Digital Photo Lifecycle
Masters of Human Computer Interaction Capstone Project
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The superscript symbol ë after a term denotes that its definition can be found in Appendix e.
Executive Summary

Our goal is to enhance the triage experience of photo sharers as they prepare to communicate the stories that are connected to their photo collection. To that end, we conducted various user studies, both formal and informal, reviewed numerous related publications, and analyzed existing products involved in the photo lifecycle. Upon completion of our exploratory research, we consolidated our results and created models accordingly to communicate our insights. Based on the overarching themes we discovered, listed below, we decided upon design implications that we plan to actively support through our innovative and attractive design.

Privacy of photos and personal information is a major concern. Control over photo collection and display is highly valued.

Annotated photo collections are recognized as extremely useful. Annotating requires too much effort.

Large numbers of photos and repositories impede access. Switching between overview and detailed view is exceedingly common.

Shared ownership of photos is a widespread and complex phenomenon. The audience has some influence and control of the viewing experience.

Short intermittent photo interaction sessions are the norm. Photo sharing is often used to promote social connectivity.
Introduction

The advent of digital photography has made capturing and saving photos cheaper and faster. This leads to increasing amounts of digital photos to manage, and more opportunities to share stories through these photos. This process, starting with capture and ending in sharing, has been defined as the digital photo lifecycle. It consists of three key stages: triage, authoring, and viewing. Past studies of this lifecycle have predominately focused on the authoring and viewing stages, leaving triage largely unexplored.

Photo triage is the decision-making process involved in sorting through and organizing photos. During triage, users select desirable photos, and delete unwanted ones. Triage occurs frequently during the photo lifecycle, from deciding where to store acquired photos, to selecting which photos to create photo-based experiences with. Even at the point of sharing, triage occurs to supply the dynamic conversation with relevant photos. However, having a vast number of digital photos hinders triage and can create barriers to organizing and sharing photos.

Our goal is to create a rewarding experience that will support and motivate people in triaging their photos in preparation for sharing them. In order to establish a rich understanding of this problem space, we have read prior research publications, reviewed competitive products, and conducted several user studies. Next we will build upon our insights to design and evaluate a compelling prototype that supports photo triage in a new and innovative way.

Team Pluto

All members of our team are in the Masters of Human Computer Interaction program at Carnegie Mellon University. Our team members come from diverse backgrounds, ranging from computer science to architecture and neuroscience. We created the team name “Pluto” to represent what we are trying to achieve for our users: Photo Lifecycle UTOpia.
Background Research

Our team has reviewed publications from various conference proceedings covering a variety of topics in the digital photography domain. Many publications we reviewed illustrate how the recent shift from prints to digital photos has affected the way people interact and share photos. They provide insights into some of the common user behaviors at various stages of the digital photo lifecycle as well as some novel interaction styles and visualization methods that enhance user experience. Although the various foci in these publications show how people have addressed this problem space in different ways, and hence generated diverse insights, we focus on findings and results that are identified as closely related or have demonstrated some relation to the photo triage process. More details about each publication are available in Appendix a.

In addition to an extensive number of publications, we conducted competitive analysis on a wide range of products that are currently in the market supporting diverse aspects of the digital photo lifecycle. The products ranged from desktop applications that primarily support importing, organizing, and authoring, to web services that support uploading, authoring and sharing. We recorded novel interactions provided, as well as breakdowns and limitations in these products. Only the key findings are mentioned below in conjunction with the publications, with additional details about each product available in Appendix b.

User Behavior

The nature of home photography is changing due to increased pervasiveness of digital cameras. The following sections illustrate the emerging user behaviors at different stages in the digital photo lifecycle.

Image capturing

There is an increase in the size of photo collections due to reduced costs of digital storage media. Not only are more photos being captured, but also people are capturing more photos of highly similar things; hence resulting in many snapshots of the same scene, object, or persons. For some people, the act of taking the photo was more important than the photo itself [49].
The nature of images captured on camera phones is different; they’re more casual and mundane. This lack of seriousness of camera phones facilitates candid and humorous shots [49].

Organizing

This phase involves importing, editing, deleting, and filing. Organization can start right after the moment of capture. People often review and delete photos on the camera itself. This may be tied to the limited capacity of the storage medium on the camera or to the lack of time commitment to photo organization after importing.

The next step in the process is importing the captured photos onto a computer. The decisions that users make while importing photos are technically-driven, event-driven, or goal-driven [7].

Many behaviors were observed once the photos were imported to the computer. Some people immediately file and archive their imported photos. Others review and delete before filing them. Photos are deleted based on image quality factors and other personal preferences. Simple editing like re-orientation, red-eye removal etc., usually occurred at the download stage.

Filing and archiving were influenced by two factors. The first is the inherent tendency of digital cameras to store pictures in “folders” which affect people to drag and drop folders between camera and file store. Second was due to the reduced use of digital album software. Studies observed that people almost never used software that was bundled with the camera, but tended to use software that was heavily tied to the operating system [7].

