1 Introduction

As computer use becomes increasingly prevalent in our everyday lives, computer usability issues must be addressed. This would appear to be a domain best left to the social sciences. Social scientists, however, are by and large not well equipped to deal with the limitations and constraints associated with software development processes. Thus is the field of Human Computer Interaction (HCI) research born. Although there is no universally-accepted definition of the term HCI, consider the following:

- “Human-computer interaction (HCI) is the study of interaction between people (users) and computers. It is an interdisciplinary subject, relating computer science with many other fields of study and research. Interaction between users and computers occurs at the user interface (or simply interface), which includes both hardware (i.e. peripherals and other hardware) and software (for example determining which, and how, information is presented to the user on a screen).” ([www.wikipedia.org](http://www.wikipedia.org))

- “[working] towards understanding the complex interplay of software tools, human behavior and social structures in order to enhance the development and use of software tools.” ([www.thechiselgroup.org](http://www.thechiselgroup.org))

The following paper details the research program undertaken by Kim Hansen in the CHISEL HCI group during the summer of 2005.
2 Background: Digital Image Library Management

Digital cameras and imaging software have become pervasive through western society, and are now used by a broad cross-section of consumers, from people with in-depth technical expertise to those who are new to both computers and cameras. As this contemporary medium gains influence, it is crucial that we develop practices to ease its emergence.

The library sciences have produced a considerable body of research on how to think about the classification of traditional images. For example, in her widely referenced paper “Analyzing the Subject of a Picture: a Theoretical Approach”[12], Shatford-Layne introduces a two-tiered classification hierarchy. Extending Panofsky’s “Three Levels of Meaning in Art”[9], she proposes that we think of images in terms of “the generic of”, “the specific of”, and “the about”. These three levels may be applied to the Who, What, Where, When, and Other facets of any particular image. We see examples in Table 1.

<table>
<thead>
<tr>
<th>This is a statue (\textit{\text{generic what}})</th>
<th>This is a Christmas (\textit{\text{generic when}})</th>
</tr>
</thead>
<tbody>
<tr>
<td>This is a statue sculpted by Rodin, (\textit{\text{specific what}}) entitled “The Thinker”</td>
<td>This is the first Christmas (\textit{\text{specific when}}) approximately 2005 years ago</td>
</tr>
<tr>
<td>This is a portrayal of Man’s unique power of thought (\textit{\text{about}})</td>
<td>This is proof of God’s great love for mankind (\textit{\text{about}})</td>
</tr>
</tbody>
</table>

Table 1: Two-tiered, faceted classification of images

The library science base of research, however, does not entirely satisfy our needs. First, it has been shown[8] that a photographer’s reading of digital images differs fundamentally from that of traditional images. Digital photographs are arguably more abstract than traditional photographs due to lack of physical presence[8].
Additionally, the marginal cost per frame of digital photography is comparatively low. It costs a photographer nothing to repeatedly fill his memory card, and very little to store the images. Digital image collections are typically several orders of magnitude larger than physical collections for this reason. In these expanded collections, the value of individual images is diminished.

With the noted swelling of digital image collections, we encounter a second shortcoming of library science research. Traditionally, a large-scale library of images has been assumed, such as the stock collections used by newspapers and magazines. This type of collection might have tens of thousands of images, and typically has a professional librarian devoted to its upkeep. The physical photo collections of amateur-to-semi-pro traditional photographers, on the other hand, tend to be more-or-less structured around the “shoebox principle” [11]. Photographs are organized in roughly chronological order, occasionally with an event-based focus (i.e. Chris’ Wedding, Our Trip to Italy), if they are organized at all. In contrast with image libraries, personal photo collections are usually not organized either because they are too small to warrant formal cataloging, or the task seems disproportionately costly. Traditional image collections moreover have physical cues such as location and storage container to assist in narrowing a search.

Today, an amateur-to-semi-pro digital photographer might easily have thousands of images in his collection. Conventional tools for image management rely on folders of image thumbnails, rough analogues to the traditional shoeboxes. Scrolling through thousands of images to find a specific picture, however, can be very frustrating. There are no physical cues, and limited desktop real-estate requires that thumbnails be relatively small. Furthermore, unlike stock image libraries, there is no professional image librarian in place to deal with organization. We can, however, attempt to provide a computerized substitute.

