

# Continual Remote Connectedness through Peripheral Vibro-Tactile Displays

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## ABSTRACT

In 2011, a young American adult in average sent and received over 100 text messages per day. Such communication habits indicate that in particular young people feel a strong urge to continually connect with people that are not physically present. It has been shown that always-on connections, e.g. by video chat, can satisfy this need. However, there might be situations in which video chat is not feasible, e.g. when it distract from other tasks us or violates the participants' privacy. We propose exploring the sense of touch as an alternative communication channel for creating remote connectedness. Our initial research focuses on the question on how to design haptic user interfaces so that they stay out of focused and in peripheral attention, so that they do not interfere with daily tasks.

## Author Keywords

Peripheral user interfaces, ambient awareness, haptics

## ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

## General Terms

Human Factors; Design; Measurement.

## INTRODUCTION

109.5 text messages – according to a PewInternet survey [3] this is the number of text messages that young adults (18 – 24 years) sent or received in average per day in 2011. This shows that young adults feel a strong need to stay connected. Thus, it does no surprise that people leave video connections open over extended time periods in order to stay connected [2] and that this contributes to the feeling of being close [4].

However, these new ways of staying connected have potentially negative effects. They may invade privacy, e.g. when used in a cubicle workplace, or they may interfere with tasks that are performed locally, such as reading a document. According to theories on human information

processing, such as Wicken's Multiple Resource Theory [6], the extent to which tasks interfere with each other strongly depends on the modalities of the tasks. For example, talking to a person (*verbal task*) interferes much stronger with other *verbal tasks*, such as reading text, than with *spatial tasks*, such as walking down a corridor. Likewise, tasks that share sensory modalities interfere much more with each other than those that use different ones. Since video chat is a visual & auditory and verbal task, it may interfere with all tasks that share these dimensions. Since many daily activities require visual and/or auditory attention, it is worthwhile exploring alternative sensory channels to connect people to achieve shared experiences.

We believe that the sense of touch holds unexplored potential in remotely connecting people, in a way that the connection remains in the periphery of its users attention. Such services may bridge the gap between synchronous communication, such as phone calls or video chat, and asynchronous communication, such as text messages or email, and hence, allow for novel, innovative communication solutions.

## CONTINUOUS CONNECTIVENESS

In our line of research, we are exploring, to what extent and in what way the sense of touch can be employed to create a peripheral, private, always-on connection with other people. Previous research supports that this approach is feasible. For example, Want et al. [5] showed that haptics can be processed concurrently to other tasks (in their case, reading) and that they can increase the emotional connectedness with the creator of the haptic signals.

The probably most ubiquitous haptic display is the vibration alarm built into mobile phones. Through an eccentric weight attached to a motor axis it allows creating vibration signals and patterns of signals. If these signals can be created in a way that they enter peripheral attention, mobile phones may be used to bring private ambient interfaces to the masses and create new ways of continuously connecting people.

With this vision, we extend the idea of Hemmert [1], who proposed to create heartbeat-like vibration pulses to continuously convey the status of the mobile phone, such as whether there are unread messages or not, to the user. We envision people being continuously connected through a

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continuous signal. Actions by remote people cause the signals to vary slightly. Ideally, these variations are subconsciously, peripherally processed and create a sense of connectedness to a group of people or a single person.

#### **CAN VIBRO-TACTILE CUES BE AMBIENT?**

In order to create such a system, we have to understand how to design vibro-tactile cues that can enter peripheral perception. However, since vibration perception naturally warns about dangers, (e.g. picture a mosquito - possible carrying lethal diseases - landing on one's arm) it is questionable whether vibration can, at all, bypass focal attention.

In his Ambient Life project, Hemmert [1] investigated exposing people to continuous haptic signal. He explored whether haptic life-like signs can continuously convey a phone's status. Six users were asked to carry a mobile phone in the pocket, which continuously created heart-beat-like vibration pulses. A timer was randomly set to let the phone "die", i.e. to turn off the vibration. In that case, the participants had to "revive" the phone, by taking it out of the pocket and pressing a key, as soon as they notice. The testers were quite fast in noting a phone's "death": in 19% of the cases they reacted within 10 sec, 44% within 30 sec, 55% within 60 sec after the "death" event. However, since many testers stated that they found the constant vibration pattern to be annoying, it cannot be ruled out that the vibration never entered peripheral perception.

To gather more insights, we replicated this experiment and advanced its methodology. Most notably, we allowed users to adjust the vibration intensity and asked them to keep the intensity at a setting, where it is just above the perception threshold when not moving. In addition, for each death event, we asked users to indicate to what extent they felt distracted by the vibration pulse. 12 participants carried the phone up to three days. Times show that 16.7% of the Death Events were acknowledged within 1 minute and 61.1% within 10 minutes. In over 95% of the events, people stated that they felt not annoyed by the vibration. These findings indicate that vibration patterns can indeed leave focal attention, while people still become aware about changes within a few minutes.

#### **FUTURE RESEARCH AGENDA**

To satisfy the apparent human need to continually staying connected, we aim at exploring peripheral communication

as a potential way to continually connect people and to investigate what information can be exchanged that way. Therefore, it is necessary to find information displays that can convey information in the periphery of a user during a daily life. In particular, we have started to study the feasibility of using vibro-tactile displays for peripheral user interfaces, as they can be worn on the body throughout the day. Our pilot studies show that they might constitute to peripheral awareness, but it is not yet clear, whether continual vibration may be a successful approach.

#### **BIO**

Martin Pielot is an associate researcher at Telefonica Research, Barcelona, Spain, which is the research group of Telefonica, one of the biggest telecommunication providers in Europe and Latin America. In 2012, he successfully defended his doctoral thesis on conveying spatial information via the sense of touch at the University of Oldenburg, Germany. At Telefonica Research, he researches how people can be connected through peripheral displays, using non-visual sensory modalities, such as ambient light, sound, or haptics.

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