HIM: A Framework for Haptic Instant Messaging

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ABSTRACT
Instant Messaging (IM) is a popular chatting platform on the internet and increasingly permeates teenage life. Even intimate and emotional content is discussed. As touch is a powerful signal for emotional content, haptic signals, and especially hapticons can contribute to overcome the inevitable loss of subtle non-verbal communication cues. Audio-visual extensions of IM to share emotions, in particular emoticons, have been received enthusiastically by IM users. This indicates a realistic user-need for hapticons in IM.

The Haptic Instant Messaging (HIM) framework introduced in this paper combines communication of textual messages with haptic effects and hapticons. The application is build as an open framework and supports small chatting communities to explore the design and use of hapticons and haptic IO devices. Researchers can use the HIM framework to monitor the use of haptics in communication and how haptics contribute to the fun and meaning of instant messaging.

Author Keywords
Haptics, Instant Messaging (IM), hapticons, emoticons, intimacy, communication, presence.

ACM Classification Keywords
H5.3 Information interfaces and presentation (e.g., HCI): Group and Organization Interfaces: Web-based interaction.

1. INTRODUCTION
Modern Internet-enabled person-to-person communication technologies – such as email and instant messaging – primarily use textual messages, often extended with audio-visual cues. In comparison to direct interaction in the real world, subtle non-verbal cues such as gestures, facial expressions or prosodic features of speech are lost.

In our ongoing research on person-to-person communication by means of physical interaction over a computer network, we explore the opportunities of real-time haptic signals to enhance communication between two users. Compared to vision and hearing, haptic information is the most direct and intimate manner of person-to-person interaction. Moreover, an extra haptic channel might be helpful in presence, attention, and identification problems in multitasking user-environments and asynchronous communication.

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Icon	Emoticon	Meaning	Hapticon
	:)	regular smile	
	:D	big smile	
	:(	sad face	
	;-)	wink	
	(k)	kiss	
	:$	embarassed	

Figure 1 – Some emoticons and proposed hapticons

As a step in the project, we developed a special instant messaging application that opens opportunities for haptic communication by allowing users to send messages enriched with haptic effects. We chose Instant Messaging as it is one of the most popular chatting platforms on the Internet that deals with person-to-person communication. The Haptic Instant Messenger provides the opportunity to explore the function of haptics in communication and study how users react to these new possibilities.

Instant Messaging
Instant Messaging (IM) increasingly permeates teenage life. Instant Messaging is no longer used merely to send messages, but has also become a major medium to stay in touch with friends and share intimate information. The Pew Internet Teenage life online project showed that already in 2001, 69% of teenagers in the USA used IM several times a week, 15% used IM to date someone and 37% have used IM to write things that they would not have said in person. [1]. Recent reports confirm a significant growth of both number of users as well as intensity of use [4]. In order to strengthen meaning or expression, emoticons and sounds are frequently used. Figure 1 shows some popular emoticons.

Application of haptics in chat, Contact IM

The ContactIM application developed by the MIT Palpable Machines Research Group is one of the rare examples of haptic-enabled instant messaging [6]. Figure 2 shows a screenshot of the ContactIM plug-in for the Miranda Messenger. In this application the user can pick a communication partner from the contacts list and throw a ball onto the other ones screen, i.e. over the white line at the right side, as if it was the net of a volleyball field.

The remote user sees a similar field, the ball enters that screen and remains bouncing around until the local user responds. In addition, haptic effects (in supported interfaces like force feedback joysticks) are added to the ball: you feel the forces when you swing the ball around when you throw it or catch it. These effects are only sensed when you grab the ball. The haptic signals therefore not create extra meaning for the message nor the communication as there is no direct interaction between the users, and touch is not exploited to generate a sense of emotion or intimacy.

Hapticons

In order to couple meaning and touch, hapticons can be used. Hapticons are defined as small programmed force patterns that can be used to communicate a basic notion in a similar manner as ordinary icons are used in graphical user interfaces. At the University of British Columbia, research has been conducted into the design and usability of hapticons [2]. It has not been explored yet to what extend hapticons can be used as an alternative to emoticons in the context of a chat-application. The advantage of using hapticons as a medium for haptic signals in asynchronous communication is obvious.

Haptic IM framework

The foregoing sections showed that although IM is frequently used to pass intimate and emotional content, haptic effects are rarely used to support communication, while particularly touch is a powerful modality for this class of information. In addition, hapticons can be used to support text messages and resolve some of the ambiguity