The picture containing folders are usually renamed with date of capture or an event name. Some even used location and people’s names to name a folder. The filenames of photos were almost never renamed [7]. Organization in online photo albums includes annotations. Why people annotate photographs? Successful retrieval is based largely on attaching appropriate annotations to each image and collection since automated image content analysis is still limited [27]. Studies showed that photo annotation only really occurs for sharing purposes, and not for organizational purposes [6]. Other studies [29] showed that consumers typically put little effort into photo annotation; they are more focused on exploratory search and serendipitous discovery of photos with a stronger emphasis on entertainment. Annotation is still considered a time consuming process, which users aren’t willing to invest in. Some research prototypes [17][47] leveraged face recognition technology to group photos based on the people in the photo.
After filing away photos, people often created archives to back-up their photo collections. A commonly observed behavior in studies was backing up of photos on CDs/DVDs.

**Triage**

A common behavior referred to as the funnel effect [11] shows that there are multiple granularities at which people perform triage. While people capture many photos, they only save a subset of them on their computers. They share only selected groups of the saved photos, and print an even smaller subsets. Studies that observed triage at the pre-share stage found that selection criteria included good image quality, good composition, and more personal preferences. Triaging and sorting were the most common and time-consuming activities observed among people who participated in the research studies [7]

**Sharing**

There are many mediums through which people share their photos. The most common ones observed in the recent studies include e-mail, online albums, personal websites/blogs and even sharing in person. The motivations for sharing photos are manifold: people share experiences, create awareness, augment communication with visual elements, enhance their social presence, and deepen personal and community relationships [28]. It is the memories and the conversation that are of primary importance in photo sharing [28].

Sharing photos in person was described as the most common and enjoyable activity and it is seen as a way of re-creating the past and reliving the experience with others who were there at the time. Prototypes like PhotoArcs [15] lets users add narratives to online photo collection in a way that mimics the face-to-face sharing patterns.

**Storytelling & Social Influence**

Some papers also propose the use of audio narrations to annotate photographs and enhance the sharing experience. Research shows that audio can be a richer media than written text [63] when communicating an experience. The amount and quality of information that can be communicated through voice media in a given amount of time is much greater than written text. Additionally, voice can convey information about the speaker’s mood, gender, ethnicity, age, and all subtle cues that might be lost in text-based annotation.
Offline sharing modes are also explored in some of the papers. For example, the TableTop prototype [5] supported sharing with a display projected onto a real table where many people can simultaneously take part in the interaction. The Personal Digital Historian [10] is another tabletop interface intended to support collaborative story sharing.

There is a changing trend observed with the advent of digital photography. Photographs are now no longer limited to important events. People now take photos more frequently, and sharing them is their primary intent [15]. Also, recognition and identification of people in the photo are of primary importance rather than composition and photographic skill.

How an online social presence can influence the way photo collections are organized and shared was also highlighted in some papers. Recent innovations in social experiences on the web (Flickr) have sought to encourage annotation by increasing satisfaction and making benefits immediately apparent.

Differentiating itself from the others, Flickr supports a collaborative sharing experience by allowing members to add tags on shared photos and open forums to discuss a specific photo or album. Although the tags are mostly unstructured, Flickr supports tagging of the capture location on a map, referred to as geo-tagging. Tagging also exists on social network photo albums, which are shared with friends on the social network. When a person is tagged, the photo provides a link to their profile. The largest concern with these social networks is privacy, as users may upload an image as public (everyone on the social network can see it), and then tag a person who would rather have their tagged photos to be private (only their confirmed friends can see it).

**Interaction**

Many publications we have read drew upon physical world analogies to design new interactions with digital photos. One such novel technique is BumpTop [4] in which a user interacts with files in a virtual three-dimensional space using pen input. The interaction was mainly through pen-based gestures and tapping (for selection). These physical analogies tend to have breakdowns in browsing and managing photos when the size of the collection grows. They work well with a small set of photos, but are not capable of scaling to the large number of photos that users own.
We also saw many prototypes (Zoomable User Interfaces) in the publications using sophisticated zooming techniques that allowed users to zoom in and out across spatially distributed photos [16] [47] [53]. This allowed users to quickly switch from thumbnail overview to the full-sized detailed view.

Certain prototypes [30] [25] offered users the ability to annotate photographs with voice and attach it to individual or group of images. The problem with this type of annotation was the inability to link annotations to a particular part of the photograph. Listening to audio annotations while viewing photos killed the conversation between people and made the activity passive [59].

Prototypes also offered photo-labeling mechanisms through drag-and-drop techniques [15] [62]. The drag-and-drop interaction mechanism is quite natural in the sense that people hold and move physical photos around. Most of the commercial products including web-based services support this interaction technique.

