

# Immediate Usability: A case study of public access design for a community photo library

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## DRAFT 6/25/2004

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### ABSTRACT

This paper describes a novel instantiation of a digital photo library in a public access system. It demonstrates how designers can utilize characteristics of a target user community (social constraints, trust, and a lack of anonymity) to provide capabilities, such as unrestricted annotation and uploading of photos, which would be impractical in other types of public access systems. It also presents a compact set of design principles and guidelines for ensuring the *immediate usability* of public access information systems. These principles and guidelines were derived from our experience developing PhotoFinder Kiosk, a community photo library. Attendees of a major HCI conference (CHI 2001 Conference on Human Factors in Computing Systems) successfully used the tool to browse and annotate collections of photographs spanning 20 years of HCI-related conferences, producing a richly annotated photo history of the field of human-computer interaction. Observations and usage log data were used to evaluate the tool and develop the guidelines. They provide specific guidance for practitioners, as well as a useful framework for additional research in public access interfaces.

### Keywords

Community photo library, photo collection, group annotation, public access system, immediate usability, direct annotation, direct manipulation, drag-and-drop, zero-trial learning, walk-up-and-use, casual use

### 1. INTRODUCTION

Personal photo albums inspire hours of browsing, reminiscing and storytelling. They capture people, places and events of special significance to family members, who often inscribe short anecdotes and stories in the albums. These photo albums are passed from generation to generation, forming a treasured pictorial history of the family (Chalfen, 1987). The ritual signing of class yearbook pictures is a way that friends capture amusing anecdotes and special memories of shared experiences from their school community. Other communities memorialize their history in photos, as well. This paper describes a novel application, a digital community photo album called PhotoFinder Kiosk, that enables members of a community of human-computer interaction (HCI) professionals to enjoy, share and contribute to similar experiences by browsing and annotating photos at an interactive public exhibit. The design of the user interface and location of the installation in a communal space are intended to encourage collaborative reflection, storytelling and interpretation of shared experiences.

PhotoFinder Kiosk was installed at CHI 2001, and attendees were invited to identify people in the pictures and add captions containing anecdotes or short stories. Attendees were also invited to contribute new pictures of the conference, either from their own digital cameras or by borrowing a camera from the exhibit. Over a three-day period, an estimated 1000 users eagerly browsed the library, adding more than 1700 labels and captions, and contributing over 1000 pictures.

Public access systems are pervasive in modern society, providing services, information and entertainment ranging from automated teller machines (ATMs) for banking to museums, government offices and unattended gas stations (Kearsley, 1994). Museum exhibits often include public access systems to provide information and educational content in a user-directed manner. Many public access systems are intended

either for anonymous use, such as museums or retail displays, or for use by fully authenticated users, such as ATMs. A community photo album for a social or professional organization, however, falls in between these two extremes, since it is designed for a specific community, in which members have common interests and established social bonds. Users in these communities are not necessarily anonymous, and may, in fact, be well known to each other. Designers of applications for these domains must address issues of security, privacy, copyright, appropriate use, and moderation (Preece, 2000), but they can also take advantage of the social constraints, trust, and a lack of anonymity within the community to provide unrestricted access to capabilities that would otherwise require stronger authentication, such as a name/password or credit card/PIN.

Public access systems must be immediately attractive, engaging and usable to be successful. Potential users typically have no training on or prior experience with the interface. There are often competing demands for their attention, such as other exhibits or small children. And users have little incentive to invest any time learning how to use an interface, even when the content has compelling interest, because there is little expectation of future use. Designers use advanced graphical user interfaces (GUIs), touchscreens and alternative modes of input such as proximity sensors and machine vision to provide attractive and engaging applications. Some applications are well designed and widely used. Automated teller machines are a success story because of extensive usability testing and a concrete motivation (e.g. withdrawing money) for users. But high profile failures such as the U.S. Postal Service's Postal Buddy still occur (Engström and Escalante, 1996). Our premise is that many public access systems sit unused and idle because designers did not design for *immediate usability*, and the systems fail to initially attract users or are simply too difficult for casual use.

This paper describes the design and evaluation of the PhotoFinder Kiosk community photo library, and a set of Immediate Usability principles (design for immediate attraction, engagement, learning, and departure) and guidelines formulated as a result of extensive informal evaluations and observations. Designers can use the guidelines to develop and evaluate user interfaces for community-oriented public access systems. Practitioners can incorporate these guidelines into development processes and researchers can use them to identify appropriate applications of new technologies.

This paper is organized as follows: First, we present the project background and related work. This is followed by a description of the design and development process. We then describe our observations and evaluation of the tool, which leads to four principles and associated guidelines. We conclude by briefly describing subsequent work and summarizing the contribution of this paper.

## **2. BACKGROUND**

The PhotoFinder Kiosk project was begun because of the need to transform a personal photo library tool into a public access system as part of a project to create a photographic history of conferences and events in the field of human-computer interaction (Shneiderman et al., 2002). One of the authors (Shneiderman) has an extensive personal library of photos spanning 20 years of HCI-related events. The library includes pictures from landmark events such as the 1982 Gaithersburg conference that led to the founding of the Association for Computing Machinery (ACM) Special Interest Group in Computer Human Interaction (SIGCHI) and shows many of the leading contributors to the field at early stages of their careers. These pictures have been digitized and annotated with basic metadata such as event name, date and location using PhotoFinder, a personal photo library tool (see <http://www.cs.umd.edu/photolib>) (Shneiderman and Kang, 2000). A challenge of the photo history project was to identify the people in these photos, most of which were not annotated. Due to the large number of photos (3300 were eventually selected from more than 7000), it was not practical to individually label each picture. Even if it were, many of the people in the pictures were unknown, even to the original photographer.

Since this was to be a history of an HCI community, we decided to bring the collection to a large HCI conference, CHI 2001 in Seattle, Washington USA, and ask the attendees to contribute their knowledge by adding names and captions to the photos. PhotoFinder Kiosk was thus developed to enable members of this community to enjoy browsing the photos and reminiscing with friends and colleagues at the same time that they contributed their annotations.



