The Gateway: A Navigation Technique for Migrating to Small Screens

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ABSTRACT
Displaying and navigating information on a large screen can be a challenge and has resulted in a variety of techniques such as text summarization and fisheye. An additional challenge is how to organize information on small screens in a format that can be understood in its context and facilitates navigation within the inherent constraints of these devices. We introduce a navigation model, the Gateway, to decrease transitional volatility introduced by migration of web pages to the smaller screen.

Keywords
Personal Digital Assistant, PDA, small screens, migration, navigation, gateway

INTRODUCTION
Most web pages have been designed for use on large screens. The increased popularity of handheld computers or Personal Digital Assistants (PDAs) leads to the question of how do such web pages translate to the smaller screens? A major challenge of displaying web pages on the small screen is how to migrate information from the large screen so that the display and layout of the web pages can be understood in its actual context to allow for easy navigation.

A major constraint of data use on PDAs is the small screen area that limits the amount of information that can be displayed at one time. An average laptop screen displays about 200 words at a time, while most small screen devices only display about 50 to 75 words. Other constraints include input, low resolution, less memory and application restrictions (such as no applets or JavaScript) [6]. The portability of PDAs makes them more sensitive to noisy environments with the high probability of interruptions and movement [3].

These restrictions can negatively influence performance of web tasks such as browsing, reading and comparison tasks on a PDA. Furthermore, users migrate between devices (for instance from their office computer, to their laptops and to their PDAs). When users migrate between devices there is a need to maintain the integrity of the information. In this work, we outline currently applied web migration and navigation techniques and introduce a new navigation model based on the Gateway metaphor [8].

MIGRATION AND NAVIGATION
Migration is the process of taking data originally designed for display on a large screen and transforming it to be viewed on the small screen [6]. When users migrate between devices there is a need to maintain the integrity of the information by minimizing volatility. Transitional volatility occurs when the look, design, layout and perhaps even information changes while viewing the same web page on different devices. The higher the volatility, the greater the user frustration and increased chance for disorientation [2].

When users visit a web page, they construct a mental model [1] and we want to minimize the adaptation of the existing mental model when migrating between devices to reduce volatility. A variety of factors that help to form a mental model of a web page can be examined to measure the integrity of the existing mental model when switching between devices. These factors include visual cues, layout, scrolling, distance to information, information changes and information density [2][7].

Currently, several techniques are used for migrating data meant for a regular screen for use on a small screen. At the same time increasingly sophisticated navigation capabilities are needed to compensate for the reduced screen size. The simplest migration technique is Direct Migration in which the data is simply sent to the small device and the user navigates by scrolling or paging. Data Modification techniques modify the data for use on small screens, for example, by reducing images and text summarization [6]. Data Suppression techniques just remove original data such as selecting keywords, first *n* words or sentences or Z-thru mapping [7]. Users can generally click to expand or compress data selections.

A forth migration technique, Data Overview is based on the Focus + Context model [7]. This model provides an overview of the entire data set and users can focus in to get

finer grained detail on some selected part of the overview. Information may be distorted or shrunk but the overview is always available. Detailed information is displayed within the context of the global view to provide a cognitive model of the information space. This has been shown to improve navigating a large amount of information and can lessen navigational disorientation [1][7] on larger screens. Common Data Overview navigation techniques include fisheye views, context maps, Zoom and Pan, brushing techniques, such as riffling techniques [7], and image representation of the layout [4] on larger screens.

There are two broad categories for the layout to support navigation within the Data Overview. Hierarchical models present information in nodes or layers that can be traversed to expand or collapse. Second, an overview arrangement presents all the data in compressed format, which is then expanded or collapsed as needed.

To minimize disruption and transitional volatility when migrating between devices and to preserve the initial mental map, we propose using the Gateway metaphor [8]. This approach for small screen web navigation is similar to the 'Digital Dashboard' model [5].

THE GATEWAY

The Gateway displays the web page designed for a large screen on the small screen by reducing the web page in scale to fit the screen and remains fixed. It replicates the exact look, design and layout of the source web page. Selecting individual elements within the Gateway results in a finer grain view as shown in Figure 1. Users navigate the finer grain view as they would on the large screen web page (for example, follow a link or select a menu item).

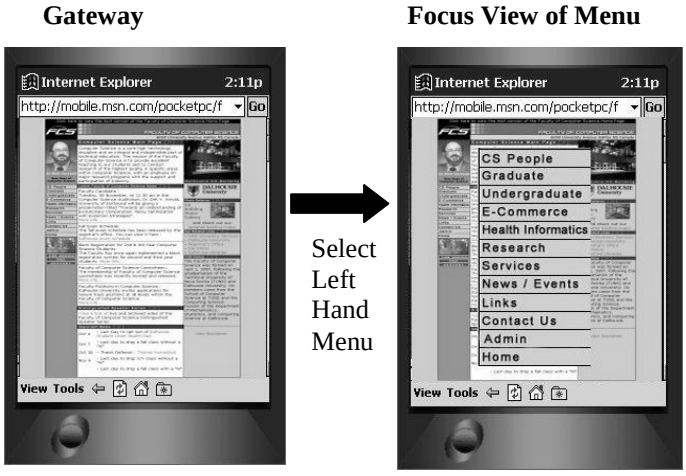

Figure 1
Gateway of Dalhousie Computer Science (www.cs.dal.ca) web site

Hypothesis

Users can migrate more effectively and efficiently between devices using the Gateway approach. The global and local context of a web page designed for a large screen displayed on a small screen should reduce volatility measured by the number of clicks to complete a web task. Further, we propose that by providing the exact layout and original format of a web page on the small screen, the Gateway will help users navigate the information more easily and lessen disorientation by reducing transitional volatility than the Hierarchical model.

FUTURE RESEARCH

We will conduct user testing to compare the effectiveness and efficiency of the Gateway navigation and Hierarchical models. Users will complete both a simple lookup task and a more complex task of comparison using both models. Efficiency will be measured by the number of actions to complete a task, while effectiveness will be a measure of the accuracy of the result of the task. Users will migrate between a web page on a large screen device to the same web page on the PDA and vice versa using both navigation models to compare the transitional volatility when migrating between devices. The volatility of the two models will be further measured by comparing the influencing factors of the mental model development for the web page, including visual cues, layout, scrolling, distance to information, information changes and information density.

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