effMeet

effMeet: peripheral interaction design for meeting management

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Abstract
In an office environment, people tend to have full agendas with many meetings. Therefore increasing time awareness, by knowing your personal and other people's agendas in meetings, could be helpful. We want to achieve this through the use of peripheral interaction design, inspired by Weiser's vision on Calm Technology [12]. This paper presents the design process that led to *effMeet*, a peripheral interaction design that aims at increasing time awareness in meetings. *effMeet* subtly informs people of the remaining meeting time and communicates the users' availability statuses to participants in other meetings by using their business cards as tokens. This paper contributes to research in the area of calm technology [12] and Ambient Information Systems [10] by proposing an innovative design which combines both peripheral perception and interaction.

Keywords
Peripheral interaction, dividing attention, office environment, time awareness, interaction design, exploration, design, Work in Progress.

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

Introduction

In the world we live in, interactive products are becoming increasingly present in everyday life. These products can be engaging and have the capability of seizing (almost) all our attention resources. On the other hand, the increasing amount of interactive systems that require the user's focused attention could overburden this same user with information [2, 5, 12]. To avoid such information overload, literature in the area of Human Computer interaction (HCI) suggests employing the *periphery* of the user's attention. This approach was initiated under the term Calm Technology [12], and later also referred to as Ambient Information Systems [9] and peripheral interaction design [3]. These approaches build on the human ability to gain awareness of perceptual information without focusing the attention on it.

In everyday life, we can perceive all kinds of information such as the weather, lights and traffic signs. Most of the time, we are not consciously aware of these perceptions; we know that it is raining without consciously having to look out the window, or we know that it is evening without having to think about the fact that it is dark outside. Such information is therefore not perceived in the *center* of the attention, instead these perceptions take place in the background or *periphery* of the attention. The periphery is described as "what we are attuned to without attending to explicitly" [12, p. 8], and it allows us to be aware of what is going on around us [5] in a broad sense. Besides peripheral perception, people can also perform actions in the periphery of the attention. While tying shoelaces or switching gears in a car, one does not consciously thinks about this process, meaning that these actions are performed in the periphery of the user's attention.

Clearly, both perceptions and actions can take place in the periphery of the user's attention, while they may also shift to the center of the user's attention when they become more relevant. In this paper we present an interactive system which aims to employ the periphery of the attention, in the context of meetings in the office. We noticed that many employees have back-to-back meetings that result in stressful situations, e.g. if one meeting runs late. Making employees more aware of time, concerning personal and other people's agendas, in the periphery of their attention seems suitable and valuable for this context. It would be useful to let users focus on the main meeting content and peripherally inform them about relevant information as the remaining meeting time.

Related work

The approach to employ the periphery of the user's attention is known under many terms, such as calm technology [12] and ambient information systems [10]. Both terms are characterized by systems that can switch between the center and periphery of the attention, by presenting information in a subtle, non-intrusive way.

An example of an ambient information system is Ambient Umbrella [10], which is an umbrella connected to a weather service that lets you know when rain or snow is in the forecast by subtly illuminating its handle. AmbientROOM [8] is a physical architectural space that

presents information through movement, light and sound which can be processed in the background of the attention. StaTube [6] is a tangible presence indicator that displays availability information from Instant Messaging through colors on a physical artifact. StaTube offers both peripheral interaction (by rotating it, a user can change his own state) and peripheral awareness (by perceiving the availability status of contacts). Edge and Blackwell [4] elaborate on Tangible User Interfaces by using physical tokens for peripheral tangible interaction: digitally-augmented physical tokens that represent tasks or documents which can be used within teams, for example to stay updated about task progress. Another example is CawClock [3], a clock for a classroom setting which uses subtle sounds to represent pre-marked timeframes.

Apart from these examples, some peripheral interactive systems have been developed specifically for the meeting room context. For example, Sturm et al. [11] designed a system that uses a peripheral display to visualize social dynamics (gaze behaviour, speaking time) of a meeting in real time. Occhialini et al. [9] explored the use of light as a communication tool for peripheral information by presenting an innovative ambient display that uses dynamic light patterns to support time management.

These examples explore peripheral awareness or peripheral interaction with tangible objects. The design described in this paper contributes to the exploration of applying peripheral interaction design in an office environment, especially focusing on business meetings.

Design process

In order to explore the possibilities of applying peripheral interaction design in an office environment, we conducted an iterative design process, an approach promoted in literature on tangible interaction [7]. The first two iterations ended with a visualization of a concept, while the third iteration resulted in a tangible prototype. The three iterations built on each other, with a final design as result. In this section we will present the different iterations in detail before we present our final design called *effMeet*.

Iteration I: Shake&Select

In the first iteration we explored *perception* in the periphery of the attention. This exploration was done by developing a conceptual design for the office context.