The PhotoArcs interaction to add narratives to online photo collection in a way mimics the face-to-face sharing patterns. Using this interface the users can organize their pictures into linear arcs connected by textual descriptions. Much of the PhotoArcs interaction is drag-and-drop [15].

Another interesting interaction mechanism was gaze-based interaction that was used for semi-automatic photo cropping. This was an interactive method for cropping photographs using eye tracking.

**Visualization**

A frequently identified visualization technique in many of our research materials was automatic grouping or clustering of photos to improve user’s access to them. Some of the automatic capabilities include semantic grouping, time-based grouping, and color-coding [40] [41]. Many works have tried automatic grouping of multiple photos of the same scene or based on their semantic similarities that could help users identify the best ones [30] [42]. In addition to simple clustering of photos by similarities, an automatic function to suggest names to attach to each image without using face recognition was previously used [52]. Sometimes multiple grouping or sorting techniques were used simultaneously such as clustering based visual similarities, juxtaposing based on color and texture, and automatic within-frame highlighting to help identify similar photos [14].
In commercial products such as Adobe Lightroom, Picasa, and Apple iPhoto, users can choose to view selected groups of photos by different criteria, which in most cases was by date and event. However, some automatic grouping of photos showed problems in that they can compete with user’s manual organization method, which will delay the process of selecting or finding a specific photo [18].

Similarly to grouping of photos, opportunities in using labels and metadata to display collection of photos appeared in many recent publications. FXPAL used various ways to display photos using labels or categories such as date, event, people, and places [41]. Algorithms that use metadata to sort photos by various criteria such as size and names also demonstrate effective use of metadata in displaying collection of photos [33]. FotoFile paper suggests an opportunity for useful metadata from photos that are organized as stories [54]. A semi-automatic approach for facilitating quick and easy labeling of photos with people using face detection technology is presented also, but most of face detection or recognition technology still showed some limitations in their complete functionality [51].

Zoomable User Interfaces (ZUI) are helpful for users to rapidly navigate between the overview and the detailed view of the photos. ZUI is a visualization technique that allows users to zoom in and out, as well as pan around spatially organized information, which have been and can be applied for efficient interaction with photo collections. A sophisticated zooming technique was introduced in a publication, which allows zooming into thumbnails so that the most interesting or relevant section of the photo is displayed while panning through the photo in an optimal path is also supported [47]. Such interface allows users to rapidly switch between full-size image view and thumbnail overview. Some study results suggest that ZUI and the thumbnail grid were the best for performance time and user satisfaction when browsing for a given photo [53].

Many of the prototypes or products that we reviewed suggested providing different views for the photos. In StoryTrack, users cannot only view their stories of photos but also the original versions of the photos and the story that they are creating [25]. Numerous works chose methods to display different views simultaneously so that users don’t have to repeatedly switch views [31]. Some prototypes were designed so that users can access different preset image sizes for the same collection, which can reduce additional storage costs [40] [41]. Opportunities for using different views was also proposed in publications such as sending only the current view resolution photos to the client for enhance the user's experience on the web in greater efficiency [32]. Most of the desktop applications have the capability to display photos in various views including Adobe Lightroom, which
offers most flexibility by allowing users to choose various views both for multiple photos (thumbnail, loupe, compare, survey) and individual photos (fit, fill, 1:1, 1:4).

Displaying photos in thumbnails were proved to be efficient for users as they facilitate visual search and almost all prototypes or products implemented this view in their system. The most important features of Shoebox as claimed by the authors are that it automatically sorts the photos in chronological order and it displays huge amount of photos in thumbnails [30]. Similarly, the Time Quilt system used representative thumbnails in a timeline [16]. Recent commercial products, both web services and desktop applications, are also based on thumbnail displays, including Microsoft Windows Explorer, Picasa, and Flickr.

In separation from computer screens, other display methods were also frequently demonstrated in our selected publications. Digital tabletop appeared as an opportunity for displaying digital photos in a collaborative environment. Team Tag offers tabletop visualization method so that multiple users can view the photos simultaneously and collaboratively interact with them [5] [10]. Many hand-held display devices including cell phones and PDAs were commonly used in previous works mostly because they offer great mobility and tangibility [25]. However, some constraints were also found those devices as small display real estate on cell phones limited opportunity for users interaction with photos and annotations [19].
User Research

To move beyond our personal experiences with the photo lifecycle and the background research, we performed several user studies. We conducted seven Contextual Inquiries\textsuperscript{\(\text{c}\)} (CI) and several Retrospective Account\textsuperscript{\(\text{e}\)} interviews to inform our intuition and collect qualitative data. We also analyzed the time-scale of the tasks observed using Diary Studies and verified the predominance of our observation with a survey\textsuperscript{\(\text{e}\)} answered by 415 participants. Here we revealed people’s methods for managing and sharing\textsuperscript{\(\text{c}\)} their photos, discovering things that even they did not know about their own process. Our focus through most of these studies was the following:

We want to explore photo triage that takes place in preparation for sharing stories, and how this triage interconnects with photo organization. Additionally, we want to investigate how social factors motivate and influence this process.

