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# Mobile Access to the Digital Library

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## Abstract

*The paper discusses the access of Digital libraries through other devices. It discusses the issues like size of the screen for display, mental model, access to critical data, etc. which may seriously affect performance in mobile environment.*

Along with the explosion of digital content has come the widespread deployment of wireless networks and availability of mobile devices to use these networks. With the increased popularity of small screen devices, more people are using their smaller devices to access the information over the Internet. In this paper we concentrate on the effect of viewing information from web-based Digital Libraries on a small screen, especially for users who switch between large screened devices and small screen devices either between sessions or during sessions. Clearly, we cannot maintain separate versions of the data in a Digital Library for each anticipated device but must move towards algorithms that provide automatic transformations for the migration of information between devices as needed. The goal is to support the information needs of the user independent of the device in hand so that the access to the Digital Library is seamless and ubiquitous from their perspective. Understanding the cognitive and navigational factors that affect the user experience when using small screen devices and when switching between devices are critical if this is to be successful. In this presentation we consider performance transformation issues within the context of current research.

Several studies have shown that screen size *does* have an effect on performance. A recent study by Jones et al (1) examined the effect of screen size on the overall metric of task performance and they found that the smaller screen size impeded task performance. Several factors have been identified. First, line width has been shown to effect performance more then number of lines. Duchnicky and Kole (2) showed that width was more important than height for comprehension of text on a screen. Of course, accessing data of any kind on a smaller display may involve additional scrolling, which has a mixed review on user task performance.

Second, studies, such as Reseil and Shneiderman, show that smaller screen sizes result in slower reading time of textual material. Dillon showed that smaller screens result in many more page forwards and backwards interactions. Third, the organization of menus has an effect on performance. Han and Kwahk (3) showed that searching through menus on smaller displays is much slower than on conventional displays. It is interesting to note that this reduction in menu-based access does not affect hierarchical menus as much (4).

Fourth, the use of search functions, like "find" in Windows, increases as users get into smaller and smaller displays. Jones et al (1) found that small screen users followed shorter paths and used search facilities much more (double the rate) of the large screen users. Not too surprisingly, small screen users had to use scroll right and down extensively to read the data. A recent study of 84 users showed that the effectiveness of performance on complex tasks using larger tables of data on a small screen was significantly improved by the consistent use of context information, even though it took up to 25% of each screen. Furthermore, this study showed, surprisingly, that the introduction of a search function for accessing data in a large table on the small screens degraded performance.

Automatic transformation algorithms are being developed to transform the source data in ways that make it more usable on the target device. The transformation process depends, of course, on the granularity of the source information. If the data is archived as large units, say reports or web pages, then the transformation process may need to first decompose or parse the unit into smaller structural units such as tables, lists, text, images. If the data is archived in finer grained units, such as tables, lists, paragraphs, then the process is one of best-fit composition of these units. The first process is more difficult and often is accompanied by loss of data. Bickmore and Schilit (5) proposed a transformation matrix where data loss is categorized as semantic, i.e. removing summarizing content, or syntactic, i.e., outlining or compressing data. Once syntactic and/or semantic components have been identified it is a relatively straightforward process to create useable small screen versions of text chunks, forms, tables, lists, and portals. It is not, however, as simple to support the context of the original information within which individual components get their semantics.

We consider three variations of the transformations (6) that support context for the user; direct, linear, and focus + context. Direct transformation methods simply allow the user to view the information on any device as determined by the server, typically requiring both vertical and horizontal scrolling. Linear transformations for small screens compose a linear or possibly hierarchical view to the information so that it is accessible on the small

screen by vertical scrolling. Focus + context transformations, like those developed for large data sets, provide an overview of the entire information space for the user while allowing the user to zoom in on specific data as needed. These transformations support late committal navigation, that is, the user can probe the data at the higher level and only request details as needed. A new type of contextual transformation, called the Gateway, is introduced to support users who switch back and forth for data access between their small screen and large screen devices or who collaborate with users on different devices. The Gateway uses as its context an exact replica of the large screen version to deuce the cognitive overhead usually associated with multiple versions by allowing the user to use a single mental model for all sizes.

In summary, in discussions of access to Digital Libraries using a wider range of devices many of which will have smaller screens, we need to recognize that the size of the screen matters for the user, consistency of mental model affects performance, access to all of the data may be critical, and distractions in mobile environments may seriously affect performance. These issues need to be address if mobile access to Digital Libraries will indeed "Save the time of the reader."(7)

## References


1. [JonM99]Jones, M., Marsden, G., Mohd-Nasir, N., Boone, K. and Buchanan, G. 1999. Improving Web
2. [DucK83]Duchnicky,R.L. and Kolers, P.A. 1983. Readability of text scrolled on visual display terminals as a function of window size. *Human Factors.* 25, 683-92.
3. [HanK94]Han,S.H. and Kwahk,J. 1994. Design of a menu for small displays presenting a single item at a time. *Proc. Human factors and Ergonomics Society 38th Annual Meeting*. 360-364.
4. [Swie90]Swierenga,S.J. 1990. Menuing and scrolling as alternative information access techniques for computer systems; interfacing with the user. *Proc. Human Factors Society 34th Annual Meeting.* 356-359.
5. [BicS97]Bickmore, T.W. and Schilit, W.N. 1997. Digestor: Device Independent Access to the World Wide Web. In *Proceedings of the Sixth International World Wide Web Conference.* Santa Clara, California, April 1997, 655-663.
6. [MacW03]MacKay, B. and Watters, C. 2003. The Impact of Migration of Data to Small Screens on Navigation. *IT&Society*. 1(3): 90-101.
7. Ranganathan, S.R.: *Prolegomena to Library Classification*, Bombay: Asia Publishing House, 1967.

8. Albers, M. and Kim, L. 2000. User Web Characteristics Using Palm Handhelds for Information Retrieval. In *Proceedings of IPCC/SIGDOC Technology and Teamwork*. Cambridge, Massachusetts, Sept. 2000. IEEE: New York, 125-135.

9. Chen, Y., Ma, W. and Zhang, H. 2003. Adapting Content to Mobile Devices: Detecting Web Page Structure for Adaptive Viewing on Small Form Factor Devices. In *Proceedings of the 12th International Conference on World Wide Web*, Budapest, Hungary, May 2003. ACM Press: New York. 225-233.

10. Danielson, D.R. 2003. Transitional Volatility in Web Navigation. *IT&Society*. 1(3): 131-158.

11. Dillon, A., Richardson, J., and McKnight, C. 1999. The Effect of Display Size and Text Splitting on Reading lengthy Text from the Screen. *Behavior and Information Technology*, 9(3): 215-227.

12. IBM. 2002. Demonstrations of IBM Transcoding Technology [online]. Available: www.research.ibm.com/networked_data_systems/transcoding/ Accessed: April, 2003

13. Interaction on Small Displays. In *Proceedings of the 8th International WWW Conferences*, Toronto, Canada, May, 51-59.

14. Resiel,J.F. and Shneiderman,B. 1987. Is bigger better? The effects of display size on program reading. In G.Salvendy (Ed.) *Social, Ergonomic and Stress Aspects of Work with Computers*. Elsevier, Amsterdam. 113-122.

15. Watters, C., Duffy, J. and Duffy, K. 2003. Using Large Tables in Small Screen Devices. *International Journal of Human-Computer Studies* (IJHCS). 58: 21-37.

16. Watters, C. and Comeau, D. 2000. Adaptive Portals with Wireless Components. *Distributed Communities on the Web, Lecture Notes in Computer Science*, Springer, Berlin, 1830: 34-44.