feelabuzz:
Direct Tactile Communication with Mobile Phones

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ABSTRACT

Touch can create a feeling of intimacy and connectedness. This work proposes feelabuzz, a system to transmit movements of one mobile phone to the vibration actuator of another one. This is done in a direct, non-abstract way, without the use of pattern recognition techniques in order not to destroy the feel for the other. The tactile channel enables direct communication, i. e. what another person explicitly signals, as well as implicit context communication, the complex movements any activity consists of or even those that are produced by the environment. This paper explores the potential of this approach, presents the mapping use and discusses further possible development beyond the existing prototype to enable a large-scale user study.

Keywords: *Haptic Display, Mediated Communication, Mobile Devices, Tactile Feedback, Wearable Computing*

INTRODUCTION

Touch is arguably the most immediate, the most affective, and – when it comes to media – one of the most overlooked modalities used for human communication. It can convey emotions and feelings on a direct and primordial level (Eichhorn, Wettach, & Hornecker, 2008; Heikkinen, Olsson, & Vaananen-Vainio-Mattila, 2009; Vetere et al., 2005).

We propose feelabuzz – a system to directly transform one user's motion into the vibrotactile output of another, typically remote device. Unlike previous work on tactile communication (Chang, O'Modhrain, Jacob, Gunther, & Ishii, 2002), we do so using only mobile phones without any additional gear. Nowadays most mobile phones universally have both accelerometers for the sensing and vibration motors for the actuation of the interaction. Mobile phones have the key advantages of not only being widespread to the point of omnipresence but also to usually be in the direct vicinity of their users. Not having to buy and more importantly to carry around an extra piece of hardware is a property whose importance cannot be overstated. Using phones also makes it easy to integrate the new haptic channel with existing auditory, visual and maybe textual channels, thereby extending the phone's capabilities as a communication

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device. As we have our phones with us or nearby most of the time, they are well suited not only for direct communication but also for implicit context communication (e. g. walking or riding the bus) as well. The choice of vibration as an output modality not merely stems from its prevalence on the chosen platform and its availability and unobtrusiveness when carrying the phone in a pocket but also from the fact that movement naturally transforms into vibration and similar tactile feedback in the real world (e. g. footsteps on the floor, multiple persons using one stair rail, someone stirring on a sofa or even the feedback to one's own hand when stroking something).

RELATED WORK

Similar approaches have been followed by others. The work of Heikkinen, Olsson, and Vaananen-Vainio-Mattila (2009) provides insights on the expectations of users regarding haptic interaction with mobile devices. Their results underline our design considerations. The participants brought up poking and knocking metaphors as well as the idea of a constantly open "hotline" between two participants. Their participants even saw the possibility of the emergence of a haptic symbolism or primitive language, which have been developed during the evolution of the interaction.

O'Brien and Mueller (2006) created special devices of various forms to examine the needs of couples when "holding hands over a distance". A main critique of their participants was concerned about the cumbersome and unfashionable design of their devices: "The participants stressed how they wanted a device that was more personal and easy to carry. They desired it to be small enough to fit it in their pocket. One participant noted that she wanted something she could relate to personally". Furthermore, their users disliked that the special device draw to much public attention.

Eichhorn et al. build a pair of stroking devices for separated couples. Each device has a sensor and a servo which expresses the stroke initiated by the remote device. The device functions as a proxy object to stroke each other over a distance. A lot of the work already conducted on vibrotactile interaction is focused either on the recognition of haptic gestures or on mapping different cues to haptic stimuli (Murray-Smith, Ramsay, Garrod, Jackson, & Musizza, 2007; Rovers & van Essen, 2004; Brewster & Brown, 2004; Mathew 2005; Enriquez & MacLean, 2003).

To our knowledge there is no practical work on direct mapping between the accelerometer readings and the vibration motor of a mobile phone. With feelabuzz we aim at creating a personal, lightweight and always ready-to-hand haptic communication channel. In this work we will first discuss aspects of haptic communication and then introduce the feelabuzz system.

THE CHALLENGE

Albeit the vibrations today's mobile phones can make are a poor substitute for the actual touch of another person, we believe that the knowledge that it is the very movement the other person is doing just now that makes a user's phone vibrate in a certain way can give them a real feeling of presence and intimacy. Imagine how a piece of clothes our loved one once wore or a letter or the place he or she used to sit can make us feel just because he or she touched it. Often, the fewer images there are, the more powerful the images our mind will conjure up. Instead of transmitting reality with as much sensory bandwidth as possible, we intend to give people something to build upon and depend on their minds to add in all the details.

Still, how much is there to really hook on to? Figure 1 shows accelerometer data for different activities. It is not necessary to be an expert to distinguish these four sample activities. We are optimistic though that people will become experts in the sense that they will learn even to pick up the comparatively subtle cues that separate the way of movement of close persons from everyone else's way. Provided that a strong social tie is a profound enough motivation to