

Development of perspective controlled display using an eye gaze point detector

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1

Introduction

Strange perspective method of Katsushika Hokusai



Vanishing point
The projection of parallel lines converges toward one common vanishing point.



"36 Views of Mount Fuji"

Katsushika Hokusai
(葛飾北斎, 1760–1849)
Ukiyo-e painter of the Edo period.

Strange perspective method of Hayao Miyazaki



"Spirited away", 2001

"Parallel lines don't converge toward one point in our perception. Vanishing points are located in a circle"



Hayao Miyazaki
(宮崎駿, 1941-)
Manga artist, film director, and animator

植草信和(編)(2001).『千と千尋の神隠しを読む40の目』株式会社キネマ旬報社

2

Previous study

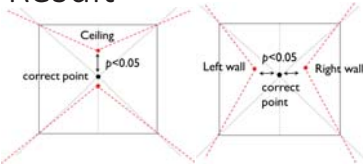


4 perceived vanishing points;

1. the ceiling,
2. the floor,
3. the right wall,
4. the left wall.

Participants : 10 students (aged 19-21 years)

Result



There was difference between perceived vanishing points and the correct vanishing point in its perspective image.

➡ The locations of vanishing points in Hokusai's picture are similar to results of our experiment.

A clue to understand the Hokusai's strange perspective

3

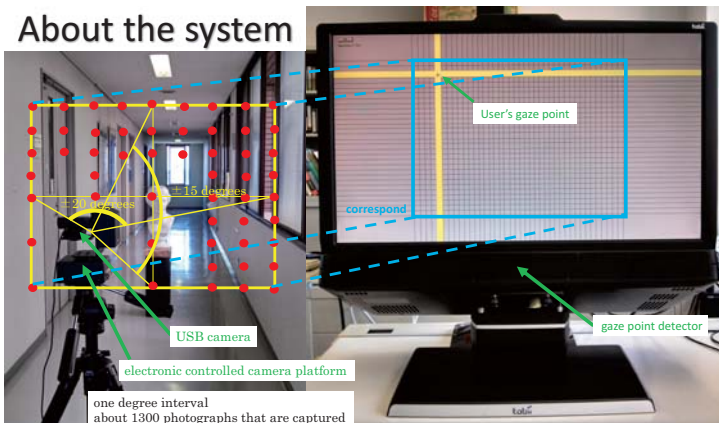
Our vision system reconstructs space from 2-dimensional images on the retina with moving gaze point all the time, but photographs always show one view in each scene in spite of viewer's gaze point.

Generally, reality of photographs or moving pictures is improved by increasing its screen size or resolution, but it isn't progress to investigate for improving the sense of reality in 2-D display device.

Purpose

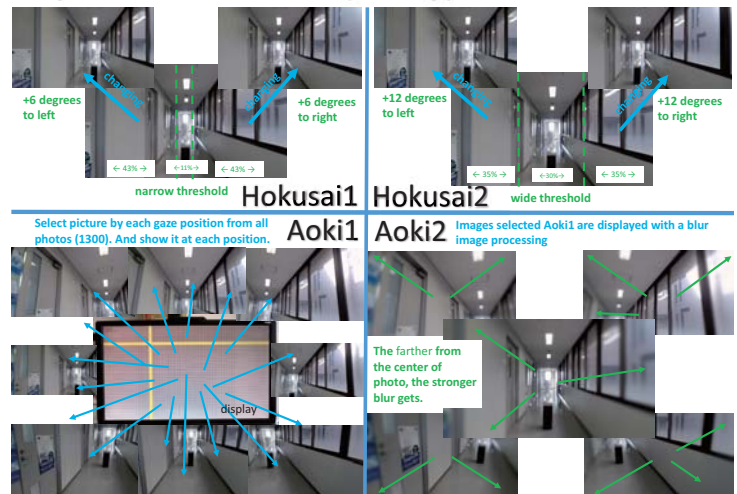
- Make a perspective-controlled display using an eye gaze point detector
- Reveal the effect of the display

About the system



This research developed a system that displays different perspective images according to viewer's gaze point. The system is composed by a personal computer and eye tracking device. And, this uses image series which are captured by a USB camera and an electronic controlled camera platform. The image series are about 1200 photographs that are captured from a fixed view point to various directions, ± 15 degrees (angles of elevation and depression), ± 20 degrees (left to right), one degree interval. The system detects user's eye gaze position on PC monitor, and an image is selected from the image sets according to the gaze point.

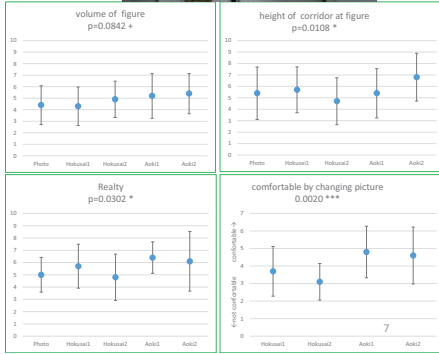
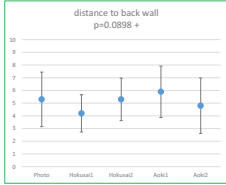
Experiment method (4 way)



Evaluation points

- volume of back wall
- width of back wall
- height of back wall
- distance to back wall +
- volume of figure +
- height of figure
- plasticity (3D) of figure
- width of corridor at figure
- height of corridor at figure *
- whole 3D
- extent of space
- reality *
- comfortable by changing picture***

Doing experiment →



Conclusion

- We were able to make a perspective-controlled display using an eye gaze point detector
- The way using many photos is more comfortable when changing picture by less one.
- This system may represent better performance than ordinary photographs in senses of volume at the figure (distance about 4m from user) , reality and distance to back wall (about 21m)
- This system is unlikely to represent better performance than ordinary photographs in senses of volume at the back wall (distance about 21m from user)