Shake&Select (see Figure 1) is an interactive device developed for the situation in an office in which several activities (e.g. a ringing phone, pop-ups and sounds of receiving emails) happen at the same time. Users can shake the device to select an activity, so that one can handle the activities one by one. This selection happens manually by the user itself by first identifying the number of activities and then assigning a color to each activity or task. When shaking the device, it might turn e.g. red. The task that is assigned to this color should be treated first. During the process of selecting tasks

Figure 1. Shake&Select

and colors, one is fully aware of this action. It requires full attention, whereas the illumination which indicates the selected activity could be perceived in the periphery of the attention. This means that the employee consciously interacts with the concept in the center of the attention (action; selecting tasks and colors), but he or she may perceive it in the periphery since the device illuminates if a task is selected. Shaking the device may, over time, also be performed in the periphery.

Iteration II: Intermeet

Intermeet (an illustration can be seen in Figure 2) is a device that is located in the middle of the meeting-table. Intermeet unobtrusively presents the amount of time left in the meeting. Every employee has an individual RFID token or badge which contains their meeting schedule. This token needs to be placed briefly on the Intermeet. Due to conflicting appointments, one might not be able to attend the entire meeting. If a person needs to attend another meeting, Intermeet alerts this person by a simple illuminating circle (visualized in Figure 2), 20 minutes before the current meeting ends. The circle illuminates at the position where the person scanned his token and then starts descending, visualizing the time that is left for that person in this meeting. This individual time circle only appears for three seconds. Then it is replaced with the general time bar that continues descending on the general agreed meeting time. Both the individual and general time bar have a unique color to avoid confusion. Others might also perceive this subtle, person specific, information, aiming at optimizing the effectiveness of the current meeting. In order to subtly interact with the device without too much attentional effort, interaction needs to take place in the

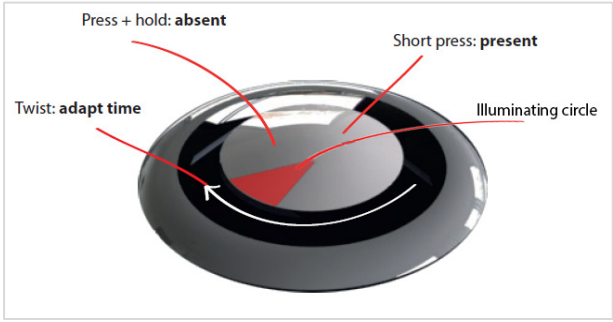

Figure 2. Intermeet

background of the user's attention. This was attempted by integrating interaction-styles (see Figure 2) performed often in everyday life in order to shorten the learning process. If one will attend a next meeting, a short press is needed. If one will not attend the next meeting, a press and hold is needed. If one will be X minutes late for the next meeting, a twist determines the amount of minutes one will be late.

Iteration III: effMeet

The outcomes of iteration I & II, focusing on peripheral perception and peripheral interaction, served as input for the final concept iteration. In this iteration, *effMeet* (see Figure 3), a tangible prototype was implemented in order to show the feasibility of the concept in terms of technology and functionality.

effMeet consists of a central device located in the center of a meeting table, which subtly presents information through a descending illuminating circle in the middle of the device. Also, the meeting agenda, if available, is displayed in the middle of *effMeet.* This information is retrieved using personal RFID-cards which users can place on *effMeet.* The meeting time is displayed in a circular red bar which descends as time

passes. This time bar starts illuminating as soon as a minimum of two meeting participants have put their RFID-cards on *effMeet.* The cards contain personal agenda information, and are recognized by *effMeet* through RFID-readers. At the end of the meeting *effMeet* gives a short beep to create awareness of the ended meeting. If the meeting is finished, participants wrap up, take their cards and leave. If the participants leave their RFID-cards on the device longer than two minutes after the meeting-time has ended, *effMeet* extends the meeting automatically with eight minutes, resulting in a total meeting extension of ten minutes. Participants are also given the opportunity to extend the meeting themselves by turning the ring on the device. This enables them to determine the amount of time with which they want to extend the meeting. When a meeting is extended automatically or by hand, *effMeet* detects remaining cards and associated calendars. In case the extension would result in card owners being late for other meetings, *effMeet* sends a message to participants of these upcoming meetings.

To encourage users to make effective use of the meeting time without overburdening them with information, the meeting time is presented subtly, so that it can be perceived in the periphery of the attention. This way, only few attention resources are needed to perceive the meeting time, and it can potentially be done in the periphery. After getting familiar with the system, users will likely require only a glance at this descending time bar to gain an idea of how much meeting time is remaining. In addition, the interaction required to extend the meeting is designed to be quick and straightforward so that it may be performed in the periphery of the attention as well.

