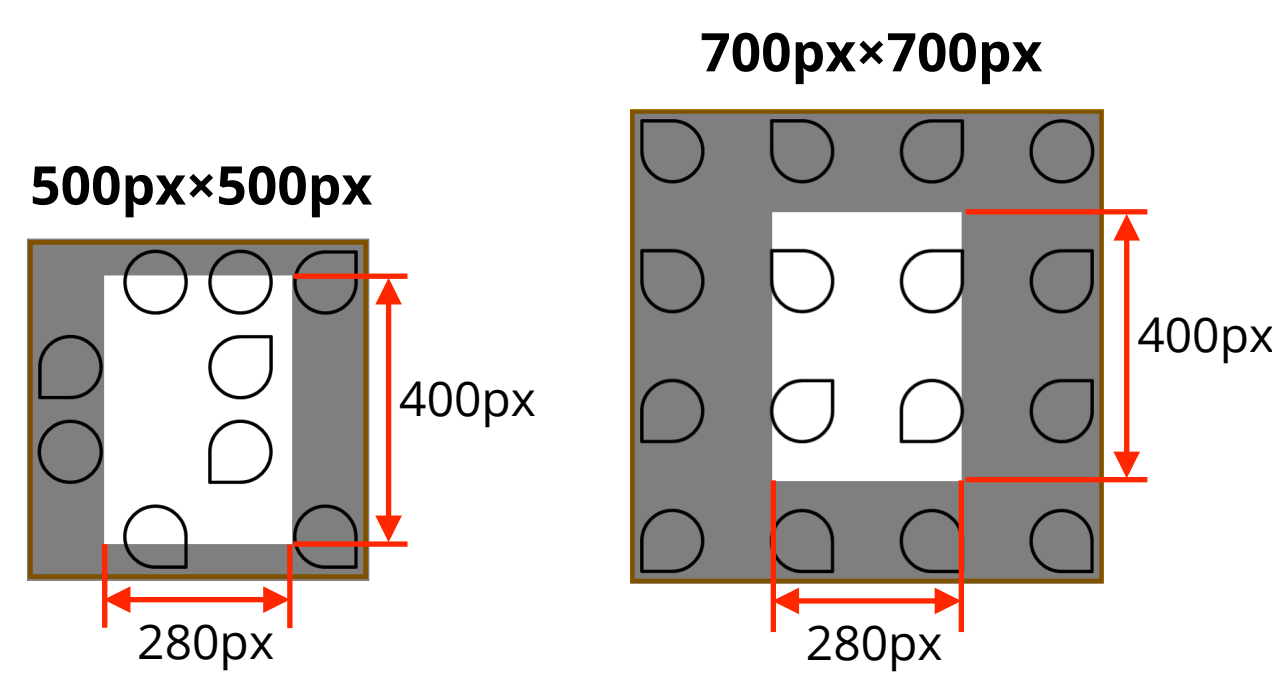
METHOD

Participants count the number of circles among drops.



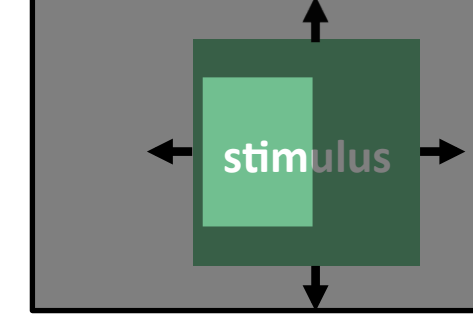
Stimulus

size : 500px×500px or 700px×700px
number of items : 4, 9, or 16
number of targets : 0, 1, 2, 3, or 4