**Figure 1. The interface for the original tool, PhotoFinder, showing the Library Viewer (left), Collection Viewer (top right) and Photo Viewer (bottom right). The depth of each photo stack in the Library Viewer indicates the number of photos in the corresponding collection. A name list (lower center) is used for annotation and search by dragging and dropping onto the Photo or Collection Viewer, respectively.**

PhotoFinder Kiosk was developed from PhotoFinder (see Figure 1), a single-user program that provides collection management and annotation, with an emphasis on easily annotating and searching for people. It uses a conceptual model (metaphor) of a user's photo library having a set of collections, with each collection having a set of photos. Three views of the library are always visible: Library, collection and photo. The library view provides an overview of all collections, with each collection represented as a stack of photos. The collection view displays thumbnail images of all photos in the currently selected collection, and the photo view shows the single image currently selected from the collection. Users can annotate photos by dragging names from a list and dropping them onto the photo. The location of the annotation on the photo is preserved. Users can search for a name by dragging from a list and dropping it onto the collection view. This creates a pseudo-collection, displaying all photos that have been annotated with that name. PhotoFinder is a powerful tool, providing a rich set of features, but it requires a non-trivial, albeit modest, investment of time to learn the annotation and searching techniques. Nor does it provide access control or annotation tracking features, because of its focus on personal collections. The PhotoFinder database is dedicated to a single client and does not allow synchronous access multiple clients, nor is there any way to notify clients of database changes. For these reasons, it is not a practical tool for a public access system, where users have minimal motivation and little time for learning.

PhotoFinder Kiosk is designed to overcome these limitations, supporting casual use by multiple users in a semi-public environment, such as a conference, wedding or other event that brings together a community of people with a common interests and social bonds. It is intended to encourage side-by-side group exploration, storytelling and annotation of photo libraries, in an environment where users share a common PC or use a network of co-located PCs. Another design goal was to encourage members of the community to contribute their own pictures to the library.

### **3. RELATED WORK**

This research draws on related work from several areas: Photo sharing tools, public access systems and online communities. Photo sharing tools can be classified into three sub-areas: Personal browsing, shoulder-to-shoulder sharing (where users are sitting near a friend or family member, showing the photos while operating the device) and remote sharing (where users utilize some form of media and send their stories to another user for viewing).

Many personal photo management tools – both commercial and experimental – support browsing, including FotoFile (Kuchinsky et al., 1999), Shoebox (Mills et al., 2000), PhotoMesa (Bederson, 2001), Adobe Photoshop Album, ACDSee, PhotoSuite, and ThumbsPlus. These tools (including PhotoFinder) support features of shoulder-to-shoulder and remote sharing, too, but their design is primarily intended for individual users to browse or annotate their own collections of pictures.

Shoulder-to-shoulder sharing features are provided in tools such as StoryTrack and the Personal Digital Historian. StoryTrack supports side-by-side sharing of a photo library between two people and the creation of stories with audio annotation on a prototype portable device (Balabanovic et al., 2000). The Personal Digital Historian is a tabletop interface used by small groups to explore photos, audio and video (Shen et al., 2003). Both of these devices support face-to-face exploration and storytelling, although they are not public access systems.

In the domain of remote photo sharing, Collections, an MIT research project, enables the owner of a collection of pictures to generate multiple customized views of the collection according to the intended audiences (Viégas, 2000). Different audiences will see different photos, and a single photo may have different captions for different audiences. In addition, online services such as HP Photo, Kodak's PhotoNet and AOL's You've Got Pictures enable registered users to share pictures and their stories remotely. However, most remote sharing systems only allow the owner to annotate and publish and thus they don't support group annotation. Kodak's PhotoQuilt web site encourages anyone to contribute a photo and story, without any registration requirements. PhotoNet and PhotoQuilt allow multiple people to contribute photographs to a library, but only the contributor of the photo may annotate it.

Many texts provide general guidelines for developing public access systems, including Blank (1992), Felix et al. (1991), Heller and McKeeby (1993), Kearsley (1994) and Maguire (1999). Kearsley describes a four-stage model of a user's interaction with a public access system: Attraction, learning, engagement, and disengagement. In the attraction stage, potential users are alerted to the system and encouraged to use it. This can be done with pamphlets or signs, in addition to displays on the system itself. The first few moments of use constitute the learning stage, and ease of initial use is of paramount importance at that time. During the engagement phase, users explore the content of the system. Disengagement occurs when users decide to leave the system. This model is used to organize the evaluation of PhotoFinder Kiosk and develop the principles in section 6.

The CHI '89 InfoBooth was a public access system that allowed conference attendees to create digitized photos of themselves and enter personal information, which could then be browsed (but not annotated) by other conference attendees (Salomon, 1990). Shneiderman et al. (1989) and Plaisant (1990) describe the design and evaluation of several hypertext-based museum exhibits. They observe that users needed at least a brief demonstration of the system to effectively use it (short written instructions were not useful). They also note that users needed clear feedback when making selections and a clearly marked button to return to the introductory text.

Preece (2000) addresses the social and user interface issues of online communities. She describes characteristics of communities that affect policy and software design decisions such as moderation (whether to allow anyone to post a message, whether to allow anonymous contributors, whether/how to monitor postings, etc.), security and privacy. Schuler (1994) describes several early online communities, discusses the political and social aspects that impact their design, and provides a model for their development. The Blacksburg Electronic Village's Blacksburg Nostalgia web site (Carroll et al. 1999) is an early example of an online community history archive organized around a physical community (the town of Blacksburg, Virginia). It encourages unrestricted annotations of stories. Although it is comprised mostly of text, researchers found that pictures, when available, generated substantial interest and commentary. This illustrates the power of photos to evoke recollection, reflection and commentary within a community and hints at the potential for using community members to annotate a photo collection. It also demonstrates how an online community can be developed around a physical community.

#### **4. DESIGN PROCESS**

A lightweight, iterative design and implementation process incorporated elements of user-centered design (Nielsen, 1994) and rapid prototyping (Martin, 1991), with multiple design reviews and a field test at a small conference before the main conference. The design team comprised a cross-section of the HCI community, with long-term members and newcomers to the field. We used our interests as well as previous work on a user/task analysis for personal photo libraries to guide the requirements analysis and interface design. The project was initiated by considering the community members to identify typical user profiles, tasks and anticipated usage characteristics, as well as requirements introduced by the inclusion of personal photos in a semi-public exhibit. Much of the early discussion of requirements focused on the need to simplify and streamline the interface and what core set of functions to retain from PhotoFinder. A small number of new features to be added were also identified, such as emailing photos and support for multiple libraries. Initial designs used sketches and storyboards. They were then implemented using Microsoft Visual Basic and evaluated and refined with several rounds of informal user testing. The system was field tested at the Computer-Supported Collaborative Work conference, CSCW 2000, where over 50 conference attendees used it and provided feedback. It was subsequently refined based on observations and user feedback, followed by additional informal user testing, in preparation for the CHI 2001 conference.

