



Beyond Ambient Display: A Contextual Taxonomy of Alternative Information Display

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ABSTRACT

With the recent emergence of a wide range of information displays that reach beyond the traditional graphics-based computer screen, it seems that the original definition of ambient display, and its focus on user attention and aesthetics, has become diluted. Instead, we propose a taxonomy of alternative information displays that is mainly based on context, in terms of the data it represents and the environment it is located in. The resulting model described three different categories: visualization as translation, visualization as augmentation and visualization as embodiment. This model aims support visualization designers and developers in considering the correct visualization as well as display medium. [Article copies are available for purchase from InfoSci-on-Demand.com]

Keywords: Ambient Display; Information Visualization

INTRODUCTION

Since its conception about 15 years ago, most discussions in the field of information visualization have focused on the graphical representation of data on screen-based output media. The use of traditional screens (including light projections) for the purpose of presenting information graphically possesses several obvious qualities, including: 1) its dynamic frame-rate to update the

displayed content quickly and frequently, 2) its huge, detailed display resolution to convey a large amount of visual objects simultaneously, and 3) its capability to “immerse” people within the presentation, in particular for applications that require user interaction. Due to the evolving character of modern technology, the very nature of digital screens is in constant flux. A wide spectrum exists between the ultra-bright LED screens as large as (and non-conventionally proportioned) as skyscrapers, and

e-paper displays as thin, light and flexible as real paper. For all the obvious qualities such displays enjoy, they still generally require dedicated flat surfaces, brightly illuminate their surrounding environments, are less perceivable in daylight, tend to obtrude everyday tasks by grabbing visual attention, and often remind users of advertising and work-related tools rather than an informational medium that encourages contemplation, analysis or reflection of the content being shown.

Therefore, the question can be asked whether displays, and in particular those displays located in public or environmental contexts, should mimic the inherent discrete nature of computing by utilizing pixel-based graphics. Instead, we propose that such displays should be inspired by how our everyday physical environment is able to communicate meaning and functionality by natural and easily understood affordances. By considering what exists “beyond the screen”, novel display techniques might emerge that are less disruptive, but more enjoyable, in conveying information in meaningful and effective ways. Naturally, an inherent trade-off exists between the communication bandwidth and the obscurity of the physical embodiment (in the sense of providing material shape) of information. However, we claim that what a non-graphic pixel-less display might lose in information resolution, it could make up in a richer, more intriguing and memorable experience that nonetheless is able to communicate insight and contemplation.

The concept of displaying information in alternative, non-screen based ways is not new. In particular, the field of ambient display (sometimes also labeled as *peripheral display* (Matthews, Dey, Mankoff, Carter, & Rattenbury, 2004), *ambient visualization* (Skog, Ljungblad, & Holmquist, 2003),

informative art (Redström, Skog, & Hallnäs, 2000), (Skog et al., 2003), *ambient awareness device* (Brewer, Williams, & Dourish, 2005) or *ambient information system* (Pousman & Stasko, 2006)) has focused on representations that primarily target the periphery of human awareness. However, with the recent emergence of a wide spectrum of alternative information displays, as overwhelming as architectural facades (ChaosComputerClub, 2001), and as subtle as electronic jewelry (Fajardo & Vande Moere, 2008), it seems that the original definition of ambient display has become diluted, in spite of various existing models (Pousman & Stasko, 2006), (Tomitsch, Kappel, Lehner, & Grechenig, 2007) and heuristic evaluations (Mankoff et al., 2003). This article therefore reaches beyond the concept proposed by ambient display and its main focus on functionality, user attention and aesthetics, by presenting a concise taxonomy of alternative information displays that is instead based on the notion of context. It merges and builds upon previous models on Physical Data Visualization (Vande Moere, 2008) and the Invisible Display (Offenhuber, 2008), in capturing the essence that drives most, if not all, approaches towards conveying information beyond the traditional screen.

THE DEFINITION OF CONTEXT

In academic literature, the discussion of ambient displays is mainly limited to their intrinsic qualities. Displays are regarded as solitary objects - only the relationship between observer and display is taken into account. Yet, the relationship between a display and its context is equally important for the experience, especially when the display is seamlessly embedded into the

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