Exploring Design and Combination of Ambient Information and Peripheral Interaction

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ABSTRACT
In modern office life people have to keep track of many appointments and are overwhelmed by notifications. Paper calendars are complemented with electronic tools such as Outlook or Google Calendar, which offer reminder pop-ups. However, these notifications are (1) disruptive (imposing both an immediate context switch as well as a change of input focus on the user), thus (2) causing problems such as lost text input or accidental confirmation of a pop-up. In this paper, we investigate designing an ambient calendar that lowers disruptions while maintaining awareness. To further reduce focus switches between the main task and calendar, we show how peripheral interactions can be used for (1) acquiring details, and (2) silencing the reminder.

Author Keywords
Peripheral Interaction, Ambient Information, Multitasking

ACM Classification Keywords
H5.2 [Information interfaces and presentation]: User Interfaces – Interaction Styles, Graphical User Interfaces.

INTRODUCTION
In today's digital office, applications compete for the user's attention – solely on the display. One prominent example is a reminder function of digital calendars that interferes with other desktop applications (e.g., Word). Currently, pop-ups often claim the input focus, interrupting the user's main task (i.e., input is lost) or causing accidental confirmation of the reminder (i.e., the appointment may then be missed). Not having such reminders, however, requires users to periodically check their calendar to not miss an appointment, causing further interruptions of the primary task. We argue that the ideal calendar offers the best balance between showing necessary information and not disrupting the user.

We present an ambient calendar next to the keyboard (see Figure 1). Through a peripheral gesture, users acquire details of the next event. Our exploration showed that combining peripheral interaction and ambient visualization offers sufficient awareness of events while minimizing disruption.

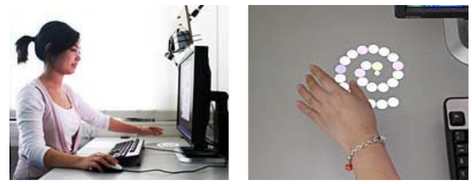

Figure 1. The ambient visualization projected onto the desk offering peripheral interaction

RELATED WORK
Many systems visualize time-based data: *SpiraClock* [1] uses a spiral replacing the standard computer clock. *Ambient Calendar* [5] uses a single image to encode calendar data and other information sources (e.g., public transit). The *Ambient Dayplanner* [7] projects the past and upcoming hour as wall clock, and uses a tangible interface for setting a reminder. With its tangible interface, it is one of the few truly interactive ambient systems. However, setting the reminder explicitly contradicts the ambient nature.

Our work builds on the concept of peripheral interaction. Edge [2] defined it as "episodic engagement with tangibles, in which users perform fast, frequent interactions [in] the periphery of their workspace". Olivera et al. [4] broadens the definition: "Peripheral Interaction is brief because our interaction focus is somewhere else and […] we want to deal with [the peripheral task] without strongly affecting the main [task]." Thus, peripheral interaction can be seen as sub-form of multitasking, i.e. interacting with a secondary task (here: monitoring the calendar) in the periphery.

DESIGNING THE SYSTEM
Our system comprises two aspects: (1) ambient visualization and (2) interactivity through peripheral interaction.

Visualization
The most important information of an event is the period of time until it starts (its *temporal distance*) and its *duration*. To minimize macro-attention shifts, detailed information (e.g., location) may be shown on demand. To identify a good representation of calendar data, we designed six calendar visualizations (see Figure 2). We based the design process on the four design dimensions of ambient systems by Pousman and Stasko [6]. Note that we created all designs with a strong emphasis on aesthetics.

Information Capacity: The six designs range from medium (i.e., *temporal distance* only) to high (i.e., *temporal dis-*

tance and *duration*). In the *Ball Path* each sphere represents an event. The spheres fall into boxes and – while the boxes move – eventually reach the bottom, indicating the start of an event. In the *Sun* the surrounding spheres are arranged in a clock metaphor indicating their start time and move closer to the center and get darker as an event comes closer. The *Flower* depicts each event as single flower whose stem represents its duration and color represents its temporal distance. The *Corner* shows each event as stripe, with duration as thickness and temporal distance as distance to the black line. The *Spiral* uses spheres for events and free time slots. The sphere's distance to the center encodes its temporal distance and the size its duration. In the *Hourglass*, each layer of sand represents an event with duration as thickness and temporal distance as its distance to the hole. Similar to the *Spiral*, light grey layers denote free time.

