Designing an Intuitive Dynamic Telepresence System with Tangible Interface

Abstract

The team is designing an intuitive telepresence system that offers a dynamic user experience by means of a tangible control –with haptic feedback. The team uses Video Prototyping as a tool to get an understanding of strengths and weaknesses of the design. The authors show the first working prototype physically and

a. A Video Prototype: enacting the functionality and user experience of a TUI
b. A video where test persons play out the experience of the system

Author Keywords

Telepresence, Tangible User Interface, Affordances, Video Prototyping, User Experience

ACM Classification Keywords

Experimentation, Theory, Design, Human Factors

Introduction

Telepresence is in our eyes one of the ‘magical’ technologies introduced at the end of the 20st century that have only partly delivered on the –no doubt exaggerated- expectations (Minsky, 1980). Although Skype is a generally available application, there are relatively few ubiquitously used additions or applications that aim to enhance the user experience. Instead of a telepresence experience, we were sold a video phone. This inspired the authors to:

a. Employ appropriate methodologies to design an intuitive dynamic telepresence system.
b. Look for simple but effective additions to the video conferencing tools available.
c. Look for innovative, but not necessarily new, interface methods.

The System

The application we present is a first working prototype of an embodied system that consists of a rotating screen with high standard sound system controlled by a Tangible User Interface (TUI). We use the term dynamic telepresence for a system that offers a number of interactions in addition to the classical video conferencing tools (Haans, 2012).

Figure 1 first mockup of screen: panning and tilting

Telepresence is as much about the experience as about the effectiveness. With this in mind the authors are explicitly designing for the added value, for the qualities that make a conversation feel more worthwhile (Buxton, 1991).

Because the members of the designing team work all over the world, video seemed an appropriate tool to communicate our ideas. We subsequently found that the use of video to evaluate the strengths and weaknesses of the design, firstly by producing video prototypes and secondly by recording user tests, proved to be a valuable addition to our design research toolkit (Bonanni, 2009).

The process resulted in a number of mock ups of the interface and one early prototype of the application.

The Screen

The application consists of a piece of hardware that houses a screen on which teleconferencing software is running. Users can control the camera at the other end: they can pan and tilt but also zoom in and out. This holds that they can ‘scan’ the space while talking. The application, instead of employing the pan/tilt functionality of a built in camera, moves itself, showing the pan movement at either end of the application.

Figure 2 first sketches of the application

Figure 3 screen at workshop

Figure 4 first iteration of TUI at workshop

Figure 5 iteration 2 of TUI in testing session

The application integrates technologies to address some of the core issues regarding remote projection of presence via videoconferencing. It combines four elements into one integrated experience to overcome these issues:

a. Gaze awareness. The video screen displaying a life size image of the far end users face, has an integrated camera attached to it, physically rotating to the left and right to control camera direction. This mimics the way a person rotates their head while looking at people around a table and gives the people at the far end a sensation of the direction of the gaze of the person they are looking at (Gemmell, 2000).
b. Eye Contact. The video display has an integrated screen that is approximately the same size as a human head (13"-15") and can be rotated vertically from landscape to portrait mode to position the camera directly at the eye level of the users at the far end. This facilitates the sensation of eye contact through intraocular parallax mapping (Chen, 2002).
c. Attention Protocols. The haptic feedback system, a vibrating motor in the interface, provides physical feedback when a user on the far end asks for attention. This tactile sensation overrides other more obvious visual interactions and forces the user to focus on the request for attention (Starzyk, 2011).
d. Remote Camera Control. A tangible camera control interface allowing the user tangible control over the application and information about the status of the system. Current systems offer no obvious indication of where the remote camera is pointed (Shaer, 2004).

The application and interface exist as a first working prototype. The prototype addresses the issues above; the authors are in the process of evaluating to what extent all properties tie in with each other.

The Interface

The application has defined features. In the design process, we looked specifically at the affordances, at the interactions the design suggests (Gaver, 1991). Contrary to a general application employing a camera with pan and tilt function, in our prototype, the screen that shows the actual video image of the user, pans, as mentioned above, showing the direction of the gaze. Therefore, the interface of the telepresence application controls the gaze of the user. Thus, the control of this functionality should be intuitive and clear. Because user experience is one of the important values in this design, we decided to set up the first iteration as a classical TUI: with high token value, embodiment and feedback, haptic, visual or both (Fishkin, 2004).

Our starting point was a ball shape. The central idea of the design is that the status of the interface shows the status of the system. This resulted in iteration 1: a ball that refers in its design to an eyeball. The ball controls the camera movement, for the zoom function we added a separate slider.

Figure 6 first iteration tangible interface

In workshops we emulated the interaction of iteration 1, in a Wizard of Oz fashion. This resulted in a Video Prototype. This setup, where the interface controls a remote control camera (see video 1), lead to iteration 2, a mockup of a smaller interface with the zoom control integrated in the ball, on the front. The ball is also smaller and easier to manipulate.

We set up workshops where the interaction of the interface is enacted with a first working prototype of the telepresence application. Test persons played out the interaction of the application with the interface (see video 2). We also conducted interviews about the user experience.

Figure 7 second iteration tangible interface

Conclusion

In a collaborative design process, the designers usually worked from different locations. In the end phase of each design cycle the authors worked together at the same location to be able to evaluate last minute design decisions. The Video Prototypes allowed to

- communicate the steps of the design process to each other
- use video prototypes as a tool in workshops to get feedback about the strengths and weaknesses of the design
- build a dataset of the design process

We conducted 2 workshops:

1. Evaluating the interface. In a video studio the interface was coupled to a remote control camera. A professional video technician provided feedback.

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2. The interface with the application. In a prototyping studio 4 test persons (no experienced users) gave feedback on the interaction of the application.

In both workshops video was used for documentation and evaluation. Not all test persons wanted to give permission to be recognizable in the video's. We edited their faces out.

In the complete design cycle, video was the dominant communication tool. We found this facilitated a thorough collaborative process where design decisions were well documented. We present the first working (alpha) prototype of the design, and are setting up workshops (Hartman, 2006) to generate feedback for the design of the beta version of our design.

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