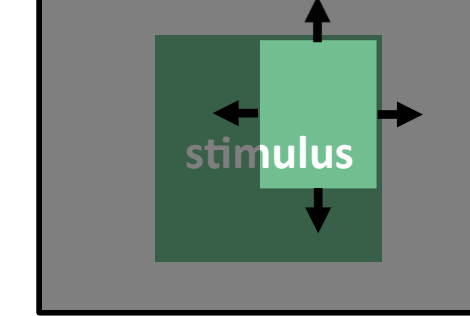
Condition

Image-Scroll



Visual peculiarity
A+B

Window-Move



Visual peculiarity
A

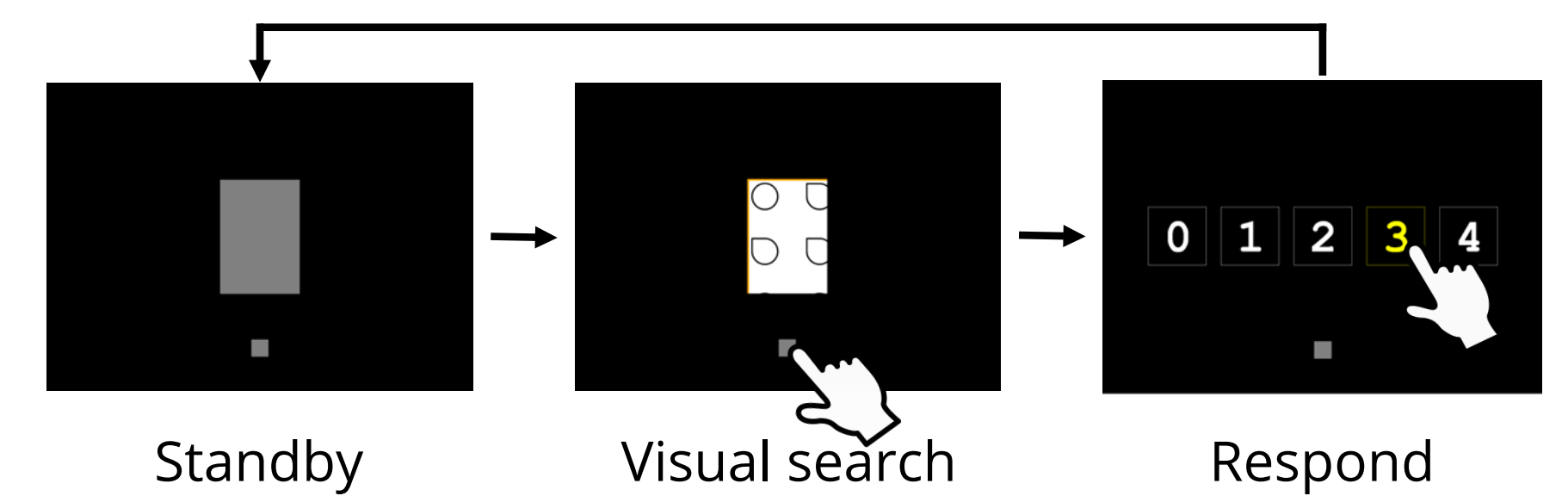
Control



Visual peculiarity
non

Procedure

Each participant performed 1 block (30 trials) per condition.