Artificial intelligence is not yet sufficiently advanced to make possible the fully automated cataloguing of the recent proliferation of digital images. We must therefore rely on digital camera users. In order to create intelligent tool support, however, it is essential that we first understand how digital photographers think about their images. To this end, CHISEL group researchers Tricia D’Entremont and Kim Hansen undertook a participant study of this user group during Hansen’s research term. It was our contention that Shatford’s two-tiered hierarchical library holds for personal collections, and furthermore that it holds for digital collections.
3 Study: An experimental exploration of faceted categorizations

3.1 Project status and direction

At the close of the summer 2005 term less than ten digital photographers had participated in the study. The sample is unfortunately not statistically significant. Therefore, D’Entremont and Hansen intend to continue this work through the fall 2005 semester. The following outline is based on research conducted thus far; analysis of data and subsequent conclusions will be made upon completion of fieldwork (spring 2006).

3.2 Participants

7 people, 4 male and 3 female, between the ages of 22 and 53. Completed education ranged from high school to doctorate, with most participants having completed some university. While they were not informed of this at recruitment, participants were given two movie tickets in appreciation for their commitment of time.

3.3 Procedure

Participants were asked to use Picasa, digital photo organization software produced by Google, to organize a portion of their own digital photo collection. Due to the fact that this is fairly widely used software, participants fell into two groups; those who were already using Picasa to organize their images (Alpha group), and those who were not (Beta group).

Alpha group

Alpha group users had already used Picasa to organize their collections in the course of their everyday lives. Thus, users in this group were simply asked to record their existing partitions and annotations, and complete a short qualitative questionnaire.

Beta group

The beta group was instructed to spend one hour organizing the photos in their collections “to the best of their ability, in as natural a manner as possible”. It was required that image collections consist of at least 150 images. If collection size exceeded 400 images, Betas were permitted to work with a reasonable subset of their collection between 150 and 400 images. Collections larger than this were too judged too unwieldy for the one-hour time frame. Participants were then
asked to record all partitions and annotations made on their image collection. Finally, participants completed the qualitative questionnaire.

3.4 Procedure: Motivations

Picasa

Csikszentmihalyi[5] and Bederson[3] lay out the following set of guidelines for the creation of interfaces which allow users to concentrate on the task at hand rather than the software.

- The software is pleasantly challenging, providing meaningful rewards for advancing along the learning curve.
- Through an intuitive interface, the software allows users to concentrate on the task at hand.
- The software gives users a feeling of control over the outcomes of their actions.
- The software is efficient enough to provide feedback in a timely manner.

Picasa was chosen as an engine for this study for several reasons. Chief among them was that the program generally follows the above guidelines, allowing users to organize their photographs with minimal confusion. Additionally, Picasa has very little embedded idea of the facets of Who, What, Where, and When (a fairly rudimentary timeline is present, but due to several programmatical limitations, it is not considered to be an interfering factor). Participants were thus free to assign categorizations and annotations based on their inherent mental systems. Other programs such as Adobe Photoshop Album could force users into these facets, invalidating the study.

Stock vs. personal photo collections

Studies show[6] that the curator of a digital photo collection is typically also the photographer, and intimately familiar with collection’s images. While some organization software benchmarks use stock photo collections[10], we thought it vitally important that we use participants’ own photo collections for this study. Only with a personal photo collection will a participant have a firm idea of the who, what, when, and where facets of each photo, allowing categorization by these natural groupings.

The Alpha group compromise

Preliminary studies revealed that asking participants to reorganize their photos for the purposes of a study resulted in extremely half-hearted efforts. Participants felt that they were “reinventing the wheel”. The upshot was that re-organized collections did not well resemble the every-day organization schemas
of these participants. Thus, it was conceded that Alpha participants must be allowed to use their existing structures.

This is not to say, however, that the two groups are not useful in their own right. Alpha group allow us a view of the real-world categorizations of Picasa users. It has been shown[7] that camera owners usually do not put as much effort into organization as they might in an ideal situation. Therefore, the existing organizational structures of Alpha group may not be “complete”. Categories and systems of annotation which are in place, however, are normally the product of extended thought and revision.

