

SUMMARY OF Ph.D. DISSERTATION

School of Open Environment and Systems	Student Identification Number	SURNAME, First name BANNAI, Yuichi
Title A Study on Spatial Models of Remote Collaborative Mixed Reality		
Abstract <p>This research aims to propose the models of remote collaborative Mixed Reality (MR) as a kind of real time groupware systems.</p> <p>In researches into groupware, there were two main streams; i.e., Media Space based on video communication and Collaborative Virtual Environment (CVE) constructed by VR technologies. MR, which enables to merge virtual objects into real world, has become a new trend of groupware in recent years.</p> <p>Previous studies showed that MR was preferred for collocated collaboration while immersive CVE was preferred for remote collaboration. In the case of remote collaboration, in contrast to collocated settings, neither real objects nor real spaces can be shared at the same time. Therefore, most object sharing mechanisms between the remote sites were provided by the CVE using the virtual objects. As a result, no models of remote collaborative MR has been proposed at the present time.</p> <p>In this study, we focused on the symmetry of the collaborative model, and introduced the asymmetric model using one real space and the symmetric model using dual spaces, since the previous research showed that the asymmetry of model caused an impediment to mutual communication.</p> <p>The asymmetric model has a single workspace where the worker manipulates the object, while the indicator existing in the remote site assists the worker with his pointer as if he were in the workspace.</p> <p>The symmetric model has dual workspaces in each site where the user interacts to the shared physical object. We introduced “tangible replicas” (dual objects that have the same size, shape, and surface) to avoid the asymmetry of the model.</p> <p>We discussed the merit and demerit of the models from the viewpoint of user interface such as WYSIWIS, awareness, and seamlessness, and evaluated the models using the implemented systems. The first experimental results showed that the asymmetric model provides the seamless WYSIWIS interface, which reduced the asymmetry problem. In the second experiment, we found that the symmetric model created the seamless and relaxed WYSIWIS interface with fully symmetric condition, although there existed some restrictions for manipulation of the replica as well as the display of awareness information such as an avatar. It is also observed that the task performance (pointing and drawing task) is good enough for a practical use.</p>		