Contextual Inquiries and Retrospective Accounts

We modeled and analyzed our seven contextual inquiries for breakdowns and insights, which can be viewed in full in Appendices c and d. The flow model describes how work and information are distributed and coordinated among people, irrespective of time. We isolated the various roles played by photo sharers to better understand the tasks involved. The cultural model captures the influences which define expectations, desires, and the whole approach towards sharing photos. The tangible and virtual items people interact with in the course of their work are explained in artifact models. We created two artifact models, which generalized the use of email and web services we frequency saw used for photo sharing during our user research. The important findings from our seven contextual inquiries are below, supplemented with qualitative information gained from our retrospective accounts.

Participants

While any digital photo taker is a potential participant, we targeted participants who have a large influx of new photos, such as a couple with a new baby or people returning from a vacation trip, so that we would have a lot to observe. Of our eight CI participants, six
have been university aged students, although one of them held a full-time job and two had babies. The remaining two CI participants were retired.

Our first participant was a student finding and triaging photos for a class project (U1). The next participant was a photography hobbyist, who used a variety of websites for sharing (U2). The third and fourth participants were a couple who recently had a baby, and shared ownership of their photos they have taken since they got married (U3m & U3f). The fifth participant (U4) has a full-time job, wife, baby, and is a part-time master’s student, and a dedicated Flickr user. Our sixth participant was a male master’s student (U5). The seventh participant was a grandmother living with her husband nearby two children, and far from the third (U6).

Our last participant was an elderly photographer who has taken award-winning photographs (U7). We considered him as an outlier in our CI participants, as he was an expert photographer who had performed a large amount of triage with older non-digital systems. We thought his experience could draw our attention to aspects of photo management and decision-making that we would otherwise miss.

Our Retrospective Account participants varied from college students to business consultants. One particularly interesting retrospective account participant was a housewife in her 40’s with two grown daughters (R1).

Tasks

In our CI’s and Retrospective Accounts, we focused on triage that occurs on their computer. We specifically looked at tasks involving triage, such as when importing new photos or receiving photos from others. Further triage tasks included organization of these photos on the computer, filtering out of unwanted photos, and preparation for sharing photos. The pathways for sharing that we studied included email, personal blogs, photo sharing websites such as Flickr and Yahoo! Photos, as well as social networking websites such as Facebook and Cyworld. Other tasks that we observed included searching for and downloading images to use in a school project on iStock Photo and requesting new pictures from family members.
Breakdowns and Insights

During these three contextual inquiries, we witnessed many breakdowns and observed many interesting behaviors. Much of this was information that the users did not know about themselves. As U2 said, “I didn’t know that I had an order to what I do.” In general, we found that users were dissatisfied with the current products. For example, U3m and U3f said they tried Hello, Picasa, and Ringo before settling on Flickr and Kodak EasyShare Gallery, which they were still not satisfied with. The most informative insights and breakdowns are as follows.

Privacy

Over time, privacy became an important concern for the U3 couple. In the past, random people sent spam emails to them about photos that they had posted on their public online albums. Since then, they have paid more attention to who is allowed to view their photos, adding passwords to protect what they post. When selecting a photo sharing site, they evaluated the privacy controls, and specifically mentioned that they found it difficult to configure permissions on Flickr.

The U3’s also expressed concerns over the imbalance between how many photos they share with others and how much others share with them. This makes them uncomfortable because it means others know more about their life than they know about others’ lives. U3m explained the situation as “the curse of being technically savvy,” in that they know how to share, so people expect them to share more.

U5’s privacy concerns had more to do with companies and web services. He said that “most of Google’s products force you to download all these applications. It is pretty intrusive.” He was concerned that the programs may pass information about him and his use to the company; “just because it is a free software I do not want it to infringe on my privacy.” U6 would not order prints online since she did not want them going through the mail. Related, is the rejection of downloadable software for augmented functionality, which we observed in some users. U2 would rather upload each photo by hand than download special upload software even though he once uploaded 70 photos in one session.

U4, on the other hand, does not use the 'private' setting for any of his collection of 1790 photos on Flickr, because he does not want to keep updating the list of people who can view his photos. There are many people who he is fine with seeing his photos but not
necessarily those he knows very well, such when his parents direct extended family to his web album. The privacy settings on web services are not flexible enough to allow him to set his photos to private, and concurrently allow these extended family members to view his photos.

Control

U1 does not use iPhoto because she wants complete control over where images are saved, and feels that iPhoto denies this control. Along the same lines, U3m has a specific file organization and naming convention that he is very proud of. He enjoys the direct control and clean organization that it gives him. Lack of direct access to the file structure would make both of these users feel not in control of their system, and lead them to not use it.