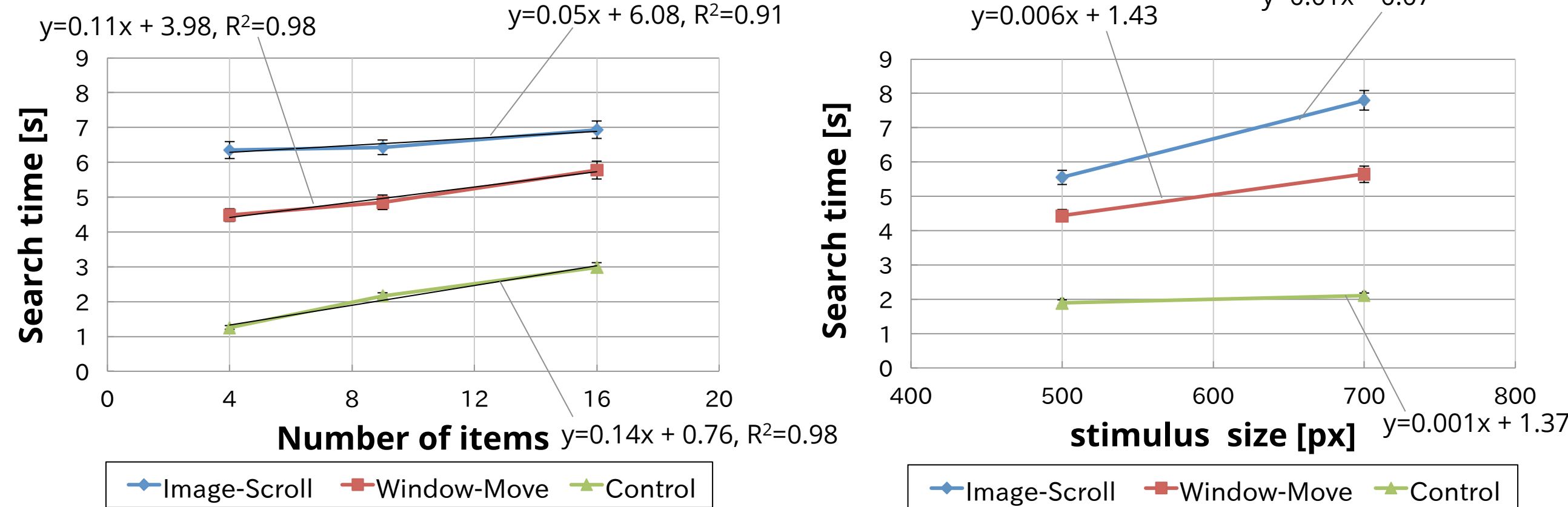


RESULTS

Participants 25 students with normal or corrected vision.

※ Error bars show the standard error.

1. Search time



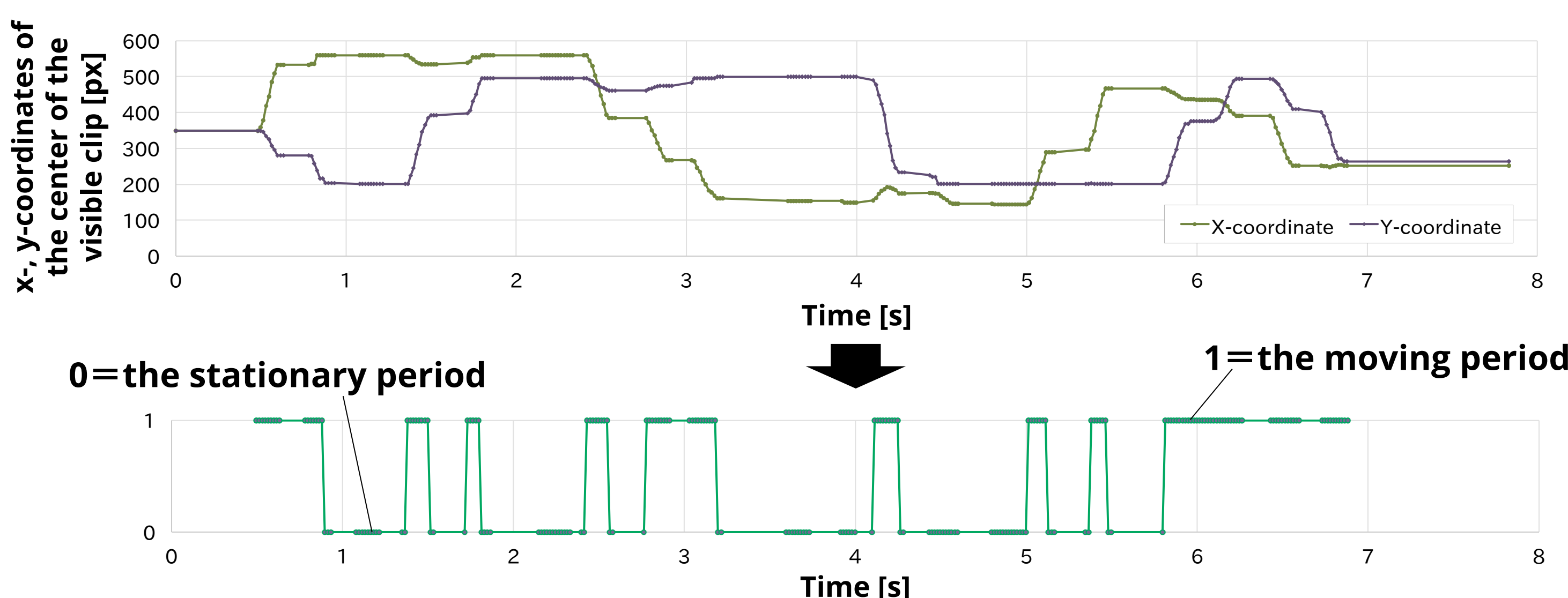
2. Scanning path

We investigated the scanning path of 10 participants to trace how they search.