##### **4.1 User Profiles and Content Interests**

We identified two primary user profiles: HCI veterans, and HCI newcomers. Although the profiles could have taken into account user characteristics such as whether they were in industry or academia, designers or evaluators, etc., in the context of the CHI 2001 exhibit, the social nature of the content lessened the importance of those attributes relative to the users past experiences at CHI conferences. As noted in Maguire (1999) and Heller and McKeeby (1993), having compelling content is critical for the success of a public access system. Thus, when developing user profiles, we carefully considered what content would be attractive to each type of user, reasoning that the different types of users would engage with different content. We were confident that long-time CHI attendees and other HCI veterans would be attracted to the exhibit and would enjoy browsing the photos because of the pleasant memories associated with them. The challenge with these users was to encourage them to add annotations, to help more completely identify the people and activities in the pictures. To do this, we decided to add a caption capability and evaluated several designs with alternative sizes and locations to make it highly visible on the screen.

For more recent attendees, though, most of the historical pictures are not relevant. These users have less shared background with the photo subjects and, lacking that common experience, they are unlikely to contribute annotations to the historical photos. Several requirements were identified to help attract and engage these users. First, a small subset of pictures would be selected to create a collection of highlights – pictures that showed significant people and events in the CHI community. A second set of humorous pictures (labeled “Outrageous”) would show people in amusing poses. Allowing users to contribute pictures was expected to enhance users’ interest, so we decided to lend digital cameras to attendees, which they could use to take pictures anywhere in and around the conference. Pictures would be imported from several digital formats so users could contribute pictures from their own digital cameras, too. This would

provide a growing set of pictures from the current conference, encouraging users to add timely commentary about events they had attended.

Eighty-one photo collections with 3300 photos were selected from the original 280 collections and organized into three libraries: Historical CHI conference photos (38 collections), other related HCI photos (43 collections), and photos taken at the current CHI 2001 conference (initially empty). The CHI 2001 library would be initially populated with several collections of photos to be taken during conference setup.

All users would initially see the same interface and content. Although it is conceivably desirable to adapt the content for each user profile, we found no reason to seriously consider adapting the interface. Any form of adaptation would require additional information about each user, which would be impractical to capture in a walk-up-and-use environment. If implemented as an initial dialog sequence, it would interfere with users' initial use of the system. On the other hand, providing user-selectable content "modes" (i.e., for conference veterans vs. newcomers) would be superfluous, because the users can accomplish that by choosing one of the three libraries. An adaptive approach based on implicit user modeling is impractical because of the lack of initial knowledge and limited duration of each user's interaction with the system.

#### **4.2 Privacy and Security Requirements and Issues of Community Use**

The development of PhotoFinder Kiosk raised issues of privacy, security, copyright and control/management of the annotations. Legal and social constraints set limits on the use of photos, particularly of private citizens (Chalfen, 1987), and we needed to respect those limitations. To do so, we adopted a policy of removing any photos if desired by the subject. We considered making this function directly available in the interface, but that would have required positive identification of users, impractical in the exhibit environment. The alternative of providing a button to request photo removal was also considered. Rather than dedicating a single button to handle what we anticipated would be a rare event, we decided to provide a button labeled "Contact Us" in which users could send any message to the exhibit administrator. Additionally, a disclaimer would be posted conspicuously at the exhibit and on printed materials indicating our willingness to accommodate requests, without specifically mentioning photo removal. This appeared to provide a reasonable balance between practicality and privacy needs.

Allowing unauthenticated users to annotate photos raised issues that online communities have had to address with user contributions, that is, how to prevent or remove inappropriate or offensive material. Two primary approaches are used: moderated, in which material is reviewed and approved by an authorized user before being distributed or posted to the community, and unmoderated, in which all material is made available to the community and inappropriate material can be removed, either by an authorized user or other members of the community. Because the CHI community is formed of members of a professional organization, a level of trust can be inferred from that relationship, and we were confident that users would act in a responsible manner. Moreover, the exhibit would be in an open area, where passers-by or exhibit staff could easily observe visitors, and this exposure would help to further discourage any inappropriate comments. For these reasons, the unmoderated approach was chosen.

Although we did not intend to authenticate users, we did wish to identify them. This would be necessary for several reasons. First, we intended to permit an annotation contributor (but no other users) to modify their annotations. Second, we hoped that the information about who authored each annotation would be inherently interesting to users. Third, if a user was determined to have provided (presumably inadvertently) an inappropriate annotation, the administrator should have the capability to identify and review other annotations by that user. Finally, should a user desire to reference a photo or annotation in the future, it would be impractical with having their name or some other identifying information associated with the photo or annotation. The details of how to identify users generated substantial discussion within the design team. The original solution was to provide an initial dialog (similar to a login box) to request a name and email address (but no password) at the beginning of each session. This was eliminated following the initial field test (due to problems discussed in section 4.4) and replaced with a less intrusive approach that collected only the user's name. The final design was intended to let users stay more fully in the "flow" (cf. Bederson, 2003) of exploration and annotation, feel more in control, and engage more fully with the exhibit.

Soliciting pictures from visitors required addressing copyright issues because we intended to eventually publish the photos on the SIGCHI web site. To do so required that we secure either the copyright or permission from the copyright holder (presumably the photographer), or else suppress certain photos from the final web site. Adding additional features to track intellectual property rights on a per photo basis was undesirable, so we elected to have all photo contributors sign a short form granting limited publication permission while retaining copyright in the photos.



**Figure 2. The final interface for PhotoFinder Kiosk. A photo of several prominent HCI researchers from the Highlights collection is selected. The subjects are labeled with names and one conference attendee (John Thomas) has supplied a humorous caption, visible at the bottom of the Photo Viewer. The interface has been streamlined by removing unneeded interface elements and the remaining functions are consolidated into a toolbar on the bottom, with a prominently located search box. The current annotator's name is displayed at the lower right.**

#### 4.3 Developing the PhotoFinder Kiosk Prototype from PhotoFinder

PhotoFinder provides a rich set of visual cues and experience indicated that users quickly understand it (Cho et al., 2000; Goto et al., 2000; Jung, 2000), so we streamlined and simplified the interface, but retained the fundamental metaphor of libraries, collections and photos (see Figure 2). Instead of displaying a single library and requiring users to change libraries via the File/Open menu function, tabs are displayed for each of the three libraries at the top of the Library View, providing a visual indication of the available content. The Full Screen and Slide Show modes from PhotoFinder were retained and made more visible by enlarging the icons and buttons. A new feature was added to allow users to email pictures, and a button was placed at the bottom of the screen for this function.

