MULTITASKING IN A MOBILE CONTEXT

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ABSTRACT

Mobile computing on a handheld device requires user interaction design for multitasking. Investigating user anticipation and origin of interruptions on a handheld indicates that designing for guiding user attention and mediating of interruptions can support user web task performance.

Keywords

Mobile context, multitasking, attention, task switching

1. INTRODUCTION

The nature of mobile computing creates user issues due to constraints of wireless technology, the mobile context (environment, task characteristics, device etc.) and use of outdated web design concepts. During mobile computing, users often experience frequent disconnections and data loss due to poor network coverage from loss of transmission [5]. Users must also cope with mobile device constraints for limited screen size, limited input capabilities (e.g. small keyboard) and a restrictive physical environment (e.g. noisy location), [5]. Today, commerce services used on handheld devices are designed for screen presentation and interaction for the desktop user.

Innovative interaction design solutions are required to facilitate user and handheld interaction with web activities in a mobile context. When designing web services for a mobile context, a users multitasking interaction needs to be considered. For example, a user on a noisy train with a handheld device can purchase Internet tickets while concurrently having to answer a cell phone call and get off the train then finish the Internet ticket purchase. Alternating between tasks (multitasking) on a handheld can result in usability issues such as incomplete web tasks, disorientation, need for recovery during a web task and juggling of tasks while mobile computing.

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The Personal Assistant for onLine Services (PALS) project aims at design concepts for an intelligent interface with a virtual assistant to mediate interaction for multitasking interaction between the user and web –site or –service. PALS will support a user in quick and accurate web task performance using interaction design concepts developed for a mobile context.

This paper provides an overview of the theoretical foundation of multitasking in a mobile context, study hypotheses and results supporting interaction design concepts for an attentive interactive display and mediating of interruptions for the PALS intelligent interface.

2. MULTITASKING AND TASK SWITCHING

Mobile computing is a highly complex and attention intensive task. Interaction between the user, device, web service and environment influence how attention is allocated and information processed for activities in a mobile context. Interruptions are common to mobile computing and problematic due to cognitive limitations of users attention, limiting efficiency during multitasking on a mobile device. An interruption can influence a user to alternate or switch attention (task switching) from the task to the interruption. This multitasking places an increased burden on attention and memory.

Task switching describes user performance on multiple tasks conducted in an alternating fashion, engaging switching of attention from one task to another. In the context of this research, the focus is primarily on attention and on the associated costs related to task switching, represented by performance time on a task and number of errors. Task switching can be used to examine the effects of origin and anticipation of interruptions on web task performance during multitasking with a handheld.

Tasks were identified for observing users multitasking with interruptions in a mobile computing situation. For example, a participant was presented with a scenario to purchase shares of company stock. The activity consists of tasks to buy stocks on a specific web site. During the transaction the user automatically responds to stimuli on the web site by clicking on links etc. and responds to disruptions in the environment, a ringing phone or instant message.

This research draws a relationship between task switching in a mobile context and serial attention. Serial attention is required when multitasking and involves adopting a task, shifting to a different task and back to the original task [1]. When a user attends to an interruption during a primary task, the user is serially attending to the primary and interruption task. Previous research suggests that a delay in switching time to another task may be a result from chunking behaviour, which refers to the tendency to delay switching until completion of a sub task [2]. Switching of attention back to a primary task can also be dependent on the type of interruption that causes a switch. Furthermore, delays in switching may be related to difficulty with reconfiguring attention to another task. Reconfiguring of attention is comprised of several aspects including: inhibition of responses to previous tasks, selection and activation of new intentions and schemas, and sequencing of operations in time [3]. Reconfiguring of attention can explain costs such as increases in performance time and increase in number of errors involved during task switching and provides a foundation for further investigation into multitasking and attention during mobile web tasks.

3. MULTITASKING AND INTERRUPTIONS

To facilitate task performance in response to interruptions, an understanding of factors that influence multitasking during mobile computing is required. How do factors such as origin and anticipation of interruptions influence web performance task time during mobile computing? An initial study examined the effect of anticipation (expectation or no expectation) and origin (i.e. instant messaging or phone, intercom) of an interruption on user web performance on a mobile device (iPAQ h3800 pocket PC) or desktop computer group [4]. The origin and anticipation of an interruption is expected to influence web task performance on a mobile device. It is hypothesized, that web tasks with interruptions will take longer to complete on a mobile device than a desktop computer, due to a smaller screen, limited input interaction and increased demands on attention. Instant messaging (IM) interruptions are more disruptive to web task performance, than phone or intercom interruptions, due to similarity in computing medium (i.e. IM, web task). Interruptions anticipated by the user are expected to facilitate attention, promoting efficient web tasks actions and less disruption on web performance than unanticipated interruptions, regardless to platform or origin of interruption. Anticipated interruptions will decrease web task performance time, compared to unanticipated interruptions, particularly on a mobile device. These hypotheses were confirmed in an initial study and they provide a starting point for design concepts to improve multitasking with a handheld.

4. RESULTS AND DESIGN CONCEPTS

Mobile web tasks with interruptions appear to last 1.5 times longer in comparison to a desktop [4]. Attention indicators can reduce the time spent on a mobile web task when receiving interruptions. A *Point of Return Indicator* can direct a users attention to a suspended task after an interruption. For example, a highlight around a text box can indicate a specific point in a task. An *Interactive Suspension Point* is a bookmark concept. With a stylus, a user can tap the screen to indicate to the system a point of return in a task. When returning from an interruption, PALS will then present a point of return indicator. Intelligent mediation can be used to handle computing interruptions. *Interceding IM interruptions*, the assistant handles IM interruptions during web transactions. IM interruptions increase web task time, compared to phone or intercom interruptions for mobile and desktop computing [4]. *Transparency of interruptions*, when an IM is interceded, the assistant informs the user creating anticipation to deal with the interruption. The expectation of receiving an interruption on a handheld decreased web task time, compared to no expectation of an interruption [4]. *Virtual assistant and user communication should be in a different presentation mode (e.g. voice) from the primary web task*. Virtual assistant communication via a mobile screen is considered an interruption. A similarity in computing mediums for interruptions (e.g. IM and web task) indeed prolonged web task time [4].

5. CONCLUSIONS

In conclusion, the mobile context and associated usability issues impede a users performance for speed with web tasks on a handheld. The study supports that IM is disruptive to a web task. Furthermore, anticipation of an interruption is less disruptive than non-anticipated interruptions on mobile web task performance time. Future research will focus on validating the interaction design concepts for the Point of Return Indicator, Interactive Suspension Point and mediating interruptions.

6. REFERENCES

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