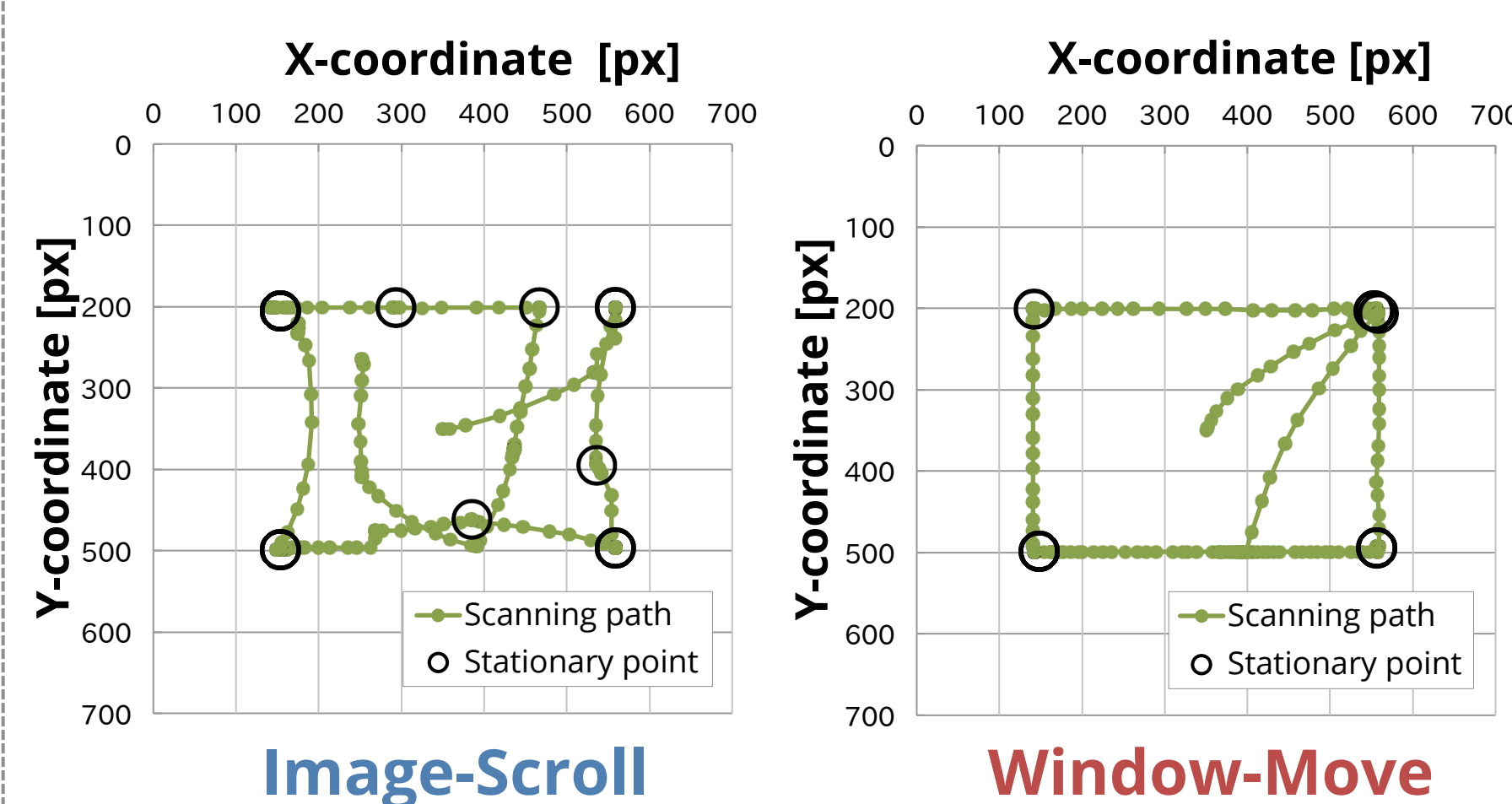
We discriminated the stationary period from the moving period on the basis of the x-, y-coordinates of the center of the visible clip of the search array.

