

Unobtrusively reminding users of upcoming tasks with ambient light: Ambient Timer

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ABSTRACT

In this paper we describe the “Ambient Timer”, a tool to assist users in task switching in an office context. We use ambient light to notify users in an unobtrusive way that they have to finish one task and get on to the next one. We have created a prototype and have evaluated it in a lab study with seven participants. Results of our pilot study suggest for potential for exploring the design space further. Overall, participants response to our prototype was positive. A long-term evaluation in the wild” should be conducted to further explore the utility of this ambient light display.

Author Keywords

Ambient light; user interface; attention shifting; task switching

ACM Classification Keywords

H.5.2 Information Interfaces and Presentation: User Interfaces

BACKGROUND AND MOTIVATION

Today’s daily life requires users to be on top of their appointments. Thus users face a lot of interruptions in their work schedule. They have to squeeze in productive work at their desk in between the time slices where meetings, phone-calls, etc. demand their attention.

In order not to miss appointments people use alarmclocks, computer generated reminders, look at their watch all the time, or simply work until someone interrupts them. All techniques either prevent the user from getting into the flow - the state in which the user is all consumed by the current task - or they interrupt the user thus causing frustrations.

As solution, we explore ambient information presentation, as such displays allow users to be aware of information while attending to another primary task at the same time [4]. Instead of being interrupted by a sudden alarm, the user increasingly becomes aware the next appointment and can smoothly bring the current work to a satisfying intermediate result.

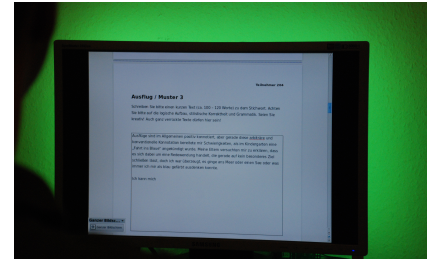


Figure 1. Ambient Timer

We introduce the “Ambient Timer”, an ambient light display designed to inform users of the time until an upcoming event. In this paper we report from a pilot study that aimed at exploring the design space. We investigated different ways to change the ambient light over time to slowly catch the user’s attention and make her finish a foreground task in time.

Ambient displays are used to move information off the screen into the physical environment [2]. They display information that is important but not critical and can easily move from the periphery to the focus of attention and back [5]. Ambient displays aim at presenting information without distracting or burdening the user [3].

AMBIENT TIMER

The Ambient Timer is a countdown timer. However, instead of digits or watch hands it uses ambient light. We fixed stripes of RGB-LEDs upon a frame of the same width and height as a computer monitor we used in our experimental setup. This frame was mounted on the back of the monitor (Fig. 1).

We aimed to keep information about the progression of time off the screen thus limiting interruptions of flow in the foreground task. Peripheral vision is well suited for detecting changes, if the dynamic of change is strong enough [6].

Pilot Study

To explore different light designs and to get first insights on whether the Ambient Timer works as envisioned, we conducted a pilot study. In brief, we asked people to compose and finish several small texts in a finite amount of time, which was displayed by the Ambient Timer.

Methodology

We tested eight light designs to display the remaining amount of time. We used four sine-wave designs with increasing frequency as well as four gradual exponential change designs addressing the parameters saturation, brightness and color

change between neighboring colors (green and orange) and complementary colors (green and red). All designs started in the color “green” state. We omitted linear designs as they are inadequate for gaining user attention in long display times. We administered a post-hoc questionnaire after each design trial asking participants for their experience with the design using a five point likert scale. We asked if a design was distracting, progression and end of time was noticeable, users were able to finish in time as well as free comments.

The study took place in a lab with controlled lighting conditions. Lighting level at the desktop was constant at 420 lux, which is within the range recommended for office workplaces. Our apparatus was located on a table so the light of the LEDs was reflected by a wall.

Seven participants (3 female, 4 male) aged 24-52 ($M=29.0$, $SD=10.5$) took part in the study. All participants ranked their typing speed as average. Four participants used ten-finger-typing.

At first, participants were introduced to the idea of Ambient Timer. Participants were then asked to write texts to randomized keywords while being shown the light designs in randomized order. Each trial lasted ten minutes. A popup message ended the trial after an additional minute if participants failed to notice the end of the time period. Participants were told to stop writing in what seemed a sensible manner to them whenever they thought that time was up. There was a break after four trials. One experimenter monitored the participants at all times. We measured the time usage for writing as well as had participants fill out a post-hoc questionnaire.

Results

Sine-wave change from green to orange showed the best results in our experiment with respect to participants thinking that they were able to finish in time ($M=1.9$, $SD=1.2$) - (1=strongly agree, 5=strongly disagree) - and being able to finish in a sensible way ($M=1.7$, $SD=1.1$). Worst results in these categories were experienced in the sine-wave change in saturation (Time $M=2.7$, $SD=1.7$; Sense $M=2.3$, $SD=1.9$).

Least distracting design was exponential change from green to red ($M=4.7$, $SD=0.5$), while most distracting was sine-wave change in saturation ($M=2.7$, $SD=1.4$). Exponential changes overall were seen as less distracting ($M=4.4m$, $SD=0.8$) than sine-wave changes ($M=3.3$, $SD=1.3$).

Concerning the time, when participants stopped writing, exponential green-red ranks best. All but one participant finished before the given time was up ($M=44.4sec$, $SD=14.4sec$). Worst results were recorded in the exponential green-orange condition, where 5 of 7 participants did not recognize the end of the time period. Participants said that the change dynamic was difficult to detect in this condition.

Qualitative answers in the questionnaire show that participants felt confident in detecting the end of time in the exponential green to red change. Sine-wave changes were either fully accepted or strongly rejected by participants. In exponential change conditions participants sometimes found it hard to detect the end of the transition. On changing bright-

ness, one participant said “it would be more intuitive to have a change in brightness increasing rather than decreasing”.

Discussion

Our prototype study offers promising results. Overall the system helps users understand in an unobtrusive way, when they should finish a task. Changes in saturation or brightness seem to be less intuitive and easy to perceive as changes in color. A change between complementary colors seems to be superior to a change between neighboring colors. This may be due to the well-known meaning of green-red in our society. Rapid changes in sine-wave conditions seem to be more distracting than gradual changes in the exponential conditions.

One limitation comes from the fact that we have only tested changes using a decreasing parameter values (de-saturate, reduce brightness) so far. Participant feedback suggests potential in designs with an increasing brightness.

CONCLUSION AND FUTURE WORK

We have introduced “Ambient Timer”, an ambient light display designed to unobtrusively remind users of upcoming appointments. We have shown in a lab study that the system helps the users to finish or sensibly interrupt their tasks in time. We discovered that exponential designs are less distracting than sine-wave designs and color changes are most efficient for signaling the end of available time. We have also noted a large acceptance by the participants of our lab study.

Future work should focus on exploring further light designs using increasing measures. Once a set of promising designs has been established a long-term study should be conducted in an office environment, thus allowing the Ambient Timer to become and function in a truly ambient way [1].

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