Control of what photos to import to the computer or specific software is also important. U5 expressed that he wanted to select the photos to upload himself instead of the computer doing it. This issue is highly related to privacy, as U5 also said that “I find it annoying and like an intrusion of privacy that [Picasa] goes through my entire computer and finds all my photos.”

Editing

One of the breakdowns we observed repeatedly was the poor support for basic editing during triage. U2 and U3m mentioned that photos are too big to be uploaded unedited, and the U3’s said it was a big pain to fix this using existing products. They used Adobe Photoshop in the past, but opening images up individually to edit them was too time consuming. U7 did this, but he was irritated by how long it took. Current products only marginally support the desired quick fixes other than rotation.

Annotating

Many of our participants wanted to have their photos tagged but did not want to put the time and energy into tagging them. U5 did not tag because of time constraints, though he wanted his photos to be tagged so that he could search them. He said “I took 137 pictures in one day last time. I’m not going to sit down and write every detail.” U4 said that “I haven’t been tagging because of time, and a need to get these pictures out to people”. However, he also said he did not see a use for tagging. He tended to assume that people could get all the important information about a picture just by looking at it. He only
added information to photos on his blog if it was important, such as adding the time of birth and weight of his baby daughter to her first photo.

We also noticed a distinct lack of support for recording users’ thoughts about photos during triage. U1 used textEdit application to take notes in a temporary document because it opens quickly. U2 had no place to record his decisions; he kept track of everything in his head. However, he labeled folders of photos by where he stores them on the internet. While on trips, U7 and R1 both took notes that they later used to name their pictures or to write comments about them. They said that later they would not remember the details.

**Access**

Another pain-point we observed was maintaining access to the photos that users have. All of the people we observed kept photos in more than one place. For example, U2 has images on his work computer, home laptop, his main website, PBase, and Kodak EasyShare Gallery. Besides this, U2 moves most of his photos from his laptop to an external hard drive, keeping only a selected few on his computer. The sheer number of places people are storing their photos causes problems, such as forgetting where photos are stored. The U3’s lost an important video for a couple, years before finding it on an old computer of U3m’s. U6 could not find some photos of her grandchild because they were in a folder of pictures of another grandchild. Users’ disparate photo storage forces them to remember passwords, logins, and website addresses as well.

Another issue with access is the number of photos people have. U4’s collection of 1790 photos on Flickr is uploaded to a single group. Unless he has sorted a photo into a "set," which refers to the sub-folders on the website, it is difficult for him to locate it again. The photos get buried in the large single group, which is difficult to navigate since the web album splits the group of photos across 90 web pages.

**Speed**

Speed was of concern to many of our users. U5 specifically said “I don’t like waiting for anything.” Time and bandwidth constraints were the primary limitations on number and size of pictures shared. U5 said “I don’t want my friends to waste time going through lots of pictures. It also wastes my time – it takes a lot of time to upload them.” U7 preferred physical slides for choosing photos because it was faster. He could just “throw all the slides in a projector, go forward and backward, [and decide:] I like this one better, so the
others are out.” Actually enacting the choices is faster using slides; he could just pull the rejected photos out of the projector and throw them away. The high resolution and large size of the projection also helped with the decision making.

View Size

We noticed that many users switch between viewing their images full-sized and seeing them as thumbnails. There is a balance between quality and content versus seeing the image in context and comparing the photos to the photos around it. Users glanced through their thumbnails, jumped between thumbnails and full-sized images, and sometimes flipped through full-sized images like a slide show. Flipping through full-sized slideshow allowed users to compare nearby images very effectively. U4 did this to choose which photo to use from a set of similar photos with the same content.

U4 organized his photos into sets using only the thumbnail view. He could just glance at the photos and see the visual breaks where photos from one event ended and the next event’s photos began. U7 could make his decisions about his photos very quickly based only on their thumbnails. Composition seemed the most important, unless the image was blurry, dark, or light enough that it had no detail. U5 used the four thumbnails on each folder in the Thumbnail view in Windows Explorer to find the folder he is looking for; “It’s all because of these previews. These previews are extremely important.”

Shared Ownership of Photos

In several of our CI’s we observed people who shared ownership of pictures. Often times this was a couple, although we saw this with siblings or people who had gone on the same trip together as well. Couples usually looked through their images and discussed them not long after they were taken, though this was not necessarily seen as a time for triage. To some degree, these people acted as one person. Each individual chose what to share with their own family and friends, however.

With co-ownership came issues with dissemination of photos. R1 burned CDs for her brother and sister of all the images from a trip they went on together. Users U3m and U3f had a photo-sharing folder on both their computers that were kept identical using necessary software they had.

Social Influence
There is an inherent difference between sharing a lot of pictures and sharing just a few. Sharing a lot means the sharer does not have to do much triage, but makes it far less special or pleasant for the viewer. On the other hand, Okurt only allows its users to upload 12 photos, which means that it is not a repository but rather a selection of the “best” or most representative photos. A lot of factors come into play when selecting these 12 photos too. U5 said: “All of these pictures need to say something about me. They have to be very descriptive, and come from very diverse backgrounds ... so these pictures change every few weeks.” The small number of shared photos became a way for the user to express his identity.