Beta group, on the other hand, gives us insight into what people come up with “on the fly”. This means that Beta group solutions may be more imaginative than Alpha group solutions. As well, Beta group tends to more closely approximate what they consider to be ideal, as they are forced to spend a solid hour focusing on the task in a more or less controlled environment.

3.5 Methods of Analysis

There are four basic methods of categorization and annotation within Picasa: folders (similar to Windows folders), labels (an image can have multiple labels, and images with the same label may be grouped), keywords (per-word searchable, not displayed with picture), and captions (per-word searchable, displayed with picture).

The proposed method of analysis is fairly simple. For each participant, extract the names given to each folder and label, and all keywords and captions associated with the images. The two researchers separately categorize extracted information according to the specific or the general of the facets spanned. A caption of “Jimmy and I at Luminara Festival 2005”, for instance, would elicit a classification of 2x[Specific Who = Jimmy, I], 1x[Specific What = Luminara Festival], and 1x[Specific When = 2005]. Upon completion of this task, categorizations are compared between researchers. Any differences are reconciled via debate.

4 Conclusions & future work

While conclusions cannot be drawn from the current body of research, it is the hope of the research team that this work will greatly enhance our ability to write intuitive photo organization software. Additionally, insights gained here will contribute to the Master’s research of the author, to commence spring 2006.
References


5 Appendix: Informal findings arising from the research program, on the process of human subject research in computer science

The largest share of computer science research will ultimately be employed to produce software. It is essential that this software be usable by the market for which it is intended. Thus the user study, aimed at creating more usable software, comes into play.

A computer scientist is uniquely qualified to carry out user studies, as he alone is capable of understanding the unique variables and uncertainties associated with his software. The term “user study”, however, might be considered misleading, in that it implies software which has already been written. Common practice for fields which focus on human research is to do exploratory studies when little is known about an area[4]. The groundwork laid there enables researchers to determine what direction further research should take.

Applied to computer science research, this approach makes it possible to rule out unprofitable avenues, avoiding wasted man hours and user frustration. The territory of human-subject studies may be outside the realm of experience for many computer scientists, however. The following insights were gained by the author over the course of her research, and might be worth noting for novices in this area.

1. “It’s for the good of science” is not an effective way to recruit people. People are busy. They typically require an incentive to give up their valuable time. Even after people have agreed to participate in your study, do not assume that they will participate in your study. The effort that it takes to actually leave one’s house and arrive at a meeting place on time is significant, even with an incentive in place.

2. While it may be easy for you to wave away your prototype’s shortcomings, the same will not be true for participants. Something so simple as not implementing a drag-select can affect the results of your study tremendously. Construct a simple as possible interface to test your specific hypothesis. Make sure that every aspect of your interface works well. Not only does this approach eliminate the Prototype Effect, but also mitigates result invalidation due to extraneous factors.

3. Do not assume that participants will follow the instructions given them. Asking someone to read and assimilate a ten-page document, no matter how well-written, is simply not an option. Providing click-by-click instructions on how to open a Zip file will result in an successfully opened Zip file only part of the time. Alleviate these tendencies by providing video or in-person assistance as often as possible.
4. *Once a study design has been formalized, stick to it.* It is surprisingly easy to answer “No, it doesn’t really matter” when a participant asks you if they absolutely have to complete a section of the study*. This is a good way to invalidate your results. Conducting the study in an “official” environment can lessen this phenomenon. [*Note: if you are consistently running into this problem, perhaps it’s time to consider changing your study design. Asking a participant to organize a group of photos in three slightly-different environments seems like a very good idea on paper. By the third iteration, however, participants are not likely to be enthusiastic about the task at hand.*]

5. *Just because subjects do not exhibit the reactions that you were hoping for does not mean that their results are not valuable.* Again, this is just good scientific method. Even completely off-track responses can provide interesting qualitative evidence. Follow the data, and see what happens!

6. *Unless you are holding a participant’s 100% completed study in your hand, do not assume that they will complete the study.*

To sum up: assume the worst, hope for the best, and plan as well as possible to further your cause. A user study requires patience, determination, and above all a good understanding of human nature.