A login dialog box was added, which prompted users to enter their names and email addresses before being permitted to browse or annotate photos. Any non-blank name and validly formatted email address was acceptable. This design was found to be problematic during the field test and revised as described in section 4.4.

Since multiple contributors can provide annotations, it will often be of interest to know who provided a particular annotation. For name labels, this information is shown as pop-up text (i.e., a “tool tip”) when the pointer pauses over a label. PhotoFinder did not originally support captions, so a caption box was added below the picture. Each caption is displayed prefixed with the annotator’s name. Multiple captions are allowed for each photo, encouraging users to contribute to and elaborate on previous captions. The current annotator’s name is displayed at the bottom of the screen, labeled as Author.

Eliminating scrolling was considered desirable. This was accomplished in the Library Viewer by limiting the number of collections to a maximum of 40 per library. This was not practical for individual collections, which contain as many as 100 photos, so the scrollbar was retained when displaying large collections on the Collection Viewer. It is hidden when not needed. Several non-visible features from the original program were retained, based on the reasoning that certain types of interactions would be familiar to the target users. For example, the target users are generally well versed in computer use and aware of the interaction techniques such as double-clicking and the drag-and-drop metaphor.

Most delete features were removed or restricted. Only the administrator can delete a picture. Only the original annotator (or administrator) can move or remove the name labels they placed on pictures. Captions cannot be changed after they are entered. Users can send email to the administrator by clicking on the Contact Us button at the bottom of the screen. Administrators use a separate interface (an enhanced version of the original PhotoFinder tool) to manage the system.

Several unneeded management functions were removed and the remaining functions were carefully placed to be clearly visible in the interface. To further simplify and streamline the interface, the standard Microsoft Windows menu bar was removed from the top of the screen and the toolbar icons for the Library, Collection and Photo Viewers seen in Figure 1 (a total of 28 icons) were replaced with just seven icons in a single toolbar at the bottom of the screen. Although PhotoFinder requires users to explicitly save changes, this would clearly be problematic for the casual user, and it was changed to automatically save all annotations and captions as they are entered.

The data management component was changed from a single-user Microsoft Access database to a client/server model using a server process to manage updates to a central SQL Server database. This was done to support the multiple clients, ensure data integrity on updates, and to enable immediate propagation of changes to clients via a callback mechanism. This allowed users to see others’ changes as they happened and enhanced the interactivity of the exhibit.

#### **4.4 Prototype Evaluation and Subsequent Changes**

During the prototype evaluation most users needed some introduction to begin using the system. This was often accomplished by watching another user for 15-60 seconds. When that introduction was unavailable, some users would have difficulty getting started. As observed in Shneiderman et al. (1989), the lack of an introduction “transform[ed] an easy to use system into a frustrating mystery game for some... untutored users.”



**Figure 3. Detail of overlay help showing the task-oriented selection bar (top center) and sticky notes for the three steps of the Annotate Photo task.**

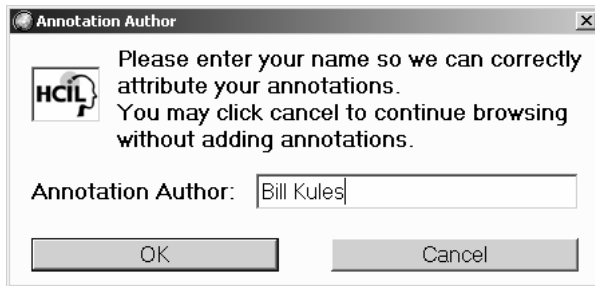
To overcome this challenge, we created an overlay help system (see Figure 3) that provides task-specific help for users (Plaisant et al., 2003). When PhotoFinder Kiosk detects 60 seconds of inactivity (possibly indicating that the user is puzzled, confused or wondering what can be done next), the help system is activated to indicate what actions are available and how to perform them. The help system consists of one small window at the top of the screen with a drop-down list of tasks, and several "sticky note" style windows that vary depending on the task. The help windows are set off from the underlying display through the consistent use of a bright yellow background, large fonts and thick borders. A shadow effect would have reinforced the perception that they float over the main window and was, in fact, added to a subsequent version of PhotoFinder. Each sticky note window is numbered, and describes one step of the task in a few words or a sentence. Sticky note windows may be individually closed, or all may be closed at once. The sticky note windows are placed to avoid obscuring critical parts of the main window, so users can keep them visible until comfortable with the task.

A slide-out search pane with advanced Boolean capabilities was difficult for users to find and caused numerous problems during the prototype evaluation, so it was replaced with a single text box prominently located at the lower left corner. This required slightly more space on the display but ensured that the search function was fully visible, and both the text box and its label serve as targets for drag-and-drop name searches.

Several interactions were redesigned to eliminate dialog boxes. A few functions still require a dialog box for form fill-in, such as emailing pictures (recipient email address, subject line, etc.), but they form a natural part of the interaction and do not interrupt the user.

It became abundantly clear during observations that the initial strategy for identifying annotators (a login box) was problematic. It obscured the most interesting parts of the tool, the pictures, which are crucial to attract users. In addition, users were clearly reluctant to provide personal information (particularly their

email address) before using the tool. The login box proved to be such a problem during the observation that we simply left a guest user logged in, effectively bypassing the login process. Subsequently, the identification process was redesigned to ask users for their names only when they add a label or caption (see Figure 4) and to retain names for subsequent annotations. This avoids interrupting users when they first start exploring, allowing them to browse or search.



**Figure 4. The dialog box used to identify annotation authors is displayed the first time in a session that a user enters an annotation. That name is used for any subsequent annotations during the session.**

A session can be ended explicitly or implicitly. A session is explicitly ended when the user clicks on the Sign Off button. A simple mechanism is used to implicitly end a session by inferring user departure. As noted above, sticky notes are displayed after 60 seconds of inactivity. While the sticky notes are displayed, if there is no activity for an additional 60 seconds, the user is assumed to have left and the session is ended.

During the prototype evaluation, several users suggested that a Back button, modeled on the web browser Back buttons, would allow them to return to previously viewed collections or search results. Based on this feedback, we implemented a Back button, but during additional user testing the semantics of the function were not immediately understood by users, and it was removed from the final version to minimize the complexity of the interface.

#### **4.5 Conference Installation**

For the conference installation seven computers were configured in an “L” shape as shown in Figure 5. One computer ran the SQL Server database, one was used to import and manage photos and five were used for end-users.

