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GazeSync: Eye Movement Transfer Using an Optical Eye Tracker and Monochrome Liquid Crystal Displays

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Abstract: We present an early work to transfer eye gaze from one person to another. In this work, we explore the possibility to transmit eye-gaze information in a subtle, unobtrusive fashion between two individuals. We present an early prototype consisting of an optical eye-tracker for the leader who offers gaze information, and two monochrome see-through displays for the follower.

Keywords: gaze detection, gaze synchronization, eye tracking

1. Introduction

The white (sclera) in our eyes is more prominent compared to primates or other animals, enabling us to communicate and recognize gaze more efficiently [1]. We often rely on gaze information in social situations, from learning over coordination to guessing intentions [2]. Yet, estimating the gaze of a person from just their eye position is difficult, especially when we are engaging in an unfamiliar task. Have you ever imagined seeing the world from another perspective or the eyes of somebody else? In our research, we aim at augmenting the social components of eye gaze and searching for ways of sharing, transferring, and extending gaze information.

2. Initial Test

As an initial usability test, we recruit two male graduate students to test our gaze synchronization glasses, one of them assigned as the leader, the other as a follower. The leader wore a Pupil Core to obtain the data of his gaze movements. Meanwhile, the follower wears our customized Pupil Core with two transparent monochrome LCD attached on the Pupil Core frame as the lenses, in which we displayed a peripheral-black but center-transparent pattern, for both left and right lenses.

We take two steps to test the synchronization. In the first step, the experimenter gives directional signs in Japanese to the leader, *e.g.,* slowly moving your gaze up, down, left, or right and back to the center. Both the leader and the follower could not see each other so that the follower does not have access to the leader's gaze directly. As the step two, to test their synchronization performance over natural gaze patterns, we ask the leader to move his eye freely and observe the corresponding eye movements of the follower.

3. Insights and Discussion

According to the observational result and the oral feedback from the follower, if the movement of the transparent circle (corresponding to the leader's eye movement) is too fast, the follower was not able to chase it. On the other hand, if the speed of the movement is moderate and smooth, it is relatively easy for him to follow the transparent region. Besides, this current prototype is somewhat heavier than ordinary glasses and its design did not distribute well the pressure on his nose. Also, we observed an obvious delay between the leader and the follower despite the devices being controlled over the RS-232 link via USB cables. Besides, to generate a virtual surface as the x and y coordinate plane, this current prototype requires a front camera which is somewhat sensitive regarding privacy when using it in public space.

4. Conclusion and Future Works

To the best of our knowledge, we introduced the first real-time gaze synchronization device. We expect that to leverage this device with the visual clues we can better react to the auditory information or vice versa in terms of both online and offline learning, teaching, and co-working scenarios. For future works, since this current initial test could not clarify whether the gaze following movements of the follower is active or passive, we will conduct a different study that covers voluntary smooth pursuit and involuntary subtle gaze guiding. Nevertheless, based on the feedback and visual observations, our device is performing reasonably well and does allow a certain level of eye movement synchronization. In the future, we will work on reducing the system latency and evaluate the synchronization levels in a more quantifiable way.

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