Discussion

The design case presented in this paper aims at exploring the use of peripheral interaction in an office environment. The design, *effMeet*, subtly represents the remaining meeting time through a red time bar and communicates an individual's status by sending messages to this person's other meetings. We have observed that valuable time is lost in meetings, a problem which could be addressed by *effMeet*. *effMeet* is intended to be interacted with in the periphery of the attention, which might take away the pressure of time and might lead to more fruitful meetings. During this

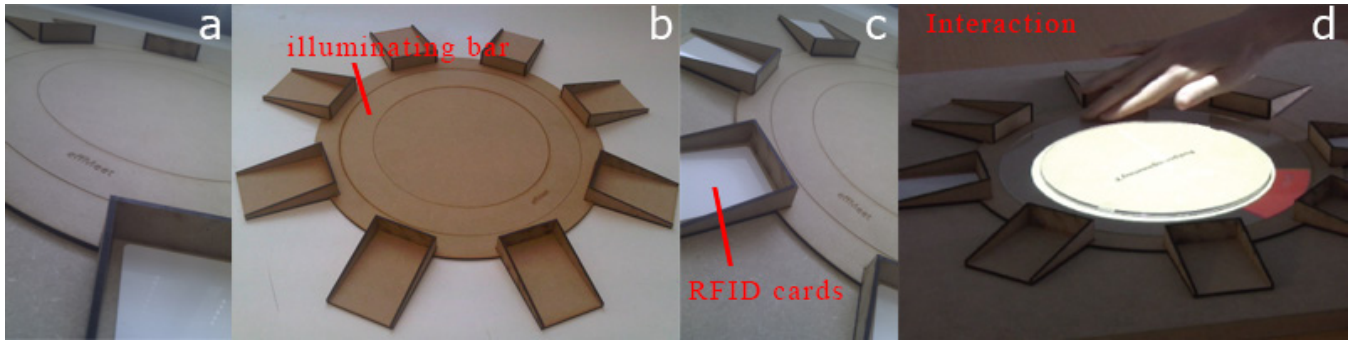

Figure 3. *effMeet*; close up of design (a), design in total (b), position of RFID-cards (c), interaction of extending meeting time (d).

exploratory research, new insights have been obtained which will be discussed in the following paragraphs.

In our everyday lives, we continuously interact with our physical environment. Some of these physical interactions are performed consciously, others are performed subconsciously. Particularly such everyday, subconscious interactions seem interesting to inspire interaction design that aims to employ the periphery of the attention: we call this peripheral interaction. More specifically, everyday, physical actions could directly or indirectly be translated to new interactive products, attaching a new meaning to these known interactions. Since people are skilled in performing these physical actions, it seems that similar interactions could easily move to the periphery of the attention. For example, by turning the ring on *effMeet,* the meeting will be extended. This physical interaction is linked to the volume increase on an iPod and to a bidirectional bezel that can be turned in order to measure elapsed time. The same physical acts occur with *effMeet*, only a different cognitive meaning is added to these acts.

To aim for peripheral interaction through design is complicated, since the design should not be perceived directly by its users [10]. To achieve this, the usage of the design and its interaction should become a routine for users. Obviously, this requires time [1]. When people use *effMeet* for the first time, it will require focused attention. Users will first have to learn to interact with the design and if they are skilled in doing so, the interaction may gradually turn into peripheral interaction. This makes it hard to design for the periphery. By integrating interaction styles that are performed subconsciously in everyday life and by using subtle sound and colors in *effMeet*, it is assumed that minimal attention is required to interact with *effMeet*.

Although *effMeet* is designed for peripheral interaction, we have not been able to evaluate this. Since such systems "should not be intentionally perceived by its users" [10, p. 12], it is a challenge to test the feasibility and success of peripheral interaction. What kind of evaluation methods should be used in order to draw solid conclusions about peripheral interaction? A potential strategy could be to apply methods used in psychology literature to study multitasking (e.g. [13]).

During this design research it became clear that following a step-by-step plan might help to design for peripheral interaction. This followed from the iterative design process that was used in this research. First, users need to become skilled in the interaction, meaning both the physical and cognitive acts. They should know how to handle the product and how it would react. Then, over time the perception of the design will move to the periphery, whereas the interaction still takes places in the center of the attention. Finally, after being skilled in the interaction and perceiving in the periphery of the attention, even the interaction might move to the periphery of the attention. This learning process takes time and requires prolonged user involvement. It is important to take these steps into account when designing for the periphery of the attention.

Personal experiences of the authors showed that many times the term peripheral interaction was explained in different contexts, the audience was mostly confused and not aware of the potential of this area, finding it a strange phenomenon. People often do not believe that

one can interact with something subconsciously. This might be due to a lack of awareness about the meaning and possibilities of peripheral interaction design. We see huge potential in this direction, e.g. in the office environment *effMeet* is designed for. People have many things on their minds and constantly appeal to this in the center of the attention. Aiming at the periphery of the attention during meetings, they become subconsciously aware of meeting characteristics such as time, content, personal and other people's agendas.

Conclusion

The design case described in this paper provides an exploration of peripheral interaction in an office environment, with the purpose of making people more aware of time management in terms of personal and other people's agendas. This work contributes to the areas of calm technology and ambient information systems by discussing a case study that does not only present perceptual information in the periphery of the attention, but also aims at physical peripheral interaction.

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