Distributed Multi-touch Virtual Collaborative Environments

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Abstract – We present a Remote Multi-touch Collaborative Environment that integrates videoconferencing in an immersive shared space. The proposed solution supports synchronous remote and co-located interactions of two or more users sharing the same virtual workspace. Two applications, that incorporate 2D and 3D shared space, have been developed.

I. INTRODUCTION

In real situations, collaboration is situated in a physical environment where spatiality between collaborators, as well as awareness of actions of the others, takes an important role. Studies on remote collaboration have tried to emulate face-to-face communication using different supports such as virtual reality [4] or videoconferencing. However, VR forces user to wear cumbersome equipment whereas VC fails when there is a need to collaborate on complex scenarios beyond documents and desktop sharing. At the other hand, in most of collaborative systems designed for tabletops interaction, users can only see each other in a separate display [2, 5]. In some cases, as in [3], participant's shadow arms and participant's video streams are integrated in two different windows on the same display.

We believe that integrating videoconferencing systems with shared spaces and multi-touch interaction can overcome some of their individual limitations. We present a revisited version of Ishii’s ClearBoard [1], a drawing application where participants can talk and draw as if they were in two opposite sides of a transparent glass window. This solution is only designed for 2D workspace. However, we believe that adding spatiality to the workspace could lead to explore new interaction techniques that support high level of cooperation.

II. IMPLEMENTATION

We implemented two applications that support collaboration within 2D and 3D shared spaces using multi-touch interaction. Fig. 1, shows the configurations of the workspace of the 3D application.

In the 2D application, users can move images in a flat (2D) shared space. A colored fingerprint is drawn in correspondence of each touched point. The fingerprints permit users to be aware of the actions of remote collaborators, while the embedded video streams of the remote collaborator provides gaze awareness.

In the 3D application, users can select and move objects in a 3D space. Each time users touch the multi-touch screen, a line (finger ray) is drawn from the touched point towards the 3D virtual space. Users move objects back or forth, touching the objects with two finger rays and moving them closer or apart.

III. INITIAL EVALUATION

We tested the system with a limited number of participants performing collaborative tasks. Participants were satisfied with the system. Most participants commented that they found easy to perceive the actions of the partner thanks to the fingerprints and finger rays printed over the selected object. However, for some participants, the interaction with the objects in the 3D space using the finger rays was considered difficult. In the 3D application participants see the workspace from a different point of view and some participants took some time to adjust. In some cases, users communicated through the video to coordinate their actions. However, someone complained that the objects could cover the face of the partner.

IV. FUTURE WORK

We have presented some of the challenges of distributed virtual collaborative environments with multitouch support.
We believe that supporting such kind of immersive collaborative environment through multi-touch interaction, could have great potentiality for learning environments and we plan to investigate in that direction. Re-addressing the problem of object selection in 3D space and supporting high level of cooperative interaction, are currently been investigating.

REFERENCES


