WWW Site Design Using Fisheye Views: An Empirical Study

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WWW Site Design Using Fisheye Views: An Empirical Study

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Abstract

In many contexts, decision-making situations call for examination of local detail without losing awareness of global context. Knowledge will be more useful if organized and presented accordingly. Fisheye view methods are one way of effective knowledge presentation and have been used in displaying various knowledge structures. This study explores an application of the fisheye view concept on World Wide Web site design. A related experiment and following empirical tests are described.

Introduction

Knowledge is a critically important element of good decision-making. Knowledge quality is affected by factors such as accuracy, consistency, and certainty, as well as clarity, meaning, relevance and importance (Holsapple and Whinston 1996). Some of these factors (e.g., certainty and importance) are intrinsic in a specific piece of knowledge and are directly related to the knowledge content, whereas others (e.g., clarity and meaning) are a result of the way knowledge is organized and presented for use. The importance of knowledge presentation methods has received attention from many scholars in the last couple of decades. Researchers have explored the difference between graphs and tables as alternative methods of data presentation. Example studies from the “graphs vs. tables” literature can be found in Jarvenpaa (1989), and Vessey (1991).

The proliferation of information technology has led to an information overload. Information overload affects the quality of the knowledge used for decision-making. In many decision-making situations, there is a need to be able to get the immediately needed information in sufficient detail but to minimize the less relevant information. Yet this “less relevant” information provides the global perspective in which the detailed information is useful. Such situations call for examination of local detail without losing awareness of global context. Hence, knowledge will be more useful if organized and presented accordingly. Furnas (1986) introduced the concept of generalized fisheye views based on a similar observation: “humans often represent their own ‘neighborhood’ in great detail, yet only major landmarks further away. This suggests that such views (‘fisheye views’) might be useful for the computer display of large information structures like programs, data bases, online text, etc.”

Since their introduction in 1986, fisheye views have found applicability in displaying knowledge structures such as hierarchical tables (Egan et al. 1989), computer graphs (Sarkar and Brown 1992), and hypertext (Noik 1993). Schafer et al. (1996) present a summary of selected visualization systems and the enabling methods.

This paper aims to examine the effectiveness of using a fisheye view system for displaying contents of a World Wide Web (WWW) site. In this context, effectiveness means better organization of knowledge rendering it possible to display more information without causing information overload. For a detailed elaboration of the information overload concept, see Sharda et al. (1999).

In the original paper by Furnas (1986), the basic motivation for fisheye views were described and the “degree of interest (DOI) functions” concept was introduced to formalize generalized fisheye views. Most of the ideas presented by Furnas are applicable to viewing hypertext when hypertext is treated as a specific instant of hierarchical graphs.

Schafer et al. (1996) reported on a ”variable zoom” algorithm to generate fisheye views for two dimensional network graphs, and conducted an experiment to compare the traditional full-zoom methods to variable-zoom (fisheye) methods. Meanwhile, other research has addressed the effect of factors such as background and image size (Dreze and Zufryden 1997), design efficiency (Eighmey 1997), and link display and link density (Khan and Locatis 1998) on effectiveness of WWW sites.

This research (in progress) aims to combine ideas from studies on fisheye view models and those about effectiveness of WWW site design and perform empirical tests based on the following proposition:

Presentation of a WWW site via a fisheye view results in higher effectiveness than presentation via the traditional full-zoom method.

Method

To explore the effect of the presentation systems, the amount of useful information extracted by the users from the test sites will be measured. This can be done by
assigning a prespecified set of tasks and related questions
to each viewer and simply counting the number of correct
answers given to these questions in a limited time. Similar
methods have been used by Schafer et al. (1996) to
measure successful task completion in hierarchically
clustered networks, and by Plaisant and Shneiderman
(1998) to measure the benefits of their graphical system
designed for visualizing personal records. Hence, the
number of correctly answered questions (i.e., successfully
completed tasks) should be a fairly good indicator of the
information sharing facilitated by the presentation system.
This discussion leads to the following hypothesis:

Hypothesis 1: Presentation of a WWW site via fisheye
view results in more correct answers to the site-related
questions than presentation via the traditional full-zoom
method.

In previous literature, there is a virtual agreement to
use the “number of pages traversed” and “the total time
spent on the site” as surrogate variables for efficiency
(Khan and Locatis 1998) and effectiveness (Dreze and
Zufryden 1997) of WWW site designs. In this study, the
users of the two systems have the same limited time to
complete the tasks assigned to them, therefore the time
spent on the site is not critical. However, our assertion is
that the fisheye view system will not only help the
viewers in accessing a larger number of relevant pages,
but also reduce the number of irrelevant pages visited.
Therefore the second hypothesis of the study is:

Hypothesis 2: Presentation of a WWW site via fisheye
view results in traversal of fewer pages than presentation
via the traditional full-zoom method for completion of a
specific task.

An experiment is designed to test the hypotheses
above. The manipulation of the experiment is the
presence vs. absence of a fisheye view model in a WWW
site setting. The fisheye view model gives information-
users the opportunity to continuously change focus from
one Web page to another without losing awareness of the
relative hierarchical positions of the pages and the links
between them. This is in contrast to the traditional (full-
zoom) method where the hierarchies are discretely
separated with only textual rather than spatial clues
regarding their relationship.

As a first step of the study, a fisheye view model of a
Web site belonging to a subfunction of an academic
organization will be implemented. Currently, the site uses
a traditional full-zoom presentation method. The
implementation of the fisheye view model will be based
on the variable-zoom method proposed and implemented
by Schafer et al. (1996). The proposed variable-zoom
method works on a two-dimensional network of nodes
and links. In the implementation herein, the individual
pages (or sites) linked to each other will be treated as the
structures that they call “clusters” in their terminology. A
cluster is a combination of nodes that are at the same
hierarchical level. In this context, the “nodes” of this
implementation are the different elements such as frames,
text, and graphical objects found on a given page. The
links between different elements on a page that are
hypothetical in the traditional viewing method correspond
to the “links” between the “nodes” in the fisheye model.
Similarly, the hypothetical links between pages and/or
sites correspond to links between “clusters”. The Schafer
et al. algorithm obtains fisheye effects by magnifying
appropriate parts of lower levels to show detail while
embedding this detail in the remaining network. As the
first step of their implementation, nodes and clusters to be
magnified are zoomed by a magnification factor, Fe. As
the second step, other nodes and clusters are reduced in
size by a shrink factor, Fs. Finally, placement of all nodes
and clusters is determined.

In conducting the experiment, the subjects will be
randomly assigned to one of two groups using either the
full-zoom or the variable-zoom (fisheye) presentation
methods. Data will be collected by means of
automatically recording information on the WWW page
view seen by the subject, name of the page requested, and
name of the previous page requested. From the basic
information collected as described, the number of pages
accessed by each subject can be extracted. Meanwhile, the
subjects will fill out a questionnaire answering questions
that have their answers on pages within the site.

After the collection of data, the hypotheses of the
study will be tested using a Multiple Analysis of Variance
(MANOVA). If an overall significant effect is found in
the MANOVA, this will mean that the fisheye view
model affects effectiveness. Otherwise, we cannot reach a
statistical conclusion. In case of a significant overall
effect, the effect of the treatment on the individual
dependent variables will be tested separately.

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