Reflexion: a responsive virtual mirror for interpersonal communication

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Abstract. *Reflexion* is an interpersonal video communication system that operates on the metaphor of a "magic mirror" in which one sees a reflection of oneself together with the reflections of other participants in remote locations, overlaid on a common backdrop image or movie. The system responds to auditory cues to appropriately compose the scene and emphasize the center of attention while maintaining the presence of less-active participants.

Overview

Traditional multi-party video conferencing systems often display participants in separate windows or employ audio-based automated camera selection algorithms to switch between views of active participants. We believe the visual or temporal separation characteristics of these designs introduces a confrontational or divisional dynamic that can have a negative impact on a meeting or interaction.

Reflexion is a multi-point interpersonal communication system that aims to address these issues by employing audio and video analysis and an interface design based on the metaphor of a "magic mirror" with the goal of creating a more intimate shared environment that visually emphasizes the center of attention while preserving a sense of background awareness among all participants.

Figure 1: Screen shots from a three-person Reflexion session.

Reflexion expands on the work of an early prototype from our organization known as Reflection of Presence [1]. Some references to other key related work include: an early system for "voice voting" to determine camera views in a video conference [2], the Clearboard system for shared drawing spaces [3], and the HyperMirror system which has experimented with blue screen technology to layer one participant into a scene consisting of another [4].

This video submission is a follow-up to a recent poster presentation at the UIST 2002 conference [5]. The key design features of Reflexion are:

- **Background segmentation:** The system extracts images of the participants from their backgrounds at full frame rate. This algorithm generally works on arbitrary backgrounds as long as they are static or changing very slowly.
- **Mirror effect:** The system horizontally mirrors the extracted participant images and combines them together into a single scene. Every participant sees the same thing in order to foster a sense of inhabiting a shared space.
- **Dynamic composition:** The system tracks who is speaking and smoothly transitions the layering and opacity of the participants as their interactions continue in an attempt to emphasize the center of attention while maintaining the presence of less-active participants.
- **Peer-to-peer:** The system uses a peer-to-peer networking strategy for audio and video transmission to help achieve lower latency. A central server handles control messages that synchronize the screen compositions at each station.
- **Backdrops:** Participants can view and discuss documents, slide shows, or movies that appear in the background of the mirror.

Our current research includes studying the effects of using Reflexion versus more traditional video conference interfaces, scaling the system to work fluidly with very large numbers of participants, and developing new interaction techniques.
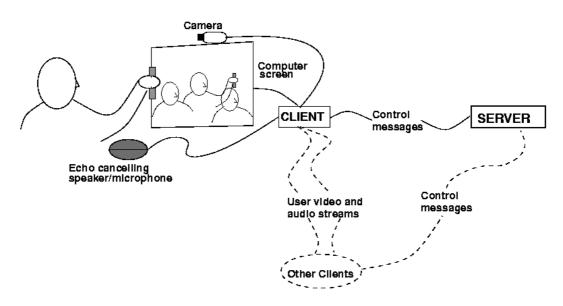

Figure 2: Diagram of Reflexion infrastructure.

Figure 2: Scene of a Reflexion station at our lab, illustrating the mirror effect of the display.

Acknowledgments

References

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