How to discriminate between the stationary period and the moving period?:

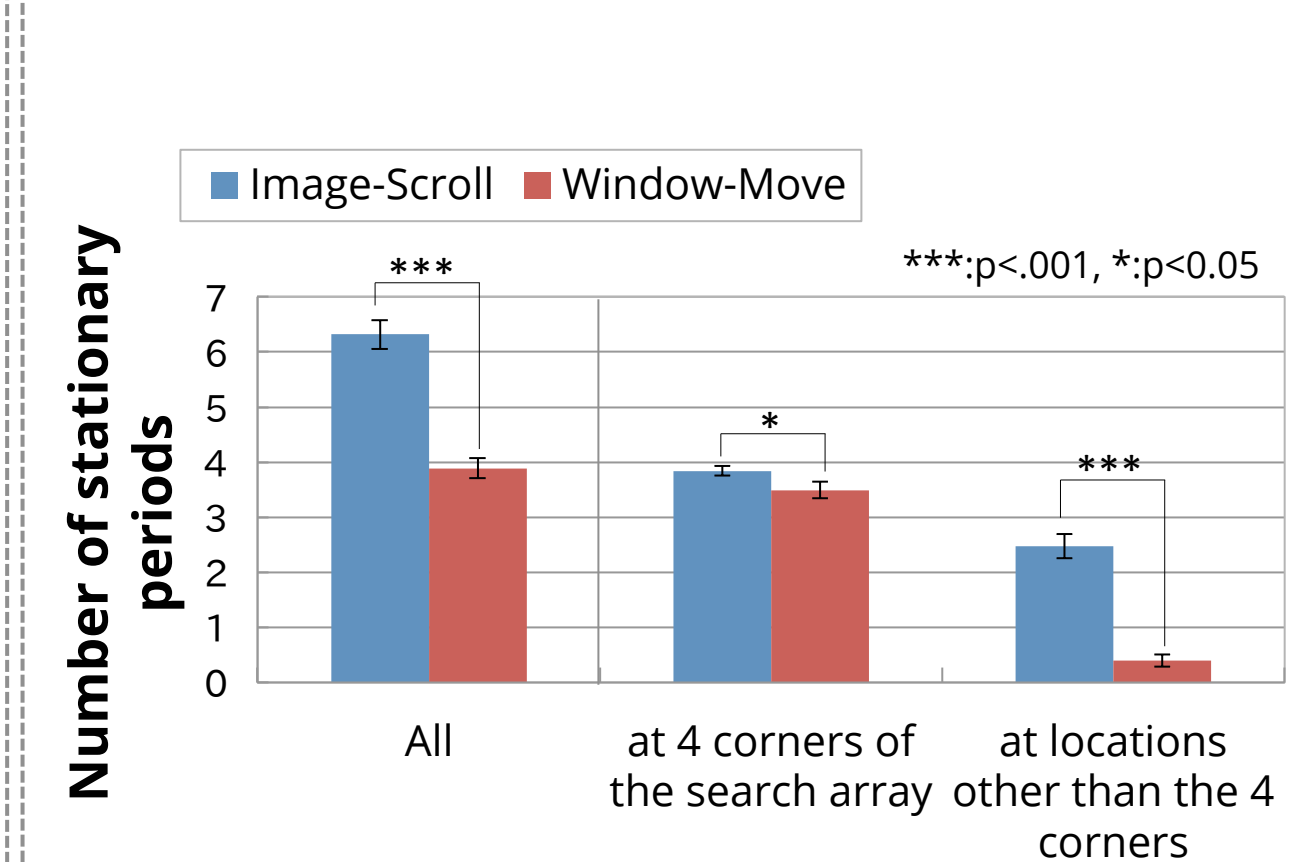
- ① If the difference between two consecutive samples is larger than 4.68 px, in other words the movement exceeds 280 px/s in speed, it is considered to be **moving**. The remaining periods are considered to be **stationary**.
- ② If the total distance of movements of a series of samples in a moving period does not reach 70 px, the period is reconsidered to be **stationary**.
- ③ If the summation of the intervals of a series of samples in a stationary period is less than 200 ms, the period is reconsidered to be **moving**.



