Contact IM: Exploring Asynchronous Touch Over Distance

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ABSTRACT
This paper explores the design space afforded by haptic communication. It differs from previous explorations of this topic in that it considers situations in which the communication is not tightly synchronized. Specifically, this paper is concerned with the idea of a haptic instant message. It discusses the motivations that inspired the development of this project and then describes the design (and briefly the implementation) of this novel form of communication.

Keywords
Haptic, Instant Message, Touch over Distance

INTRODUCTION
A number of authors have examined the role of touch in communication. The driving force behind this research has typically been to support social interactions, and not to convey structured information. In a paper describing the design of a pair of haptic communication devices Brave & Dahley [1] state: *"Touch is a fundamental aspect of interpersonal communication. Whether a greeting handshake, an encouraging pat on the back, or a comforting hug, physical contact is a basic means through which people achieve a sense of connection, indicate intention, and express emotion."*

inTouch, the system they created, comes in the form of a pair of coupled devices each consisting of three rollers. Rotating a roller in one device causes a similar movement in the other device, allowing users to push against one another, and to play.

Echoing these sentiments, Strong & Gaver [5] describe Shaker, a system that allows users to shake a device in their hand and have this represented as vibration in another user's coupled device. The authors suggest their device would encourage: *"...light-hearted play amongst friends..."*

Finally, Fogg *et al.* [2] describe HandJive, another pair of coupled haptic devices, in this case created as a toy that supports people's desire to fidget when listening to group presentations such as lectures. Fogg *et al.* describe the iterative design process that underpinned the creation of their devices, and this sheds light on user's perceptions of communication through touch. The researchers report that users found haptic communication engaging and enjoyable, but, if possible, tended to use it to physically compete with one another. These concerns were reflected in the final design of the device: it resembled two joysticks mounted on a central pivot. Each user's input was restricted to orthogonal axes of motion to ensure that they could not compete with one another. The authors suggested that the device could be used to play simple games, transmit rudimentary messages or act out collaborative dances.

This research provides a compelling argument for the use of haptic feedback to support interpersonal communication. However, we feel that it does not fully represent the available design space. Crucially, each of these systems relies on a low latency synchronous communication link between users: they are concerned with interactive communication. As one user rotates one of inTouch's rollers, or shakes Strong & Gaver's Shaker, or moves one of handJive's joysticks, this adjustment is immediately presented to the other user, who can then respond to it. As haptic feedback places high demands on update rate [3], this kind of interactive communication is challenging to implement on anything but dedicated communication links.

We suggest that there may be scope for designing haptic communication that takes place asynchronously. There are several reasons for this. Firstly, asynchronous haptic communication would not place the same heavy demands on network quality of service. Secondly, although absent in the literature pertaining to haptic communication, asynchronous communication of other sorts is commonplace. Email, answer services, and text and instant messages are all used extensively for interpersonal communication, but are not synchronous. We feel that the real world feasibility of asynchronous haptic communication, coupled with the ubiquitous nature of this kind of communication, makes it an interesting and unique area for investigation.

THE HAPTIC INSTANT MESSAGE
Our initial attempt at exploring this novel design space has focused on instant messaging technologies [6]. They make a good candidate for the addition of haptic feedback, as they are both commonplace and used extensively for interpersonal communication. Indicating a demand for richer communication in this medium, instant messaging software also often features the ability to send many other types of information such as graphics (e.g. smilies), voice

and video. From a practical perspective, as instant messaging is a mainly computer based communication medium, we are also able to leverage existing computer based haptic technologies.

In order to constrain our design, and with regard to the previous literature [6], we observed the following three critical points about instant messages. Firstly, they are persistent: an instant message is time independent. If a user is not present when a message arrives it will remain unaltered until they read it. Secondly, they are terse: instant messages are usually brief and informal, often consisting of only a few words. Finally, they are conversational: despite not requiring a rapid conversational dialog, they are typically used in this way. Users often send multiple messages per minute. Given that literature suggests that the primary benefit of haptic communication is increased support for interpersonal communication, we also designed our haptic instant message to be both expressive and engaging.

DESIGN OF COMMUNICATION

The first haptic communication we have designed within these parameters is concerned with replicating a simple cooperative physical activity: passing a ball between two people. When a message is initiated a user is presented with the left side of a tennis-court like image featuring three significant objects: a hand icon (representing the user), a ball, and a net. This is pictured in Figure 1. Operating his or her haptic device, the user can move over the ball, and by depressing a controller button, pick it up. When the ball is picked up, it becomes attached to the user's cursor by a physically modeled piece of elastic. This enables the user to swing the ball around, adjusting (and experiencing) its momentum much like one would the weight of a stone in a sling. When a satisfactory momentum has been achieved the ball can then be released by releasing controller's button. At this time the ball will bounce around the court until it reaches the net on the right of the scene. The ball will then cease to be displayed on the sending users screen, and be sent (as an instant message) to the receiving user. This user experiences the message using the same interface showing a half tennis court, a hand, a ball and a net. The ball originates from the net and maintains the position and velocity that the sending user imparted to it. The receiving user is then able to catch the ball, and send it back to the other user in a similar way. We call our system Contact IM.

The rationale for choosing this scenario is its close fit with both the properties of an instant message and the previously observed strengths of haptic communication. It resembles an instant message as it naturally has the temporal properties of being both terse and conversational: each message takes only moments to send and they can be easily chained together. The message is also persistent, as we ensure that until a ball is picked up it simply bounces around the court (including the net) maintaining its momentum indefinitely. This interaction maintains the interpersonal quality isolated as critical to haptic

Figure 1. Interface to Contact IM.

communication as the sensation involved in swinging the ball supports rich expression. The ball can be released such that its position and velocity make it easier or harder to catch, and correspondingly alter the physical sensation of actually catching it.

INTERFACE AND IMPLEMENTATION

The haptic communication was added to Miranda [4], an open-source instant messaging client that uses the OSCAR protocol (also used in ICQ) to transmit messages. The haptic communication did not interfere with the other communication functions of the client, and the message was initiated using a similar interface to other messages. Essentially, a user selects from a list of contacts who they wish to communicate with, and gains access to a context menu allowing them to choose the type of communication, be it text message, audio clip, or in this case, a haptic message. The haptic feedback can be displayed on both a PHANToM haptic interface and standard consumer level force-feedback joysticks. Unlike the majority of haptic research, this choice of software and hardware ensures that users outside of a research setting are able to run and use this software.

FUTURE WORK

We are interested in continuing to explore this design space, and our next step is to release our haptically enabled instant messaging client to the general public, hopefully generating comments, criticisms and suggestions. We will then use these to inform future generations of our design.

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