Human interface, Design, Usability

Human factors research on visual information presentation using augmented reality

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Abstract

Visual information presentation using artificial reality (AR), in which artificially generated images are superimposed in the real world, is becoming widely used as a visual interface for various tasks. On the other hand, how the use of such information presentation relates to users' attention and cognition has not been fully investigated. In this study, we proposed a monocular presentation method in which an artificially generated image is presented to a single eye and a method in which the presentation of visual information follows the position of the work object and investigated the user's attention and cognition when these methods are used, using cognitive psychology experimental techniques.

Background & Results

Visual information presentation using augmented reality (AR) is expected to expand its range of applications to a wide variety of tasks. It is necessary for users to improve AR presentation methods to better match human characteristics. In addition, future technological developments may lead to the appearance of new presentation methods that did not exist in the past, which may cause human factors problems. This is a research issue where engineering technology development and research on user behavior and psychological characteristics should work closely together.

Visual information presentation using augmented reality (AR) is expected to expand its range of applications to a wide variety of tasks. It is necessary to improve visual AR presentation methods that are compatible with human characteristics and improve visual information presentation to make it easier for users to use. In addition, future technological developments may lead to the emergence of new presentation methods that have not existed in the past, which may cause problems related to the human factor of the user. This is a research subject where engineering technology development and research on user behavior and psychological characteristics should work closely together.

Significance of the research and Future perspective

Visual augmented reality (AR) information presentation, in which artificial images are superimposed on top of the real space using a heads-up display or similar device and made simultaneously visible, can efficiently present a variety of visual information to users without requiring them to make large eye movements. On the other hand, there is a possibility that artificial images may be difficult to see because they are presented at a different distance from the real space, or that artificial images may interfere with the visual perception required in the real space.

As a solution to this problem, a method was proposed in which artificial images are presented only to a single eye (Fig.1). It was expected that the monocular presentation would reduce the unnaturalness of the artificial images during viewing by blurring the perceived distance of the artificial images, and that the artificial images would not be presented to one eye, thus reducing the possibility that the artificial images would interfere with the perception of real space. An experimental system (Fig.2) combining a semi-transparent mirror and a polarization filter was created to realize monocular presentation in augmented reality, and experiments comparing binocular and monocular presentation showed that performance on a task was higher when monocular presentation was used. In addition, a study using the "change oversight" task, which is often used as an experimental test of visual selective attention in cognitive psychology, showed that change oversight did not occur when a monocular presentation was used. In addition, an investigation using electroencephalography (EEG) measurements was conducted to determine the perceptual and cognitive mechanisms underlying the significance of monocular presentation (Fig.3), and it was shown that monocular presentation may attenuate information processing in the cognitive stage.

In AR information presentation, the presentation position of artificial images also affects work efficiency. In particular, it is desirable for information to be presented close to the work object in real space in work situations where the user proceeds with the work in real space while referring to the necessary information. In an experiment using a visual search task to find a specified object, we found that when the information on the object to be searched was allowed to move freely within the search space, the task performance was higher, and the mental strain was rated lower than in the condition where the information on the object to be searched was always displayed in the same place.

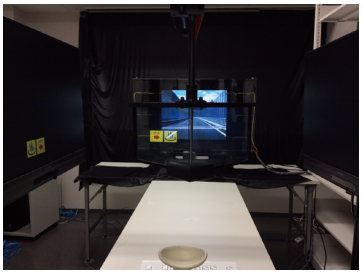

Fig.1 Monocular AR information presentation

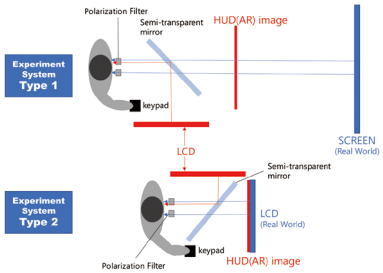

Fig.2 Experiment system

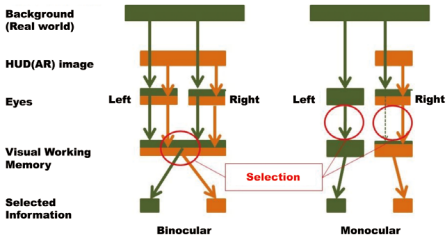

Fig.3 Hypothetical model of cognitive process when using binocular or monocular AR presentation

Patent

Treatise
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Keyword artificial reality, information display, attention, cognitive psychology, human factors