

H^oVER: Conveying Remote Presence

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ABSTRACT

This paper presents *Hover*, a device that enhances remote telecommunication by providing a sense of the activity and presence of remote users. The movement of a remote person is manifested as the playful movements of a ball floating in midair. *Hover* is both a communication medium and an aesthetic object.

Keywords

Tangible interface, sense of presence, awareness, personal communication

INTRODUCTION

Face-to-face dialogue can be more engaging than telephone conversation because of the added elements of gesture, touch, and body language. Video conferencing attempts to provide these missing elements, but does so at the cost of high bandwidth, expensive equipment, and heightened demands on the attention of the user. *Hover* provides a low-cost, low-bandwidth, less distracting solution that enhances the experience of telephone conversations with family and friends.

It provides visual awareness of remote persons in the form of an abstract physical representation with several affordances:

- A real-time indication of the level of physical activity of the remote person
- The ability to personalize the representations of the remote persons in a way that makes sense to the user
- The ability to grasp and interact with a “surrogate” representing the remote person

Hover is not intended to convey the meaning of gestures in a conversation, but rather to convey a sense of presence of the remote person in a captivating and poetic fashion.

RELATED WORK

Previous studies of awareness and embodiments [1][2] have concentrated on detecting presences, peripheral awareness, or integrating audio and video for

communication. *Hover* focuses on intentional awareness, representing presence and communicating a general sense of the physical activity of a remote person. It is similar to approaches using “tangibles” (i.e. physical objects) to communicate, to show activity or presence, or to support intimacy [2][3][4][5][6]. We wanted a solution that augmented existing personal communication on a telephone, but that could function as an easy-to-use, low bandwidth desktop accessory.

DESCRIPTION

Hover is designed to be an aesthetic object as well as a functional one, using technology that is readily available in a home or office environment. *Hover* is connected to a computer and telephone or an Internet phone. There is a stand on the *Hover* platform on which the user places multicolored balls representing persons with whom she frequently communicates (e.g. family and friends). She can personalize the identity of the balls by painting different colors and patterns on them.

In an example scenario where “Peter” calls “Jane” (refer to <http://web.mit.edu/goulding/www/Hover.swf> for an animation showing this process), Peter first takes a ball representing Jane and puts it on the top of a ramp. A sensor detects the ball and the ball rolls down and stays at the foot of the ramp. Jane’s number is then dialed automatically. On Jane’s end, the ball that represents Peter floats when the call comes in. If Jane wants to pick up the call, she grabs the ball and puts it on the ramp (Figure 1).



Figure 1: At Jane’s end, a ball floats when a call comes in. She grabs the ball to answer the call.

The ball rolls across a sensor on the ramp, sending a signal to Peter’s end to indicate that Jane has picked up the call.

At the foot of the ramp, an air stream levitates the ball (Figure 2). As Peter speaks, Jane sees the ball floating up and down in correspondence with Peter's movements (Figure 3). This will convey to Jane a sense of Peter's presence and level of activity. If Peter is inactive, the ball will hover at a fixed height. When the telephone conversation ends and both parties hang up the telephone, the ball stops floating and the user places it in its original position.

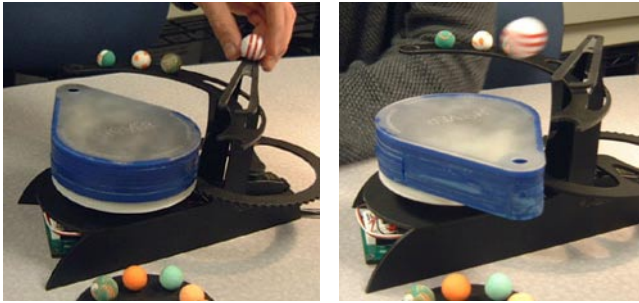


Figure 2: At Jane's end, the ball rolls down the ramp and levitates on a stream of air.



Figure 3: A conversation. The ball floats up and down in correspondence to the remote person's movement.

IMPLEMENTATION

Our implementation uses a vision-tracking camera attached to a computer. The computer analyzes the video stream and detects the level of motion. It sends this information to the remote computer, which relays the motion data to the remote *Hover* device. The *Hover* unit reads the data from the serial port and sends the appropriate electrical pulses to the fan and servo motor to control the position and the height of the ball. Varying the duty cycle of the pulse sent to the fan motor changes the volume of air produced, which in turn controls how high the ball levitates. If the remote person is gesticulating wildly, the ball floats rapidly up and down, conveying a sense of urgency.

CONCLUSION AND FUTURE WORK

The magical feel of the floating ball captivated users of the system. Although the device currently supports only a one-to-one telephone conversation, it could be extended to support multi-party telephone conferencing or a chat room environment of family and friends. In the future we would also like to more closely integrate the gesture capture with the telephone device. For instance, the telephone could have embedded sensors that detected the intensity of the grip of the remote person and mapped that information onto the *Hover* output.

As a generic three dimensional display device, *Hover* is also suitable for other applications where physical movement can be mapped into an artistic representation of that movement, such as baby monitoring or information visualization. The poetic and aesthetic nature of the display is a powerful way to show information that complements an existing communication system.

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