



Attention Aware Systems  
Introduction to Special Issue

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The inspiration for this special issue on Attention Aware Systems came from a workshop on *Designing for Attention* held at the Annual conference of the British HCI group in 2004. As digital environments become more and more complex and the tools for managing information become more and more advanced, it is crucial to assist users in selecting their short term and long term attentional focus. One of the major themes that emerged from the workshop was the importance of further in-depth interdisciplinary research on the theory, methodology, and implementation of systems capable of supporting attentional processes in digital environments.

This issue aims at beginning to address this need. The interdisciplinary nature of the work in this field is well represented by the research described by the papers included, some of which were originally presented at the 2004 workshop.

The first three papers provide an introductory overall view of the issues addressed by attention aware systems. The article by Roda & Thomas discusses many different factors operative in attentional processes, reviews the state of the art in cognitive psychology research on attention, analyses existing methodologies for Attention Aware Systems organised around key functionalities, and suggests possible future research directions. Wood, Cox, & Cheng identify eight major issues of attention as they relate to design. They emphasise the complex and multi-faceted nature of attention processes. The paper by Rapp discusses the applications for Attention Aware Systems in computer supported learning environments.

A large body of theoretical and applied research has focussed on visual attention; the following four papers explore this aspect of attention management. The paper by Toet reviews the techniques used to identify and register gaze direction and how they are currently used; it suggests possible future applications of gaze-directed displays in Attention Aware Systems. Hillstrom & Chai discuss factors that guide or disrupt attentive visual processing, with particular emphasis being posed on distraction with reference to factors such as stimuli distinctiveness. Design implications of such factors are proposed. Hyrskykari analyses how to overcome inaccuracies in detecting and tracking the focus of visual attention. The example of a system supporting the reading of foreign language documents,

relying on algorithmically corrected detection of visual focus, is provided. Davies, Tomkinson, Donnelly, Gordon, & Cave offer a specific study on visual saliency with respect to updating maps; they present the results of experiments on the effects of expertise, exposure, and other such factors on visual attention.

One of the most studied aspects of attention management is the role played by interruptions in task performance. Studies in several disciplines acknowledge that interruptions cannot be eliminated and that often they are necessary or beneficial for the performance of tasks. The focus of research on interruption management is on identifying the factors that reduce disruption and increase the benefits to individual's activities. The paper by Bailey & Konstan identifies effects of interruption and proposes optimum times for interruptability. Bailey, Adamczyk, Chang, & Chilson propose a framework for specifying, monitoring, and reasoning about users tasks with the aim of selecting the best times of interruption.

The variety of factors that need to be taken into account for supporting attention management is well represented by the research described in the last set of papers by Ho & Spence; Streefkerk, Esch-Bussemaekers, & Neerincx; and Vertegaal, Shell, Chen, & Mamuji. Ho & Spence consider the role of distribution of spatial attention with respect to visual-textual, visual-graphic, and auditory cues and suggest, for example, the possibility that non-verbal directional cues (not linked to language) could be more effective. Streefkerk and his colleagues report on a specific design of attentional user interfaces for momentary attention; amongst other factors they consider time and users' attentive state.

We conclude this issue with the paper by Vertegaal and his colleagues who propose a framework for augmented attention based on multi-party dialogues and integrating several modalities; they also suggest possible future directions for attentive user interfaces.

We hope that this collection of contributions will stimulate further theoretical and applied research.

We believe that whilst many aspects of human cognition are central to the design of more usable systems, attentional processes subsume many of these aspects and that support to these processes

should become a central objective of HCI research and of system design in general. We will appreciate receiving any comments and suggestions from the research community which might aid and support on-going work in this direction.