To attract the attention of passers-by, a 37” monitor (visible in the background of Figure 5) was used for one of the five stations in the exhibit. When not being used by a visitor, this station displayed a sequence of photos (the “attract sequence”). To select the photos, the interests of veteran conference attendees and conference newcomers were considered. The Highlights and Outrageous collections were selected as the initial set of photos because they presented notable HCI personalities. During the conference photos in the CHI 2001 library were included because of the novelty of seeing pictures of the current conference. Posters and signs were also used to direct users to the exhibit.



**Figure 5. Photograph of the PhotoFinder Kiosk installation. Note the large (37") monitor in the background.**

## **5. EVALUATION AND GENERAL OBSERVATIONS**

Usage logs, a survey and three days of extensive informal observations were employed to evaluate the use of the system by an estimated 1000 users. The system was instrumented to log usage data, but due to the limitations in detecting session endings described in section 5.6, it was not possible to record the exact number of users. The log recorded 259 sessions during which users added annotations. It did not track browse-only sessions, during which user made no annotations, but informal observations indicated that approximately one in four users contributed some form of annotation, either a name or a caption.

This section starts by characterizing user profiles and activity based on the usage log data, surveys and observations. We then consider issues of privacy and community use. The last four subsections organize observations around Kearsley's four stages: Attraction, learning, engagement and departure. These observations help to inform the subsequent exposition of principles and guidelines.

### **5.1 User Profiles and Usage**

Users were invited by exhibit staff to complete a one-page survey with six questions covering past CHI conference attendance, whether they used the exhibit alone or in a group, annotation activity, photo contributions and other comments. Sixty-one visitors completed the survey. Over half of the respondents had attended at least 5 CHI conferences and these people were more likely to contribute annotations (table 1). Of course, heavy users were also more likely to answer the survey. Twenty-one respondents (approximately one-third) reported using PhotoFinder Kiosk with a friend or colleague.

| Conferences Attended | Number of Respondents | Annotated Pictures? |          |
|----------------------|-----------------------|---------------------|----------|
|                      |                       | Yes                 | No       |
| 1 (first time)       | 9 (15%)               | 3 (33%)             | 6 (67%)  |
| 2-4                  | 16 (26%)              | 8 (50%)             | 8 (50%)  |
| 5 or more            | 36 (59%)              | 27 (75%)            | 9 (25%)  |
| <b>Totals</b>        | 61                    | 38 (62%)            | 23 (38%) |

**Table 1: Annotation activity by the number of conferences attended.**

Visitors added 1335 name annotations plus 399 captions, and attendees contributed 1180 new photos to the current conference library. Of the 1335 name annotations added, 677 were for the newly contributed pictures and 658 were for older photos. Of the 399 captions added, 268 were for older photos and 131 were for the new photos. The average length of the captions was 46 characters. A single user contributed 163 of the captions, all of which were for older photos. Thus the overall annotation activity of users was evenly divided between old and new collections, even though most of the users were long-time attendees. Most captions were humorous or sober characterizations of the people or activity pictured. A few attempts at obscure humor are puzzling but hardly seem offensive or inappropriate (an admittedly subjective judgment). A few captions are comments clearly intended for the administrator.

Users made 151 requests for a total of 2591 photos (excluding one user who requested an extremely large number – 399 photos), and 38 miscellaneous messages. These messages were often used to notify us of spelling and other minor errors, and a few people requested that several photos they had contributed be removed because of poor technical quality.

Analysis of usage logs showed that the two CHI libraries were each selected more often than the related HCI conferences library, suggesting a stronger interest in the more directly relevant material (table 2). These counts must be interpreted with caution, however, because the selected library remains unchanged when users leave. Thus the number of times a library was selected is less than the number of times it was actually viewed. We observed that long-time conference attendees spent more time on the historical photos, while newcomers appeared to divide their time more evenly between the libraries.

| Library                                  | Number of Times Selected |
|--|--------------------------|
| Current conference (CHI 2001)            | 242 (39%)                |
| Previous conferences (Historical SIGCHI) | 221 (35%)                |
| Other HCI-related conferences and events | 161 (26%)                |
| <b>Total viewings</b>                    | <b>624</b>               |

**Table 2: The number of times each library was selected.**

## 5.2 Privacy, Security and Issues of Community Use

Privacy issues were rarely a concern for visitors. A few visitors raised the issue with exhibit staff, but only one person requested that photos be removed for privacy reasons. It is likely that the non-profit nature of the exhibit, sponsorship of SIGCHI, the context of the exhibit (within the physical conference site), and the general context of the CHI community contributed to a level of trust in which attendees were comfortable having their pictures in the exhibit. In other communities and environments, privacy and related issues could be more problematic. As noted above, none of the contributed material was found to be inappropriate, although here again, several visitors asked how we handled the issue.

Many users provided negative feedback on the initial implementation of the identification dialog, which requested the user name and email address. The final version of the identification dialog, which was not displayed until users provided an annotation, elicited little comment from users, which validates our

decision to postpone the identification process until needed and to retain that information for the duration of the session.

None of the photo contributors provided any negative feedback on the publication permission form. It is likely that anyone who objected simply chose not to discuss this with exhibit staff.

### **5.3 Attracting Visitors**

The first stage in Kearsley's model is attraction, during which the user's attention is gained. This is typically done with an attract sequence that previews the content, enticing the potential user to approach and use the system. Video game developers produce sophisticated and compelling attract sequences that show the user what to expect from the game. More prosaic means such as flyers, banners and posters can also be used.

The attract sequence was displayed on the large monitor by sequencing through the photos in the Highlights and Outrageous collections, then all photos in the CHI 2001 library. This produced a combination of old and new content, which was an effective strategy, as evidenced by the crowds gathered around the display. The sequence of photos was always the same, in roughly chronological order, which meant that visitors saw all the old content before the new content. Alternating old and new collections or displaying random selections might have produced a more compelling attract sequence by introducing variation. An important usability problem with the attract sequence was discovered when visitors wished to use the large-screen station. To interrupt the display sequence, users simply had to press the Escape key or click a button on the mouse; however, there was no specific instruction on the screen for this. Users had to guess or be told. This deficiency caused some users initial difficulty.

Users arrived with various expectations and motivations. As we had anticipated, many long-time attendees were eager to see pictures of themselves or their colleagues earlier in their careers. More recent attendees came on the recommendation of a friend or colleague, for the opportunity to contribute photos, or simply from curiosity. Several users came because their pictures had been taken at an evening event, and they wanted to make sure they were "good" pictures or else have them removed – a form of attraction that was not anticipated, but which is consistent with the tactic of creating anxiety to raise interest, described in (Berlyne, 1960). After finding the pictures, they chuckled and continued browsing. Several attendees remembered the CHI '89 InfoBooth, which allowed conference attendees to create digitized photos of themselves, and thought that they could have their picture taken for an attendee yearbook.