We found it very insightful that U3f sent different emails depending on the recipient, even when sharing the same photos. The body of the email varied tremendously, ranging from paragraphs of semi-formal language to a completely blank email. She pointed out interesting things about the photos she sent by renaming them, but never described them in the body of the email.

None of our users could really explain to us how they made their decisions about their photos, except perhaps U7. Mostly they said the “best” photos, and mentioned such things as photo quality, how interesting it is, how good the people in it look, or rarity of that kind of photo. Photo decision making is primarily an intuitive process, highly influenced by social factors.

Other Behaviors

U1 exhibited the funnel effect [9]. She used a multi-pass approach to triage; first she went through iStockPhoto downloading some images & opening others in tabs. Next U1 went through the ones opened in tabs, downloading some and closing others. Then she looked through some images she had not decided on yet before ending with just a few photos. U7 also used a multi-pass approach; first pulling all of the high-quality photos from a trip onto separate DVD’s, organized by date & location. Then when he wanted to make a slideshow he went through the “good” images and selected photos from there.

Most of our users took multiple photos of the same thing then chose the best shot later. U5 said “I keep taking pictures until I get a good one.” How they treat the rejected ones, however, varies. U5 just leaves all of the photos there because he does not care and has plenty of space. When selecting photos, U1 used the Desktop on her computer as a temporary workspace. While she worked it was clear except for a few folders, a textEdit
file with notes, and the images she had downloaded so far. This behavior of creating temporary workspaces and information repositories is interesting in its impact on triage.

R1 saw herself as the most frequent viewer of the photo albums that she made. She said that she was the one who looked at her pictures the most, both in creating the albums and looking through the current albums on her coffee table during her free time. Most of our users appeared to like re-living the memories, both on their own and by sharing these stories with others. In fact, our users often treated the sharing process as a storytelling experience. U7 explicitly said that most of picking out photos for a slide show is storytelling. This story-centered sharing model is fascinating to our team since it is compelling and inherently generates a lot of information.

All of our participants organized their photos by time or event. Since the time the photo was taken is automatically tagged on the photo, it is interesting that people are adding this information again. Some photos they organized by person, such as putting all of the pictures of their baby in one folder (U4). A few other folders came up, such as all the photos of items to sell on eBay, but not many. Everyone we interviewed copied the entire unsorted photo collection into repositories and referred to this action as “dumping.” Our participants were not completely consistent in their behaviors, but these were the general organizational trends we observed.

These observations were key touch points in a deeper discussion of our problem space. They inspired our exploration of the design space and the potential directions we could take it.
Diary Study

We reviewed and numerically analyzed four diaries. In particular, we calculating intervals, frequencies and durations for different activities that supported photo triage and sharing. We also looked at the qualitative comments people had given.

Participants

Diary studies require reliable participants who are both active in the target activity as well as flexible enough to invest time in recording related details. Eight diaries were distributed by mail. Four participants have returned completed diaries so far. Of the remaining participants one had computer-related issues that interrupted his regular activity.

The diary respondents covered a range of users. The first participant (D1) was a 60-year-old female professional who shared her digital photos via email. She primarily used Microsoft Office Picture Manager, Picasa 2 and Gmail, but was not committed to these tools. The second user was a 38-year-old homemaker who home-schooled her three children and planned activities for the local home-schooling community (D4). She relied on ACDSee for managing photographs, and shared by ordering prints through Costco as well as via email. The third diary came from a young married couple, both of whom participated (D5). These 27 year-olds imported, viewed and managed their photos primarily in Windows Explorer. Besides sharing digital photos on their computer via email, this couple used their cameras on their cell phones to capture photos and their cell phone displays to share them. The last respondent was a 22-year-old college student who used the online social network Facebook to share his photos with friends and family (D7).

Reflections & Insights

Most insights gathered from the diary study relate to temporal trends in activity by the participants, and others stem from their reflections on their activity. Participants recorded in their diaries activities centered around organizing and sharing their digital photos. These findings support those of the contextual inquiries and are consistent with results of the survey.
Most sessions of activity that involved working with digital photos lasted less than a half an hour. Participants recorded various activities including: acquiring, editing, organizing and sharing digital photos. Upon reflection on her use of time, D1 wrote that she had yet to learn efficient practices to edit, manage, and share her photos, offering “I’m still floundering around.” Mostly this was because, as she said; “I feel rushed much of the time and haven’t studied the programs that I am using even now.” Yet she also wrote that she wanted to “spend more time with [her] pictures.” Other participants similarly identified that they wanted to spend less time mediating interactions with their photos through tools and more time directly with the photos. Others reflected on challenges with their photowork that extended the time needed to address their photos. Participant D5 wrote that she learned “I would like to get them more organized but organization costs time.” However, another participant—her husband—complained about the cost to disorganization. He spent extra time compressing photos for email, which he had already done before, because he had lost track of these.
Diary Study: Interval Between Activity