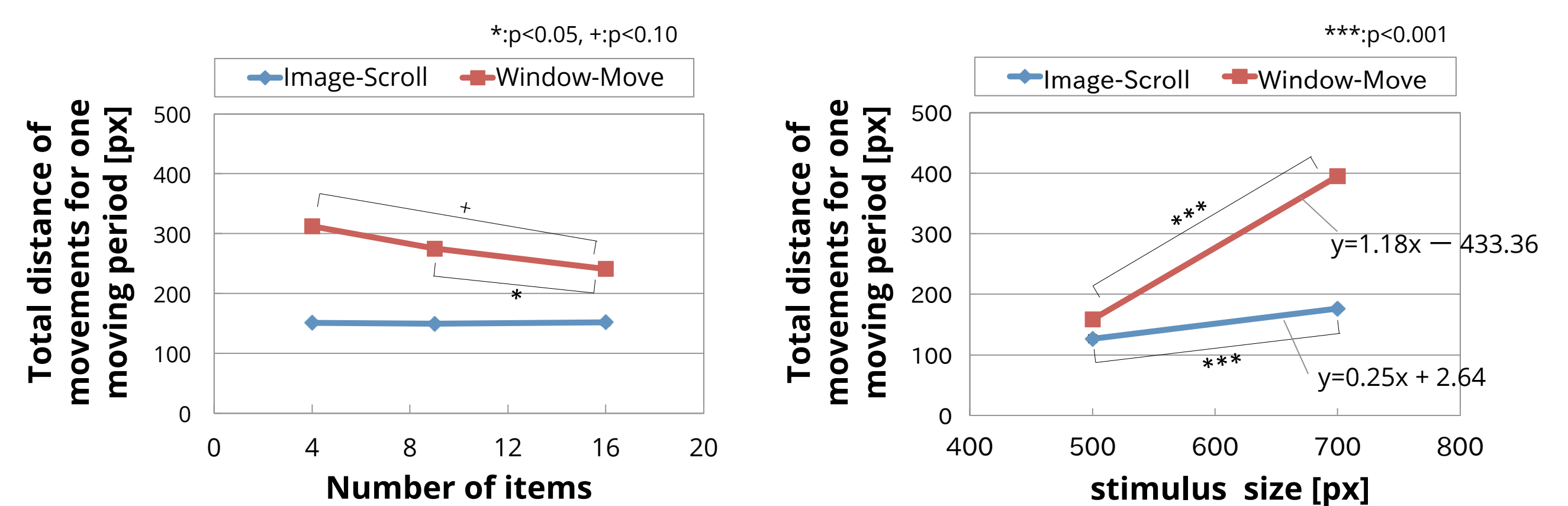
2-1. Scanning path of one participant (700px×700px, 16 items, 3 targets)