### **5.4 Learnability of the Interface**

After the user has been attracted to the system, they must immediately understand how to begin interacting with it. Thus, learning is the second stage in Kearsley's model, although it can and often does occur at subsequent points, too.

Users did not appear to have difficulty understand the fundamental metaphors of PhotoFinder. Most of the changes made to the interface were to simplify it, streamline it, and remove unnecessary interruptions such as dialog boxes. Several non-visible features from the original program were familiar to users. They often experimented with double-clicking, finding the search capability this way. The drag-and-drop feature was not obvious to users, however, most people were immediately comfortable using it to search and annotate after observing other users or reading the online help. Of 1266 searches recorded in the usage log, 692 (55%) were initiated with a double-click, 280 (22%) were initiated with drag-and-drop, and 294 (23%) were initiated by typing into the Search box. Users also appeared comfortable using the Escape key or clicking the mouse to end the slide show. Similarly, the Delete key was far more popular than the Delete button for removing annotations, being used in 82 of 88 instances (93%).

Users expressed satisfaction with the overlay help system design, and it helped some users to more rapidly understand the interface. Learnability might be improved by incorporating short animated demonstrations into the attract sequence, as is done in video games, to highlight the existence of certain features and simultaneously demonstrate their use. This is similar to the Integrated Initial Guidance of Plaisant et al. (2003).

## 5.5 Engaging Users

During the engagement stage, users start to use the system. If they don't receive prompt indications that their time and effort will produce the desired result, they will quickly lose interest and leave. The prototype asked users to identify themselves prior to browsing, which was a strong disincentive to use. This was removed in the final version, where users were only asked for identification if and when they added an annotation (name label or caption) or when they attempted to delete a name label (captions cannot be deleted except by the administrator).

As noted above, many long-time attendees wanted to see pictures of themselves or their colleagues earlier in their careers. They found great satisfaction in adding a new name or contributing a caption, and were pleased that they could send pictures to themselves or to friends who could not attend the conference. Smiles of amusement and appreciation accompanied finding youthful pictures of friends. Some were disappointed when they didn't find any pictures of themselves. One user commented, "Apparently Ben and I do not frequent the same locations. 10 conferences, not one photo." Newer attendees would often view the current conference photos initially, and then look at the highlight collections. Visitors often exchanged perspectives on specific events and laughed about unusual personalities encountered while adding captions. Many users were enthusiastic, with comments such as "Great! Thanks for the memories," "This is addictive," and "The PhotoFinder rocks!" Still others volunteered to contribute pictures from their personal collections, and many offered useful suggestions for improvements and keen critiques of usability problems.

The social aspects of the photos were very apparent, particularly for the long-time community members. Individual users would often return with friends and colleagues to show a favorite picture. Two or three visitors would often cluster around a display, reflecting, laughing and sharing reminiscences. Users of separate stations would often exchange comments and point out pictures to each other. We conjecture that the availability of 5 stations contributed to user interest. Seeing several people actively engaged is a more compelling attraction than just seeing one person at a PC. The experience of exploring pictures with others (even at separate stations) is qualitatively different than solitary exploration.

## 5.6 Visitor Departure

The final stage of system use is disengagement, when the user decides to leave. This seemingly simple process proved unexpectedly problematic. The mechanism to detect departure was too simplistic and limited the ability to properly credit authors for their annotations. As noted above, annotator names were saved for the duration of a session to avoid making users re-enter their names for each annotation. Unfortunately, when users were lined up waiting to browse photos, and one user departed, the next person's annotations were frequently incorrectly attributed to the previous annotator. There was simply no way to create a short enough timeout to detect a departure without also affecting users who were simply pausing to view a photo or carry on a conversation. Confirming identity after each annotation with a dialog box (e.g. "Thanks, John Smith") might have helped, although it would have interrupted the users and required an additional mouse click to dismiss the dialog. Alternatively, while users are dragging a name label or entering a new caption the current annotator name could be clearly highlighted near the locus of activity on screen. A better solution would have used a sensor to detect departures and immediately reset the system for the next visitor.

## 6. PRINCIPLES AND GUIDELINES

Kearsley's four stages of interaction are used here to organize a simple but elegant set of four principles and guidelines for Immediate Usability. These are based on our experience on PhotoFinder Kiosk and other projects such as the Library of Congress (LOC) National Digital Library Program (Marchionini et al, 1998; Plaisant et al., 1996), the LOC Online Public Access Catalog (Marchionini et al., 1993), and the Smithsonian's Guide to Opportunities in Volunteer Archeology (Plaisant, 1990).

### 6.1 Immediate Attraction

**Principle: Use the most attractive content ("treasures") to demonstrate the system and invite use.**

**Guidelines: Organize content to highlight treasures for the general community and for sub-communities with special interests; implement an attract sequence tailored for the audience; clearly**

**indicate how to end the attract sequence and begin using the system; avoid introductory (“splash”) screens.**

The attract sequence must clearly communicate the nature of the system, while competing with other environmental distractions. It should invite passers by to approach, displaying content that is interesting and relevant to a wide variety of potential users, balancing familiarity and novelty (Berlyne, 1960; Eysenck 1982). The interests of each sub-community should be considered when selecting content for the attract sequence. It should clearly indicate how the visitor could start using the system (e.g. “Touch screen to begin”) and what functions are available (e.g., browse and annotate photos). It may run continuously, or be triggered by proximity sensors, infrared, sonar, pressure-sensitive mats or even machine vision (Christian and Avery 2000).

The PhotoFinder Kiosk installation started with an initial attract sequence consisting of the selected highlight photos. As photos from the conference were added to the collection, they were included in the attract sequence. By the end of the conference, the sequence included approximately 1100 pictures that would be displayed over a period of about 30 minutes. The attract sequence lacked directions for how users could start using the system, and this caused initial difficulties for some users.

