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**DOES ZOOMING IMPROVE IMAGE
BROWSING?**

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Does Zooming Improve Image Browsing?

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ABSTRACT

We describe an image retrieval system we built based on a Zoomable User Interface (ZUI). We also discuss the design, results and analysis of a controlled experiment we performed on the browsing aspects of the system. The experiment resulted in a statistically significant difference in the interaction between number of images (25, 75, 225) and style of browser (2D, ZUI, 3D). The 2D and ZUI browser systems performed equally, and both performed better than the 3D systems.

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Keywords

Evaluation, controlled experiment, image browsers, retrieval systems, real-time computer graphics, Zoomable User Interfaces (ZUIs), multiscale interfaces, Pad++.

INTRODUCTION

In the past two decades, with the emergence of faster computers, the declining cost of memory, the popularity of digital cameras, online archives and even presentation slides, the amount of stored graphical information has skyrocketed. Having the ability to store and manipulate images is becoming more important as images are being incorporated into electronic documents [12]. These digital images are stored and electronically encoded for future retrieval. Hence, there is a growing need for more sophisticated ways of retrieving and browsing images. However, the advances of these tools have not grown as rapidly as the needs of potential users.

There is a vast diversity of users and individual biases that should be taken into consideration as we move toward multimedia systems. Graphical information is being used throughout many systems to help bridge the gap between such differences as languages, gender, age and personality.

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Sometimes pictures really are worth a thousand words, but what good are they if the interfaces do not offer the support that users need? In this paper we focus on the browsing aspect of the interface.

Browsing is not a new concept. Webster's New World Dictionary gives a basic definition of the term browse, to examine in a casual way. Adults browse for clothes on racks at their favorite department stores and children browse for sweets at their local candy shops. Vendors and department store owners have realized how to capitalize on sales. They know in order to maximize the purchase of their items, browsing needs to be made easy. Most storeowners understand that people will not select what they cannot see. For this reason, merchandise is usually displayed in a manner that best suits the targeted user.

Why should image browsers be any different? Just as librarians shelve books to make them easier for patrons to find, image browsers should display images in such a way that does not distract the user from the main task he/she is trying to perform. For instance, if a user is browsing for an image to include in a document, their browsing experience should not be such that it has made him/her forget the reason they sought the image in the beginning.

In image browsing, screen real estate is very important because it seems as if there is never enough. We believe 3D and zooming make better use of screen space than scrolling. We describe our experiment and give some practical guidelines for future image browsers.

In order to get a basis for understanding the context from which our system was designed, we offer the following definitions:

- 1) An *Image Retrieval (IR) System* is an application that returns one or more images given some descriptive information. This information can be in the form of:
 - a) An image,
 - b) Keywords or phrases, or
 - c) Natural language

- 2) An *Image Browser* is an application that allows users to select one or more images from multiple images. This browser has to:
 - a) Be able to display multiple images at one time (possibly reduced resolution versions), and
 - b) Support inspection of original full resolution versions of an image.

The returned set of images (results) obtained from the Image Retrieval query may be displayed in an Image Browser for further refinement of the search by the user. Often it is the case that the results of the query yield more images than the user desires, so he/she has to browse. It is unfortunate that many query systems ignore browsing and just give the results of the query perhaps in the form of a list. This makes it hard and sometimes impossible for a user to select exactly what he/she needs. After testing the features in many of the browsers we decided to contribute to the image browser community and make our own browser – a zoomable image browser (ZIB) (See Figure 1). We designed ZIB where searching and browsing are tightly coupled. With ZIB, the images located in the browse area represent the results of the query posed in the search section. Both the search term and query results can be seen in one view.

To begin our study we evaluated sixteen (16) image browsers (see Table 1). We compared and contrasted many features of the commercial and shareware products to discover some of the most popular techniques used in image browsers. We especially targeted software packages that were designed for the purpose of browsing a collection of images. To our surprise, most of the image browsers did not deviate from the typical two-dimensional grid of thumbnails approach. We chose ThumbsPlus (see Figure 2) to be the commercial browser we would later use in the experiment because it is a good example of a commercial image browser. ThumbsPlus is a grid of thumbnails that is easy to use and supports access to the full-size image.

Name of Package	Name of Company/Developer
Corel Mosaic	Corel Corporation
PhotoMagic	MicroGrafx Corporation
PhotoCD Access	Eastman Kodak Company
GifDesk	Jay Wherley
Fotoflood Image Manager	EPICAD Design Incorporated
Picture Publisher	Micrografx Incorporated
PhotoDisc	PhotoDisc
Image AXS Pro	Digital Arts and Sciences
ThumbsPlus	Phillip Crews
ACDSee	ACD Systems Unlimited
IrfanView32	Irfan Skiljan
VPIC	Bob Montgomery
CompuPic	Photodex Corporation
Extensis Portfolio	Extensis Corporation
Cumulus	Canto Software
PowerPoint	Microsoft Corporation

Table 1: List of systems analyzed

System Design of the Zoomable Image Browser (ZIB)

We designed a system that integrates image browsing and image retrieval. Query formulation is allowed within the search area. Users have the option of performing a simple or an advanced search. Within the simple search, Users have the option of entering one word or one phrase on which the query will be performed. Within the advanced search, the user may form a query by using a combination of words and/or phrases and Boolean connectives. The interface for the search area was written in TCL/TK and the search procedure was written in C++. Once query formulation is complete and the images which satisfy the query have been retrieved, the images are returned within the browse section.

The results of the query appear in the lower (Browse) section and can be browsed by panning and zooming in and out of individual images as well as all images at once. The browse section was built using Pad++, a general purpose engine for writing zoomable user interface [2]. ZIB offers a unique advantage over many browsing systems in that the user has control of the tradeoff between the number of images displayed and the resolution of those images. For example, if ten images are present in the browse section and the user wants to hone in on four of the ten images, he/she can zoom in on the view and see the images enlarge before their eyes. This gives them higher resolution but fewer images. The inverse is also true. Users can zoom out to get lower resolution, but greater numbers of images. Users can also perform in-place zooming which allows them to see an image at full resolution located in the same place in the same scene.

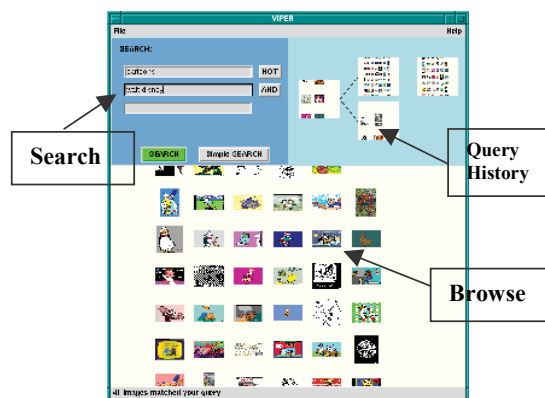


Figure 1: Zoomable Image Browser (ZIB) allows panning and zooming of individual images as well as the entire view.

While users perform successive searches, a history interface maintains a record of previous queries and displays a snapshot of the images that were returned with a particular query. In case users forget the search terms used to retrieve the corresponding set of images, they need only move the mouse cursor over the group of images they wish

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