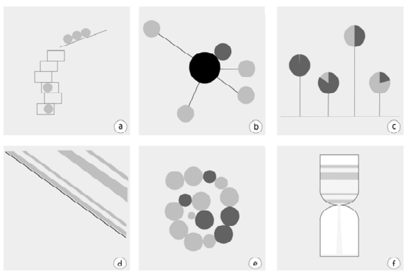

Figure 2. Design sketches of the same calendar data: *Ball Path (a)*, *Sun (b)*, *Flowers (c)*, *Corner (d)*, *Spiral (e)* and *Hourglass (f)*.

Notification Level: All of our designs support steady animations informing the user about the time flow. They incorporate blinking animations reminding users of an appointment soon to start (make-aware-notifications).

Representational Fidelity: The representational fidelity ranges from medium to low and is inspired by nature, daily life and general metaphors for "time". We used symbolic as well as iconic (e.g., *Sun*, *Hourglass*) elements.

To evaluate the understandability and likeability, we presented the designs to ten participants (3 female) ranging in age from 21 to 29 years. We asked for (1) their interpretation, (2) their idea of how to interact with it, and (3) the expected response of the system. We found that the *Spiral* was preferred in functionality as well as visual appearance.

Peripheral Interaction

When asked, users expected a variety of interactions. In contrast to previous peripheral interactions, which (up to now) solely rely on tangibles, we chose a freehand gesture: wiping was mentioned several times. It qualifies as peripheral interaction as it only requires macro movements. This gesture can be applied in both directions (see Figure 3): *Snoozing* a pulsating reminder, and *Details-on-Demand*, which shows in-depth information about the next appointment (e.g., the start time, duration, or location) as balloon tooltip on the computer's screen. We believe that showing this information on the primary display minimizes attention shifts between the primary screen and the ambient interface.

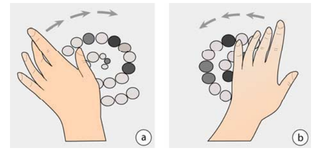

Figure 3. Details are acquired by wiping towards oneself (a). Snoozing is done by wiping away from oneself (b).

Implementation

The software is implemented in C#. It downloads the calendar data from the user's Google Calendar account. To create the ambient interface on the desk, we mounted a projector[1] next to the computer display. For tracking the aforementioned gestures, we mounted a camera next to the projector. Tracking is implemented using Touchless SDK[2].

DISCUSSION AND CONCLUSION

We conducted an initial lab study with a dual task setup (typing as primary task) to gain first insights. Results show less errors and slightly higher productivity for the primary tasks using our design compared to existing reminders (i.e. pop-ups). This suggests that peripheral interaction may be transferred from tangibles to other modalities. However, our lab study also showed that participants have to get used to both the ambient visualization [3] as well as the peripheral interaction. Thus, we will carry out a long-term in-situ deployment to eventually prove the usefulness of peripheral interaction in combination with ambient information.

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REFERENCES

1. Dragicevic, P., Hout, S. 2002. SpiraClock : A Continuous and Non-Intrusive Display for Upcoming Events. CHI 2002, 604-605.
2. Edge, D. Tangible User Interfaces for Peripheral Interaction. Technical Report 2008. Univ. of Cambridge.
3. Hazlewood, W.R., Stolterman, E., and Connelly, K. Issues in Evaluating Ambient Displays in the Wild: Two Case Studies. CHI 2011, 877-886.
4. Olivera, F., García-Herranz, M., Haya, P., Llinás, P. Do not Disturb: Physical Interfaces for Parallel Peripheral Interaction. Interact 2011, 479-486.
5. Phelan, O., Coyle, L., Stevenson, G., Neely, S. The Ambient Calendar. AICS 2008, 282-290.
6. Pousman, Z., Stasko, J. A Taxonomy of Ambient Information Systems: Four Patterns of Design. AVI 2006, 67-74.
7. Youll, J., Spiegel, D. Ambient Dayplanner: A Tangible Interface for Public and Private Appointment Calendars. MIT Media Laboratory, 1999.

[1] Samsung SP-P310ME Pocket Imager Projector
[2] Touchless SDK (http://touchless.codeplex.com)