## **6.2 Immediate Learning**

**Principle: Support zero-trial learning. Users should be able to use the interface after observing others or using it themselves for a brief period of time (15-60 seconds).**

**Guidelines: Use the simplest practical interface; take careful advantage of common knowledge in the community (e.g. computer familiarity); use an immediately understandable metaphor; make visible affordances for all operations and ensure that all results are immediately apparent; avoid menu bars and other elements that hide functionality; avoid UI navigation such as scrolling and jumping. If online help is needed, it should be extremely condensed and displayed in the context of the primary interface without obscuring it. Short demonstrations of functions can be incorporated into the attract sequence.**

Visitors typically spend limited time using a public access system and are often unwilling or unable to invest even 60 seconds to decipher a cluttered interface or discover a hidden feature. Features that are easy to learn from the privacy of one’s home or office can be unlearnable in the public access environment with its many distractions and where any mistakes are visible to others. During early evaluations it was clear that even scanning through menus on a menu bar, which can be an effective strategy for exploring the functionality of a desktop interface, is unworkable for typical public access systems. The use of the Delete key and the double-clicking interaction by many visitors would appear to contradict this guideline, but really only reflect the shared experiences of many community members, who are familiar with windowing user interfaces and have a predilection to explore them. Even though the delete key or double-clicking interactions are widely known metaphors, the corresponding visible UI widget should be designed for universal usability.

## **6.3 Immediate Engagement**

**Principle: Encourage users to immediately interact with content; provide immediate reward; avoid interrupting users.**

**Guidelines: Defer login or user identification as long as possible; avoid any interactions that interrupt the user or display dialog boxes.**

Once users have started using the system, the user interface should be transparent, so users can focus on the content. If it will be necessary to identify users (as is done in PhotoFinder Kiosk when users annotate a photo), that should be deferred as long as possible to allow users to engage as fully as possible. Any interactions that involve alert boxes, dialog boxes, or fill-in forms should be avoided because they interrupt the user. Any operation that can generate error or warning messages should be similarly avoided, although all operations should provide immediate feedback.

Within a community context, opportunities to contribute relevant material should be highlighted. This feature of PhotoFinder Kiosk provided the dual benefit of engaging the annotator as well as adding material for subsequent visitors to view and potentially comment upon.

#### **6.4 Immediate Disengagement**

**Principle: When a user departs, immediately reset the system and prepare for the next visitor.**

**Guidelines: Use proximity sensors, infrared, sonar pressure-sensitive mats or machine vision when it is important to reset the system between users; otherwise, provide a reset button and implement an idle-timeout.**

Detecting the departure of a user is difficult to do within software alone. For most applications it will suffice to provide a clearly marked reset button and implement a timeout. This will often fail, however, when a user departs and another immediately arrives. When it is important or desirable to differentiate between users, such as in the PhotoFinder Kiosk application, additional sensors are necessary. In some applications, it may be desirable to provide a farewell to the user or otherwise confirm their departure. Alternatively, highlighting the current annotator name during the annotation interaction and providing an easy, one-click mechanism for users to change annotator name would help avoid incorrect attributions. The lack of any such mechanisms in PhotoFinder Kiosk caused difficulties in properly attributing comments and annotations.

#### **7. SUBSEQUENT WORK**

We have recently developed PhotoFinder Web (see Figure 6), a web-based version of PhotoFinder, to complete the HCI photo history project (available at <http://www.acm.org/sigchi/photohistory>) (Shneiderman et al., 2002). It uses the same fundamental metaphors that were successful for PhotoFinder and PhotoFinder Kiosk to support browsing and searching. The design accommodates slower network connections, smaller screens, and limitations of standard HTML as an interaction medium (e.g. no drag-and-drop).



**Figure 6. PhotoFinder Web completes the HCI photo history project, applying many of the ideas of PhotoFinder and PhotoFinder Kiosk. The photo history is available from SIGCHI's web site as a resource for members of the HCI community as well as students, journalists and historians.**

To take advantage of labels and captions in the personal version of PhotoFinder, a new feature, StoryStarter, has been developed. StoryStarter allows users to take a collection of photos that have already been annotated and publish a static set of web pages using any of the information stored in PhotoFinder. The web pages are meant to be a starting point for sharing stories with family and friends using digital pictures. The HTML pages generated by StoryStarter are easy to edit with any HTML editor and can be uploaded to any web directory.

The SNAPshots project (<http://www.cs.umd.edu/hcil/photopres/>) explores the question of media annotation and presentation, using personal family and travel photos as case studies. Users in general do not spend time annotating their personal photo collections, due to a shortage of easily available annotation tools and an unclear set of benefits. SNAPshots looks at the second of these factors, and tries to provide interesting modes of dynamic presentations that take advantage of existing quality annotations, in order to raise user incentives to do those annotations in the first place. An existing prototype organizes family pictures by relationships in a family tree, based on generation, date, and other organizing structures.

## 8. CONCLUSION

PhotoFinder Kiosk is a novel combination of a digital photo library in a public access system. It demonstrates how designers can utilize characteristics of a target user community (social constraints, trust, and a lack of anonymity) to provide capabilities that otherwise would be impractical. This project was focused on a particular community – members of ACM SIGCHI – with a specific interest in the content of

PhotoFinder Kiosk. Users were often known to each other and had common interests and backgrounds. These social bonds, combined with the physical layout of the system, allowed us to build a lightweight user identification mechanism without necessitating a moderator. This strategy can be applied to other domains where users share common interests and have established social bonds.

As a direct result of contributions from members of the HCI community, 71% of the 3300 pictures in the SIGCHI photo history are now annotated with names, and many include amusing and informative captions. The photo history has been incorporated into SIGCHI's web site and will be a resource for professional members of the community as well as students, journalists and historians. During and after the conference members of the HCI community have had the opportunity to reflect upon, interpret and share experiences captured in photographs over the past two decades of growth and change in the field of human-computer interaction.

Public access systems are widely used, but they often suffer from poor usability for casual users. Designers need better guidelines on how to build public access interfaces. The contribution of this paper is a set of principles and guidelines for community-oriented public access systems. The principles and guidelines are informed and illustrated by direct experience on the PhotoFinder Kiosk project. They provide specific advice and concrete examples that practitioners can use to help ensure the immediate usability of public access systems. They also provide a framework for researchers to use outside a community setting when creating, evaluating and refining public interfaces to services, information and entertainment.

#### **ACKNOWLEDGEMENTS**

We would like to thank Ben Bederson for his help. We received support for this project from Intel, IBM, Microsoft and Ricoh. SIGCHI provided funds for scanning the photographs. We appreciated the helpful comments from the anonymous reviewers and we would particularly like to thank all the people who helped make this possible by annotating pictures during CHI 2001.