2-2. Number of stationary periods

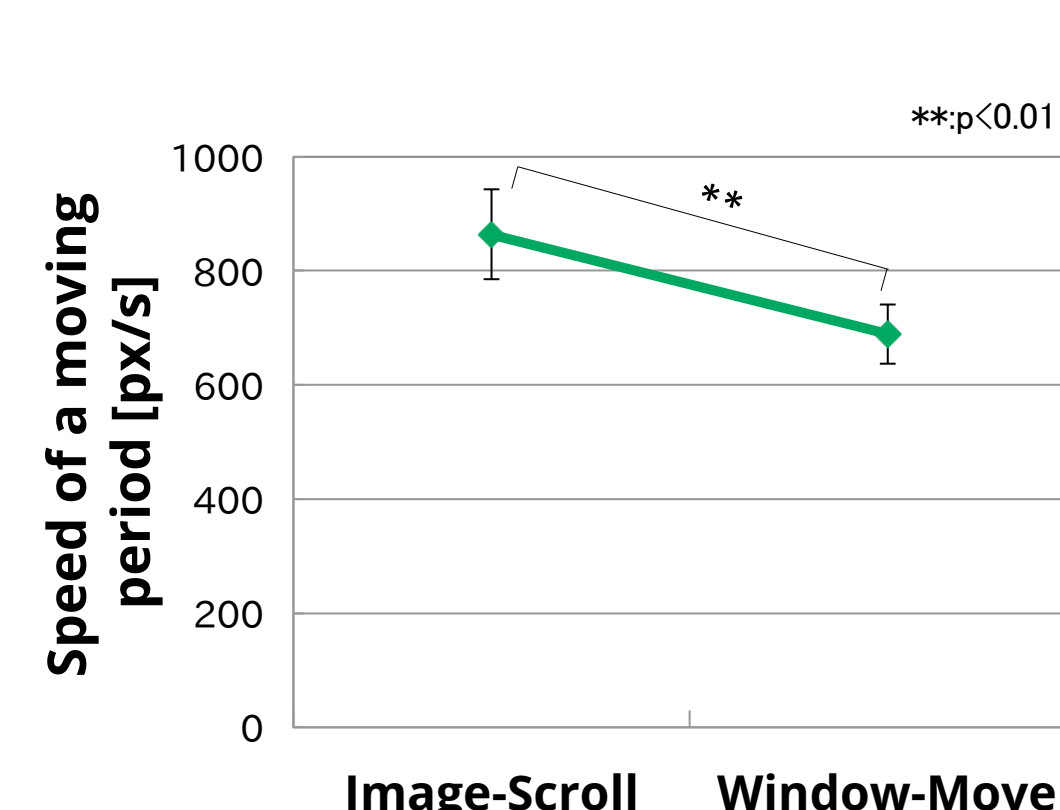


2-3. Total distance of movements for one moving period

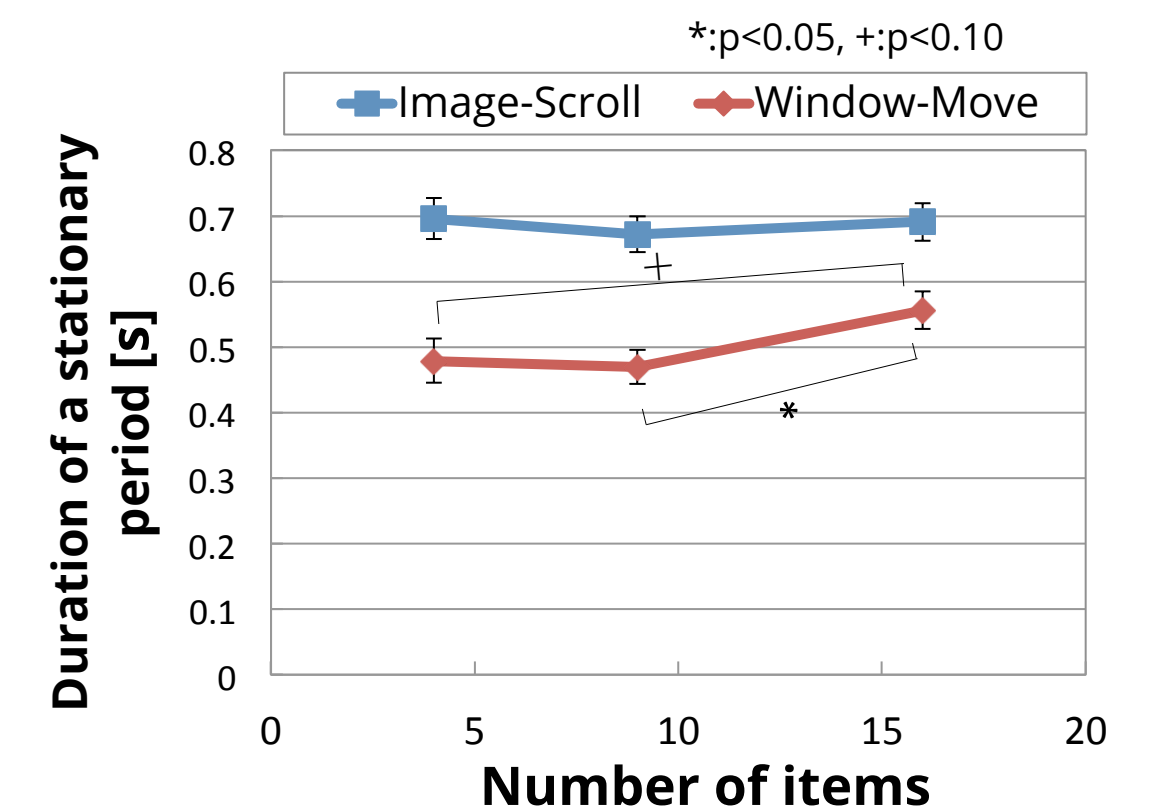


○The main effect of condition is significant ($p < 0.001$).

2-4. Average speed of a moving period



2-5. Duration of a stationary period



○The main effect of condition is significant ($p < 0.001$).

DISCUSSION

The search time is longer for Image-Scroll condition and Window-Move condition than for control condition. The slope of the search function is shallower for Image-Scroll condition than for Window-Move condition.

In the Image-Scroll condition, the viewers move arrays at a **higher speed** and **stop at a constant distance** where they **spend a longer time**. As a result the search time is affected by the size of the search array but scarcely affected by the number of the items.

In the Window-Move condition, the viewers move the window **more slowly** searching for the targets and **only stop at the four corners**.

CONCLUSION

A. The factor of small display area affects the search time, because the visual input from periphery is cut off and we must scroll or move the window to see it.

B. The factor of moving stimuli and overwriting of the clips in the fixed area affect the search function, because we cannot see the image moving fast and it's difficult to integrate clips of the image in to the whole image.