Analysis of the diary study also involved calculating the intervals between sessions, in order to measure the frequency of activities involving digital photos. Some participants were able to identify factors that influenced this frequency. D4 related that she would share more often if she was able to provide contextual information about the photos. Right now she primarily shares with her immediate family who uses them to supplement their other encounters. She wrote “I don’t share many photos – except with my immediate family. I would probably send out more on a regular basis if it were easier to label and organize them.” Another participant, D5, simply compared it to mail: “I share photos more often if I have them on the computer. It’s so much easier to add them as an attachment and e-mail 10 friends than get copies, write a letter, get stamps & mail them.” She also identified advantages of sharing digital photos on her cell phone. The ability to casually provide additional information in person with a cell phone may contextualize the photos and be a positive influence on the frequency of sharing. For example, D5 was pleased with her ability to engage her photos, which she stored on her cell phone. She was able to use photos to supplement her current activity face-to-face relating that “Digital makes sharing easy! My phone rocks!” She qualified this support by stating that the camera on the phone offered less value than its display, “The picture it takes aren’t the greatest but [the resolution] is great [very clear] when I download regular pictures.”
Survey

In order to confirm our qualitative findings across a larger set of people and find new trends in practices, we deployed a survey on the web. The survey was disseminated to a diverse group of people. The graphs depicting the results of our survey questions are available in appendix f. We had 415 individuals respond to the survey, with 300+ participants who responded to all questions.

We’ve gathered responses and conducted a preliminary analysis of the survey results. In this section we highlight some of the findings that might have implications on the design. The following table illustrates the demographic data of the survey respondents.

<table>
<thead>
<tr>
<th>Gender</th>
<th>Location</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>62 % Male</td>
<td>82 % United States</td>
<td>38 % 18-25</td>
</tr>
<tr>
<td>38 % Female</td>
<td>08 % India</td>
<td>22 % 26-30</td>
</tr>
<tr>
<td></td>
<td>02 % UK</td>
<td>24 % 31-40</td>
</tr>
<tr>
<td></td>
<td>02 % Canada</td>
<td>12 % 41-50</td>
</tr>
<tr>
<td></td>
<td>06 % Others</td>
<td>03 % 51-60</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 % 60+</td>
</tr>
</tbody>
</table>

Camera Types

![Camera Types Chart]

Number of Respondents = 366
Highlights of Findings

While many questions were answered, the most interesting results are discussed here. These include results that confirmed our prior user research, as well as those that confirmed or contradicted our literature review.

The graph below shows the frequency of various photo related activities. Across the x-axis is the frequency reported, and the y-axis represents the number of survey participants who responded with each frequency. The frequency of all activities peaks at one to two weeks; this shows that photos represent a fairly frequent, but not life consuming, aspect of users’ lives. The two viewing activities were performed most frequently, and were most commonly reported for a daily activity. The fact that viewing your own photos was dominant across all time chunks shows that there is a need to support personal viewing and reminiscing. This resonates with the self assessment by Retrospective Account R1, who said she was the one who most frequently viewed her photos.

We found that most of the respondents used pre-packaged software to manage and view their photos (Appendix f, Graph 9). We believe this is due to the hassle of finding and installing other software, as well as the privacy issue we identified in our user research.
Other applications that were commonly used were Adobe Photoshop, Adobe Lightroom, ACDSee, Picasa, and Windows Vista Photo gallery.

Many of the results we saw confirmed what we had seen or read about annotation, organization, and sharing versus viewing. The results indicated that more than half of the respondents never or very rarely renamed their photos (Appendix f, Graph 14). This was also observed during our contextual inquiries, where the photos were only renamed when either the photo was being shared or edited. Most of the respondents organized their photos by event or date (Appendix f, Graph 16). This behavior was also observed in the qualitative studies that we conducted. The date information is something that was redundantly added to photos, since this information is already captured in the meta-data collected when the photo is captured.

We were able to view behavior that was described in a Reuters article about participation in Web 2.0 services [60]. They found that a significantly lower number of users post and share content that is then viewed by a larger non-participating audience. Comparing our view and share question results, we confirmed this same trend.

**Survey Graph: Frequency of Viewing vs Sharing Digital Photos**
We found that e-mail was the most prevalent medium for sharing photos among our respondents. Sharing in person on the computer monitor was the next most frequent method of sharing photos. This was a result that conflicted with some of the earlier literature we had reviewed. Frohlich had said that viewing photos on computer displays was not preferred, but it appears that this is a changing trend, perhaps as people are more accustomed to working with computers on a day to day basis. [26]
Confirmed Need for Triage Support

When asked about how frequently photo sharers chose the following sets of photos to share, we found an overwhelming number shared only selected photos. This confirms that the triage process prevalently occurs in our target user base. Therefore our goal to support this triage process can be identified by users as a perceived need.