#### **REFERENCES**

- Balabanović, M., Chu, L., Wolff, G., 2000. Storytelling with Digital Photographs. Proceedings of the CHI 2000 conference on Human Factors in Computing Systems, ACM Press, 564-571.
- Bederson, B., 2001. PhotoMesa: A Zoomable Image Browser using Quantum Treemaps and Bubblemaps. Proc. ACM Conference on User Interface and Software Technology (UIST 2001), ACM Press, 71-80.
- Bederson, B., 2003. Interfaces for Staying in the Flow. University of Maryland HCIL Technical Report HCIL-2003-37. Retrieved June 18, 2004 from <ftp://ftp.cs.umd.edu/pub/hcil/Reports-Abstracts-Bibliography/2003-37html/2003-37.pdf>.
- Berlyne, D.E., 1960. Conflict, Arousal, and Curiosity. New York: McGraw-Hill.
- Blank, D., 1992. Developing interactive public information kiosks: The SCS Conservation Theater. Proceedings of the 14<sup>th</sup> Annual Conference on Interactive Systems for Training and Education. Warrenton, VA: SALT.
- Carroll, J., Rosson, M., Van Metra, C., Kengeri, R., Kelso, J., Darshani, M., 1999. Blacksburg Nostalgia: A Community History Archive. Human-Computer Interaction – INTERACT '99, Sasse, A. and Johnson, C., eds. IOS Press.
- Chalfen, R., 1987. Snapshot Versions of Life, Bowling Green State University Popular Press, Ohio.
- Cho, I., Holman, S., Phelps, R., 2000. Comparison of Photo Library Programs. Retrieved June 18, 2004 from <http://www.otal.umd.edu/SHORE2000/photolib/>.
- Christian, A., Avery, B., 2000. Speak Out and Annoy Someone: Experiences with Intelligent Kiosks. Proceedings of the CHI 2000 Conference on Human Factors in Computing Systems, ACM Press, 313-320.

- Engström, Y., Escalante, V., 1996. Mundane Tool or Object of Affection?: The Rise and Fall of the Postal Buddy. *Context and Consciousness: Activity Theory and Human-Computer Interaction*, B. Nardi, Ed., The MIT Press, Cambridge, Massachusetts USA.
- Eysenck, M., 1982. *Attention and Arousal*. New York: Springer-Verlag.
- Felix, D., Graf, W., Krueger, H., 1991. User interfaces for public information systems. In H.J. Bullinger (Ed.), *Human aspects of computing*. New York: Elsevier.
- Goto, Y., Jung, J., Ka-Pak, M., McCaslin, O., 2000. The Effect of Direct Annotation on Speed and Satisfaction. Retrieved June 18, 2004 from <http://www.otal.umd.edu/SHORE2000/annotation/>.
- Heller, R., McKeeby, J., 1993. Computing Access in Public Spaces: A Case Study. *Interactive Learning Environments* 3(1), pp 77-89.
- Jung, J., 2000. Empirical Comparison of Four Accelerators for Direct Annotation of Photos. Retrieved June 18, 2004 from <http://www.cs.umd.edu/hcil/photolib/paper/cmssc498paper.doc>.
- Kearsley, G., 1994. *Public Access Systems: Bringing Computer Power to the People*. Ablex Publishing Corporation, Norwood, NJ.
- Kuchinsky, A., Pering, C., Creech, M., Freeze, B., Serra, B., Gwizdka, J., 1999. FotoFile: A Consumer Multimedia Organization and Retrieval System, *Proceedings of ACM CHI99 Conference on Human Factors in Computing Systems*, 496-503.
- Maguire, M.C., 1999. A review of user-interface design guidelines for public information kiosk systems. *International Journal of Human-Computer Studies* (50) 3, 263-286.
- Marchionini, G., Ashley, M., Korzendorfer, L., 1993. ACCESS at the Library of Congress. *Sparks of Innovation in Human-Computer Interaction*, B. Shneiderman, Ed., Ablex Publishing Corporation, Norwood, NJ. 251-258.
- Marchionini, G., Plaisant, C., Komlodi, A., 1998. Interfaces and Tools for the Library of Congress National Digital Library Program. *Information Processing & Management*, (34) 5, 535-555.
- Martin, J., 1991. *Rapid Application Development*. Macmillan Publishing Co., Indianapolis, Indiana.
- Mills, T., Pye, D., Sinclair, D., Wood, K., 2000. *ShoeBox: A Digital Photo Management System*. AT&T Laboratories Cambridge.
- Nielsen, J. 1994. *Usability Engineering*. Academic Press, New York.
- Plaisant, C., 1990. Guide to Opportunities in Volunteer Archaeology - Case Study of the Use of a Hypertext System in a Museum Exhibit, *Hypertext/Hypermedia Handbook*, Berk E. & Devlin, J., Eds., McGraw-Hill , 498-505.
- Plaisant, C., Kang, H., Shneiderman, B., 2003. Helping users get started with visual interfaces: multi-layered interfaces, integrated initial guidance and video demonstrations, to appear in *Proc. of 10th International Conference on Human-Computer Interaction*, Crete, Greece, 22-27 June 2003.
- Plaisant, C., Marchionini, G., Bruns, T., Komlodi, A., Campbell, L., 1996. Bringing Treasures to the Surface: Iterative Design for the Library of Congress National Digital Library Program. *Proceedings of the CHI '97 Conference on Human Factors in Computing Systems*, ACM New York, 518-525.
- Preece, J., 2000. *Online Communities: Designing Usability, Supporting Sociability*. Chichester, UK: John Wiley & Sons.
- Salomon, G., 1990. Designing Casual-Use Hypertext: The CHI '89 InfoBooth. *Conference Proceedings on Empowering People: Human Factors in Computing Systems: Special Issue of the SIGCHI Bulletin*, 451-458.
- Schuler, D., 1994. Community networks: building a new participatory medium. *Communications of the ACM* (37) 1, 38-51.

- Shen, C., Lesh, N., Vernier, F., 2003. Personal Digital Historian: Story Sharing Around the Table. *Interactions* (10) 2, 15-22.
- Shneiderman, B., Brethauer, D., Plaisant, C., Potter, R., 1989. Evaluating Three Museum Installations of a Hypertext System. *Journal of the American Society for Information Science*, (40) 3, 172-182.
- Shneiderman, B., Kang, H., 2000. Direct Annotation: A Drag-and-Drop Strategy for Labeling Photos. *Proc. International Conference Information Visualisation (IV2000)*. London, England.
- Shneiderman, B., Kang, H., Kules, B., Plaisant, C., Rose, A., Rucheir, R., 2002. A Photo History of SIGCHI: Evolution of Design from Personal to Public. *Interactions* (9) 3, 17-23.
- Viégas, F. B., 2000. Collections: Adapting the Display of Personal Objects for Different Audiences. Masters Thesis. Massachusetts Institute of Technology. Retrieved June 18, 2004 from <http://smg.media.mit.edu/papers/Viegas/Collections/collections.pdf>.