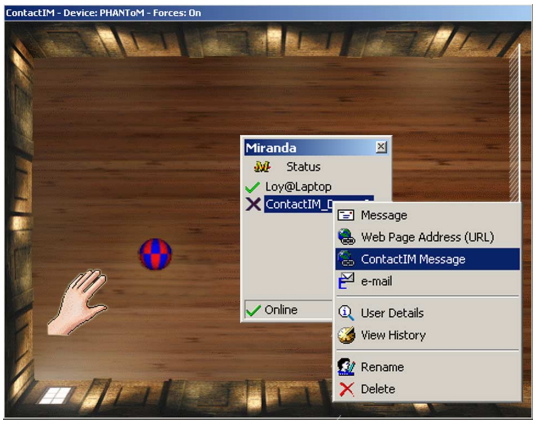

Figure 2 – Screenshot of ContactIM

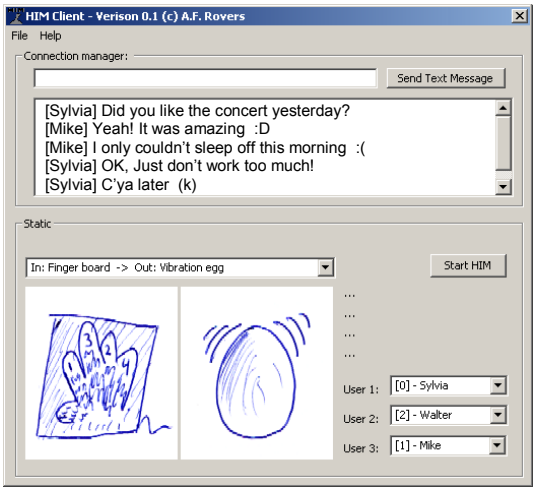

Figure 3 – HIM Application (preliminary version)

that frequently arises during chatting (and often are the beginning of little arguments). A special language – consisting of signals either send directly by the user, or generated by hapticons – might arise over time. Moreover, individual users could agree upon special – secret – tags and gestures to identify oneself and prevent others from faking to be someone else.

The haptic IM framework presented in this paper can be used to explore the possibilities of such an IM system. The next section will show how the system is implemented, section 3 discusses the use of the system by presenting realistic scenarios and the last section presents some conclusions.

2. HAPTIC IM

The new Haptic Instant Messenger (HIM) provides all features of an ordinary messenger such as listing who is online and sending text messages. Figure 3 shows a screenshot of HIM, indicating a dialogue box on the upper part and an additional feature on the lower part: The user can select the input and output devices that are used to generate haptic effects. A set of predefined hapticons and interfaces is provided, and it is easy to design your own signals and appliances and include them in the HIM framework.

Haptic effects can be triggered by using special input devices, or by using their corresponding textual representation in the text message (just like emoticons). From a technical point of view a hapticon consists of vibration patterns (specified by frequency, amplitude, duration etc.) It however only becomes a hapticon after users start to recognize the patterns and associate them with a special meaning. The way hapticons are perceived by the receiver obviously depends on the hardware that is used as output.

In the future, the experience of haptic effects can be further improved by using haptic illusions. Van Mensvoort already showed that a combination of graphics and active cursor manipulation can be used to give users the idea of force feedback, even when using a traditional mouse [5]. Also the exploration of real-time (bidirectional) communication [7] that enables the users to actually feel each other – which largely exceeds the concept of instant messaging – is an interesting future extension.

Technical implementation

We created our code from scratch, so we will be able to create future extensions with highly customizable communication protocols that enable to use real-time haptic communication. This would have been more difficult when merely writing a plug-in for an existing messenger like MSN or Miranda.

HIM comprises of two main components that are connected through a TCP/IP socket over the Internet: a server and a client (Figure 4). Both components are programmed in Microsoft Visual C++ and therefore only run under Microsoft Windows.

Server Application

The server application runs on a dedicated PC and keeps track of who is online, who likes to chat to who, and which IO devices are used. All messages are sent via the server. The server is kept relatively simple when compared to systems like MSN and ICQ, but provides sufficient features and is dedicated to setup small chat communities.

Client Application

The client application runs on the local PC of the user and connects to the remote server over a predefined TCP/IP port. The user is able to see who is online and can send messages to the others. It is possible to select the kind of input and output device that one prefers to use. Devices that are supported by default include force feedback joysticks, mice and prescribed I/O ports for custom designed touch pads and vibration devices (Figure 5). Extensions to the client can be added in three ways:

- New functionality can be created by adding plug-ins (DLL's) to the system. The HIM client already contains code templates to address DirectX® supported hardware relatively easy: initialization procedures and force feedback features are directly available.
- By using the TCP/IP plug-in module, it is possible to connect HIM to a TCP/IP server socket in your own application. The communication protocols required are well documented and can even be used by novice programmers [www.haptics.nl\him.htm]
- It is possible to connect new devices without having to program at all. The RS232/USB module enables the user to interface to custom devices connected respectively through the PC serial or USB port. The communication protocols are simple to use and similar to the ones used by the TCP/IP module. In addition plans exist to add support for LEGO® Mindstorms™ .

