# Selective Un-Presentation to Specific User by Detecting Eye Gaze

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## Abstract
Selective presentation of information to a specific user is one of main display research topics, while selective un-presentation was not fully explored. We focused on the selective un-presentation by detecting his/her eye gaze. To verify the method, we used a morphing image as an example of changing image. The result showed that it is possible to un-present information to the user whose eye gaze is tracked. We also made a prototype installation of clocks whose second hands stop when being looked at.

## Author Keywords
Eye tracking; information un-presentation; morphing movie; peripheral vision; visual one-shot leaning

## ACM Classification Keywords
H5.2. Information interfaces and presentation: User Interfaces – *Input devices*

## Introduction
Selective presentation of information to a specific user is one category of visual display research. It can be used for secure password input [1] or for enabling multi-user concurrent viewing [2] [3], and most of them are based on stereoscopic display technologies.

On the other hand, selective un-presentation of information to a specific user was not fully explored. It enables, for instance, a multi-user entertainment system in which a specific user cannot watch an important cue and others support him/her (similar to watermelon cracking or piñata) (Figure 1).

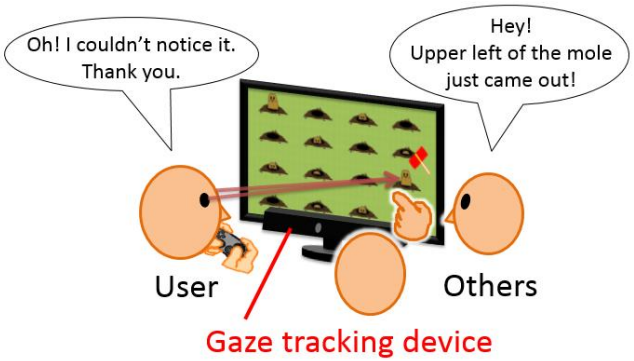


**Figure 1.** One of contents of selective un-presentation.

This paper aims to achieve this selective un-presentation without wearing devices. Our idea is to use eye tracking. It is well-known that peripheral vision has lower spatial resolution especially in color vision. If the information is presented only when the specific individual do not gaze at the information, selective un-presentation can be achieved.

## Experiment

We verified whether selective un-presentation is possible by using eye gaze. We used a morphing image as an example of changing image [4] (Figure 2), and asked users to detect the change. Chin rest was installed 70 cm in front of the 24 inch display to fix the head position. The display and participant were covered with a blackout curtain to prevent reflection.

**Figure 2.** A morphing movie used in experiment.

*Condition and procedure*

We prepared two morphing conditions. In one condition, the color of horse cloak was changed from black to red, and then returned to black 3 seconds for each as shown in Figure 2 (BLKRD condition). In the other condition, the color changed from red to blue while the brightness was kept constant (RDBLE condition). These changes were repeated until the participants noticed and pressed enter key.

We prepared two eye conditions. In one condition (ON), the change stopped when the gaze was inside 100mm outer area of the change area. In the other condition, the eye information was not used (OFF).

In each condition, total changing time (from red to black, black to red, and from red to blue, blue to red) was counted. Five novice participants were recruited for each condition, 20 participated in total.

*Result and discussion*

The result is shown in Table 1. A Poisson regression analysis was performed on counts data, and significant

increase of counts were observed when the eye measurement was used, and marginally significant increase was observed in RDBLE condition, which is presumably due to the fact that peripheral vision has low color vision.

| | | BLKRD | RDBLE |
|---|---|---|---|
| Eye tracking | OFF | 26 | 26 |
| | ON | 73 | 98 |

**Table 1.** Total changing time for each condition.

## Application

As an application for the selective un-information, we created an installation that is inspired by an illusion called Chronostasis [5]. When observers suddenly look at a second hand of a clock, it sometimes appears to be stopped for a long time. It occurs because the brain interpolate the perception during saccadic eye movement. This illusion gives people uneasiness, because they know that the clock counts periodically, but they observe that it doesn't. The purpose of the installation is to give this type of uneasiness. We made a prototype installation of clocks whose second hands actually stop when being looked at (Figure 3).

**Figure 3.** View of the intentionally Chronostasis.

## Evaluation

We conducted a preliminary evaluation to see whether participants are not able to notice the movements of second hands. Distance between each clock was more than 50mm. After watching 10 seconds, the participants were asked when they notice that the clocks are not still image but actually moving, from the following choices. 1. Noticed immediately, 2. Noticed in the middle of the experiment, 3. Noticed that just before the end of the experiment, 4. Did not notice. 13 novice participants participated in this evaluation.

As a result, seven out of 13 participants noticed immediately, three noticed in the middle and three noticed just before the end of the experiment.

Although the setup has much to improve including the number of clocks and the distance between clocks and the brightness of second hands, about half participants did not recognize the second hand movements, suggesting use of the technique for installation.

## Future impact

By applying this system, we can create a multi-user entertainment game mentioned in Figure 1. This system also allows to adjust the level between a skilled user and novice one by adjusting the difficulty of the game for each by utilizing our system.

## Conclusion

We proposed un-presentation of information to specific user using eye-tracking, utilizing the fact that the peripheral vision has low spatial acuity. The result of the experiment showed that we can separately un-present information to the user whose eye gaze is tracked.

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