A Study of Notification Media for Physical Interaction in Telepresence Robot Environment

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In cooperative work, users need to share a variety of information. We focus on cooperative work involving movement in the space like drama, dance, sports, and so on. These kinds of collaborative work require users to move around to share their actions and positional information during the task. We aim to improve real-world physical remote collaboration by notifying the users with the non-visual stimuli like audio and vibration in a telepresence robot environment.

Recent researches have discussed the effectiveness of visual support, but the users does not move from their fixed positions. There is a gap in representing remote users while allowing them to move freely in the same workplace. Besides the support of the visual stimulation, studies have reported that the effectiveness of the non-visual notification for cooperative work. It includes the auditory, tactile, electric, and so on. The non-visual stimulation can make an impact on the physical interaction of the user. However, little is known about how the non-visual stimulation effects physical interaction in remote collaboration.

We build a system to support the remote collaboration in this paper, and there are two parts in the proposed system. The first part is the telepresence robot environment, which allows the user to move around in the remote workplace and see the partner in real-time through an HMD. The second part is a non-visual notification media, which includes auditory notification and tactile notification. We investigate how the user's physical interaction changed in these kinds of notification media in remote collaboration.

As an example of cooperative behavior in the remote collaboration with spatial movement, we conduct experiment with passing each other in a remote work environment. We design two experiments in this paper to verify how the approaches effect user's behavior in the remote collaboration. The first experiment is conducted to investigate the visual support in remote cooperative work, in which the users walks and watches the partners as a human partner or a robot partner through the telepresence robot system. In the second study, we conduct two types of non-visual notification, auditory notification and tactile notification. Participants are asked to perform the task with the support of the non-visual notification in the second study. In the end, we discuss the potential of the approaches for remote collaboration.

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