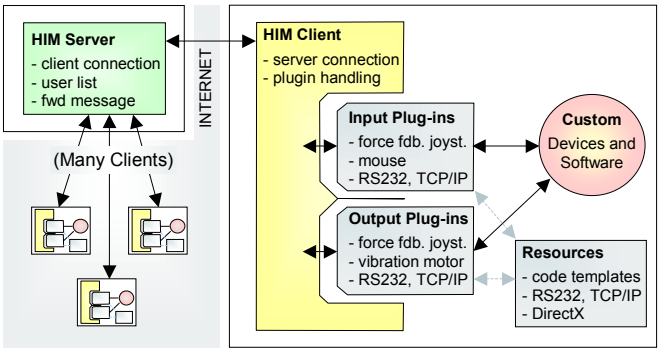

Figure 4 – Outline of HIM architecture

3. DISCUSSION

The system is made operational with commercial force feedback joysticks and touch pads as well as two custom made IO devices (a finger touchpad input and a vibration pencil output, see Figure 5) to illustrate the flexibility and possibilities of the open HIM framework. A scenario demonstrates the use of the HIM application in practice.

Sample scenario

One can think of a scenario in which two persons, Mike and Sylvia, use the HIM application during an IM session. Sylvia already owns a force feedback joystick that is connected to the HIM system, but Mike preferred to use an alternative configuration. He likes the idea of using a separated input and output device and therefore uses a touchpad that is placed on the desk and a vibration device that is worn in the pocket. The chat that emerges is (partially) shown in Figure 3.

Mike challenges Sylvia for a chat. Instead of sending a text message, he uses an alternative method: He gently tickles on the touchpad with his fingers. Sylvia, who feels some very weak force pulses, notices the request coming from Mike and responds by using her joystick to send a firm signal to acknowledge the request for having a chat session.

The chat continues in textual form and hapticons are used now and then to express special feelings. For example: Mike uses the big-smile-emoticon **:D** to express his enthusiasm. This hapticon generates an appropriate haptic effect at Sylvia's site: for example a fast vibration with increasing amplitude burst that ends abruptly. Similar, the dislike-emoticon **:(** generates a more aggressive signal consisting of three abrupt pulses of high amplitude. The kiss-emoticon **(k)** results in a signal that feels good: a vibration that increases in frequency while decreasing the amplitude.

Custom made IO devices

The vibration device consists of an ordinary DC motor – with an eccentric mass attached to it – that is controlled by a simple microcontroller. The microcontroller responds to signals that are presented on the PC's serial port by the HIM RS232-output-module.

The touchpad is merely a pattern of lines, etched on a printed circuit board in the shape of a hand. When the board is touched, the change in resistance is detected by a simple microcontroller circuit, and a signal is send to the HIM RS232-input-module.

Consideration

Using haptic IO devices like a force feedback joystick might not be realistic in a chatting scenario where you need ten fingers for the keyboard. However, many other scenarios, indicating different appliances, can be thought of.

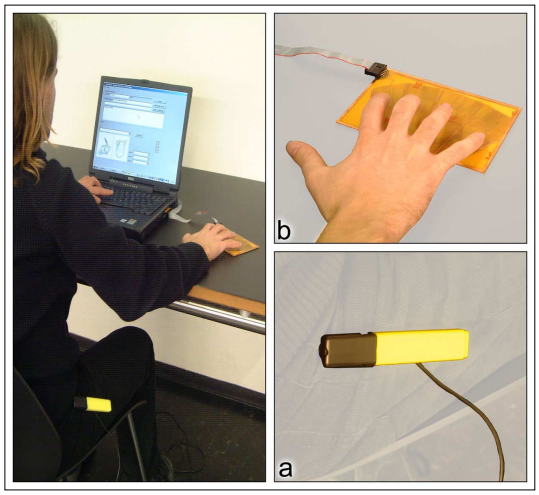

Figure 5 – Examples of custom-made devices: vibration device (a) and resistance based touch pad (b)

For example, you can integrate the HIM IO devices in beautiful desktop objects or into the desk itself, but one can also think of shoulder pads, clothing (for example a suit [3]), special earlobe actuators, feet sensors and experiments with alternative hapticons.

CONCLUSION

Instant Messaging (IM) is a very popular chatting platform on the internet and increasingly permeates teenage life. Even intimate and emotional content is discussed during an IM session. As touch is a powerful signal for emotional content, haptics, and especially hapticons can contribute to overcome inevitable losses in subtle non-verbal communication cues. Hapticons can strengthen meaning and expression, can resolve some of the ambiguity that frequently arises during chatting, and haptics can be used to draw attention in multitasking user-environments.

All audio-visual extensions that that have been added to IM in the past to show emotions, in particular emoticons, have been received enthusiastically by their users. Therefore we believe that there is a realistic user-need to implement hapticons.

The Haptic Instant Messaging (HIM) framework presented in this paper combines traditional textual messages with haptic effects and hapticons. The application is build in the form of an open framework. This means that both users and professional developers can add their own extensions to the system very easily. Chatting communities can use the system as a toy to experiment with hapticons and (possibly custom made) haptic IO devices, while researchers can use the framework to investigate in which way haptics can improve the fun and meaning of instant messaging.

As a next step in the research project, we monitor HIM chat communities and investigate during a longer period of time *how* the user group will use these effects and what haptic dialects will arise. Furthermore real-time haptic interaction and the exploitation of haptic illusions will be aimed at.

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