Web navigation structures in cellular phones: the depth/breadth trade-off issue

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Abstract

One can browse the web with a variety of devices, including hand-held devices such as the cellular phone. The small screen of those devices poses some serious usability issues, one of which is the appropriate hierarchy depth of the web site. In this study, we empirically examined whether a broad navigation structure, which was found to be superior in regular screen-size platforms, also has an advantage for a small-screen device such as the cellular phone where it may require more movements and scrolling between screens of the same hierarchical level. Navigation times and success rates were measured for two search tasks in a mock web site that was built in two versions: one with a broad navigation structure and the other with a deep structure. Both structures were tested with cellular phone emulation and a standard desktop personal computer (PC). Results indicate that performance was better with the broad navigation structure for both the cellular phone and the PC. In addition, performance was better with the PC as compared to the cellular phone, and this difference was pronounced in the broad structure. The results are discussed in terms of the impact of device-independent characteristics of the hierarchy depth along with the theoretical account of increased working memory load, confusion and disorientation associated more with deep structures.
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1. Introduction

With the advent of today's technology, web browsing has become an activity that can be performed with a variety of platforms and devices such as the desktop

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personal computer (PC), interactive TV, cellular telephones, Personal Digital Assistants and more. Platforms such as the cellular phone and Personal Digital Assistants have unique operational characteristics that directly influence their web browsing usability and thus presenting developers with unique design challenges. The major influencing characteristics are the small physical display and the mobile context of usage. In this paper we are focusing on the impact of the small display on critical aspects of the navigation structure in web sites.

The root of the usability problem is the desire to let users of small screen devices have access to the same information that is presented in the fixed, regular-size screen platforms such as the desktop PC in addition to letting the user perform similar tasks with this information (Buchanan et al., 2001; Ericsson et al., 2001). Typical approaches to deal with this requirement are to either deliver the information as is or change the data structure, reformat and adapt it to the small screen (Watters et al., 2003). Various ways of adaptation were developed, the primary one being re-formatting page layout. Reformatting guidelines were published for Personal Digital Assistants (e.g., AvantGo; Palm OS) and for cellular phones, primarily Wireless Application Protocol phones (e.g., WAP Forum, 2001; Sprint Spectrum, 2002; Nokia Corporation, 2002; Openwave, 2003).

One line of investigation that is related to the content reformatting approach was to examine the ability to read information from small screens (e.g., Duchnicky and Kolers, 1983; Reseil and Shneiderman, 1987; Jones et al., 1999). In general it was found that smaller display size with shorter text lines degraded visual search and reading performance.

Another line of development and research looked at the feasibility and efficacy of various dynamic content adaptations to the small screen. These included the use of Rapid Serial Visual Presentation to solve the space–time tradeoff of small screen presentations (e.g., de Bruijn et al., 2002; Ford et al., 1997), the use of transparent navigation mechanisms (Kamba et al., 1996), the use thumbnailing of web pages to enhance search (e.g., Wobbrock et al., 2002), and real-time restructuring of web pages to fit the small screen (e.g., Keranen and Plomp, 2002; Buyukkokten et al., 2001; Chen et al., 2003).

Another common approach to adapt the content to small displays is to restructure the information and divide it into smaller displayable chunks. In general it was found that such an approach was associated with more navigation steps required in the small screen device, such as backward and forward (e.g., Dillon et al., 1999), longer web search and browsing history usage (de Bruijn et al., 2002), and longer browsing paths (Jones et al., 1999). Taken together, the approach of information re-structuring in small-display devices was shown to influence navigation in the web site.

Regardless of the platform, information structure or architecture is critical to web site navigation (Brinck et al., 2002; Neilsen, 2000). There are two primary factors that characterize web site structure or the navigation structure: the number of items per page and the number of levels in the site. When there are few items in a page (i.e., small chunks), it creates many levels and the structure is considered to be deep. When there are many items in a page (large chunks), the structure is considered to be wide or broad since there is no need for many levels.