

Improvement of aquatic display system and preliminary behavioral experiments of fish toward VR Biology

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Aquatic display optical system has been improved to avoid distortion of images due to disturbances at the interface. The developed aquatic display was utilized for preliminary behavioral experiment of a medaka using a light grid on the wall. We have developed the world's first aquatic display that forms images underwater by use of aerial imaging by retro-reflection (AIRR). Taking advantage of the aquatic display, we are considering the use of this display instead of conventional displays for VR biology experiments, where fish behavioral experiments are conducted using visual stimuli and virtual reality environments are constructed for the experiments.

There are two problems that be caused when conventional displays are placed underwater. One problem is that the display is disturbed by water flow. The aquatic display does not require hardware to be installed at the location where the image is presented. Moreover, we have succeeded in eliminating distortion of the presented images by placing the optical components of the AIRR, the beam splitter and retro-reflector. Therefore, it is possible to present stimuli using only pure optical information as experimental cues without disturbing the flow of water. Another problem is that the display limits the observational area, making it impossible to take a photograph of fish facing the display from the front. To solve of this problem, by using polarization modulation and installing a camera on the optical pass of optical see-through AIRR, we realized an optical system that can capture the behavior of fish from the front while presenting aquatic display as visual stimuli. This system enables the entire surface of the water tank to be surrounded by the image while capturing the fish's behavior.

In addition to these fundamental researches, we also propose the application of aquatic display to the aquarium or aquaculture. We are conducting a behavioral experiment of a small fish using a light grid on the wall.



Short biography:

Ryosuke Ichikawa is a senior undergraduate student in the Department of Fundamental Engineering, Faculty of Engineering, Utsunomiya University. He will plan to enter Master's Course in Graduate School of Regional Development and Creativity at Utsunomiya University in 2024. His research interest includes an aquatic display using aerial imaging by retro-reflection (AIRR).