Talking Tangibles: Design for Peripheral Interaction

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ABSTRACT
This paper describes ongoing research in a 4 year PhD project that started in June 2009. With the computer becoming pervasive in everyday life, a need for new interaction styles has emerged. In the realm of the vision of calm technology [6], we see potential in interaction shifting to the periphery of the attention. The aim of this research is to study interactive systems designed for peripheral interaction by combining physical artifacts and audio.

Author Keywords
Tangible interaction, sound design, calm technology, attention, periphery, user centered design.

ACM Classification Keywords
H5.2. Information interfaces and presentation: Auditory (non-speech) feedback, Interaction styles, Theory and methods, User-centered design.

General Terms
Design.

INTRODUCTION
With the upcoming of pervasive technologies, the computer is becoming ubiquitous in everyday life. As a result, intelligence and thus information can be everywhere nowadays. However, most traditional methods of human computer interaction require the user’s focused attention to be effective; we need to consciously look at a screen to perceive information from the computer and we need to consciously use the keyboard, mouse or touch screen to interact with these kinds of technologies.

When we look at the physical world, a lot of information is present there too: the weather, the time of the day, the activity of people around us, etc. However, we do not have to specifically attend to this information to perceive it. Furthermore, many physical actions are performed without directly paying attention to them. Tying your shoelaces, moving a cup to your mouth to drink, looking at your watch, all these activities can be done without focused attention. Perceiving information as well as interacting with the physical world frequently takes place in the periphery of the attention. However, these human skills are not often leveraged in interaction with technology. Weiser and Brown [6] introduced the term calm technology, “technology that engages both the center and the periphery of our attention and in fact moves back and forth between the two” [6, p. 8]. Given the potential of the before mentioned human attention skills, we see this as a valuable approach to fitting new technologies into our lives.

Although peripheral perception and action could involve all our senses, we are particularly interested in combining tangible interaction [5] and audio. As becomes clear from previously mentioned examples of peripheral actions, they are mostly performed on small or wearable objects (e.g. shoe-laces, a cup, a watch). Furthermore, as sound can be perceived without having to look at the source, this modality is naturally used for monitoring ongoing information streams. The aim of the research laid out in this paper therefore is to study the potential of interactive systems designed for peripheral interaction by combining physical artifacts and audio. The research is conducted through the design and evaluation of such systems, which we call ‘Talking Tangibles’. Design research challenges include: how to leverage human attention skills in interaction design? What kinds of tangibles are suitable? What kinds of sounds are suitable? In which application areas could this be used? At which moments would this type of interaction be possible and relevant?

In this paper, we present the current status of the research, which we think lays a solid basis of theory and experiential data for design research in this area.

EXPLORING THE DESIGN SPACE
To gain initial insights regarding the approach to design for peripheral interactions, we created three simple interactive demonstrators that provide audible information, designed to be perceived in the periphery of the attention. The AudioResponse made users aware of environmental sounds through a soundscape of piano tones. EntranceSounds informed office workers of the activity in the office when someone entered. RainForecasts played sound samples indicating the short term rain forecasts. These systems were each implemented in an office for three weeks [1]. Open interviews showed that participants did perceive some of the sounds in the periphery of their attention, after having gotten used to the systems. Furthermore, we saw that the
information users picked up from the systems differed from our expectation in several cases, depending on the context, experience, interest and knowledge of the user. From these explorations, we learned that an iterative approach, in which systems are experimented with for a period of time, seems suitable when designing Talking Tangibles systems.

THEORETICAL BACKGROUND
This research is grounded in theory on the human attention process, which describes attention as the division of mental resources over different potential activities [4]. When certain activities do not require many resources, such as tying your shoe-laces, one is able to perform multiple such activities at the same time; mental resources are allocated to both activities. To support the design of peripheral interactions, we have created an illustration that captures our current understanding of the center and periphery of the attention, see Figure 1. As seen in this overview, we understand the center of the attention as the one activity to which most mental resources are allocated, and the periphery as all other remaining potential activities, regardless of whether resources are allocated to them or not. This is more elaborately explained in [2].

QUALITATIVE EXPERIMENT ON ATTENTION
Apart from a theoretical understanding of the human attention process, we were also interested in gaining experiential information, to facilitate a link to the everyday context, as well as to gain inspiration for the design process. We therefore conducted a user study on attention and particularly the periphery of the attention in everyday life. In this study, we gathered qualitative data from 13 participants of diverse ages and backgrounds. Since people are usually not aware of their actions and perceptions that take place in the periphery of the attention, the study started with a sensitizing week [3], in which the participants performed several exercises such as video observation and creating a short diary, to reflect on the way they utilize their periphery in everyday life. After this week of sensitizing, the participants took part in an extensive group interview on their experience of the periphery of their attention.

The data gathered through this study is currently being analyzed, but the preliminary results indicate that audio is currently often used to monitor ongoing events in the periphery of the attention. Furthermore, most peripheral actions are performed with the hands, on small or wearable objects, which supports our choice for tangible interaction.

CONCLUSIONS AND FUTURE WORK
This paper presents ongoing research on designing for peripheral interaction, by combining tangible artifacts and audio. We have gained an extensive understanding of human attention abilities, both from literature and experiential data. As a result, we have seen that both tangible interaction and audio seem suitable for our purpose. The next step in our research is to iteratively explore potential applications of Talking Tangibles. This will include designing and prototyping Talking Tangibles systems, which could be static, mobile or wearable artifacts. Moreover, we will thoroughly evaluate these systems to assess user experience over a period of time. We have focused our initial explorations on the office context, but intend to explore other contexts in the next iteration.

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REFERENCES