Survey Graph: Selective Sharing of Sets of Photos
Key Findings

Through our exploratory research phase, we built upon our existing knowledge of the digital photo lifecycle by examining existing publications and products, interviewing individuals for qualitative data, gained temporal data with a diary study, and confirmed that what we saw was prevalent across the sharing population through a web survey.

The following sections represent our key findings from this research. To develop our understanding of triage and sharing, we built additional insight models to represent the types of triage, the influences upon triage decisions, and the synchronicity of sharing. We also organized our findings into themes, from which we pulled design implications.

Insight Models

The following models can be seen larger in Appendix g. As we examined various triage sessions, we felt that the original definition of “select desirable photos and discard unwanted ones” was not sufficient to describe the varying nature of triage as it occurs throughout the digital photo lifecycle. The following model shows our updated understanding of the Digital Photo Lifecycle with emphasis on the four triage types we defined during our research consolidation: pre-sharing triage, co-triege, on-the-fly triage, and audience triage.

Triage Types

![Insight Model 1: Triage Types in the Photo Lifecycle](image-url)
In this model the opportunities for triage lie on the path from acquisition to sharing and viewing. The pre-sharing triage points are where a user spends time, prior to the act of sharing, selecting photos that will be shared in some way. These touch points occur mostly on the photo management and authoring side of the lifecycle. Co-triage, or triage done by more than one person together, is also represented at several points; at deletion, organization, and creation of experiences. These reflect the relationships we saw in our CI’s regarding co-ownership of photos collections, where decisions on these photo collections were often made mutually.

Co-triage, also known as collaborative triage, occurs in active sharing situations such as in-person sharing, and sharing through instant messenger. This is because the sharer and receiver are deciding together which photos to view based on their conversation. On-the-fly triage also occurs here, which is the selection by the sharer alone of photos to view on the spot. This is a very rapid triage process which, if supported well, can also improve the other types of triage.

Lastly, audience triage occurs in passive sharing situations, where the choice of which photo to view is left up to the receiver. We have not found any available tools that support triaging the photo viewing experience, yet it is a very common activity. Due to time or interest constraints, photo recipients need to triage the photos shared with them, especially in situations where the sharer has not pruned down his shared album.
Triage Influences

In the triage influences model, we looked at the various factors that affect the choices a triager makes. These include the nature of the application or service they are using, in terms of the organizational structure, and the interactions with the interface. The sharing audience plays a large role in choosing photos, as the same captured experience may be relayed differently to various people. For example, the photos from a college party chosen to share with family members are likely different than those shared with the friends who were in attendance. This involves highly complex social structures, as the sharer must choose how to portray themselves as well as the event.

The criterion for selecting a photo for inclusion in a shared experience include many qualities of the photograph itself, such as how recently it was taken or the rarity of the photo. A photo is rare if the content portrayed is not represented much in their photo collection. For example, new parents often are so busy taking photos of their child that they forget to capture photos of themselves. Hence when a blurry photo of Dad is taken, it is high in value because of its rarity, even if it ranks low in quality.

Time and communication medium also affect when how frequently triage and sharing occurs. The time constricts the amount of effort a triager can spend on a task in a
particular session. The medium through which the sharing occurs affects the type and quantity of additional information that can be relayed with the photo, hence affecting the choice of which photos to send to achieve the intended communication. A portion of this is synchronicity, which is further explored in the next model regarding sharing.

**Sharing Synchronicity**

The axes on the sharing synchronicity model represent the number of viewers in the audience, and the active or passive nature of the sharing experience. The groupings reflect the types of triage, described in the first insight model, commonly associated with this type of sharing medium. The face-to-face types of sharing tend to be more active forms of sharing, compared to the audience controlled web sharing. The sharer has more control over the photo sharing experience in the communication mediums towards the top of the model, versus the bottom. This means that they must author the photo experience more for the passive sharing in order to communicate the same story as in active sharing.
Themes

After consolidating our exploratory research, we extracted the following themes to assist in communicating our key findings.

- **Privacy** of photos and personal information is a major concern.
- **Control** over photo collection and display is highly valued.
- **Annotated** photo collections are recognized as extremely useful. Annotating requires too much effort.
- Large numbers of photos and repositories impede access. Switching between overview and detailed view is exceedingly common.
- **Shared ownership** of photos is a widespread and complex phenomenon. The audience has some influence and control of the viewing experience.
- Short intermittent photo interaction sessions are the norm. Photo sharing is often used to promote social connectivity.

As seen in our CI’s, privacy was a large issue across many users. The need for privacy control regarding who sees personal photos appears to have increased over time, compared to the free flowing sharing that some users spoke of having in the past. In a related theme, users felt a lack of control over their photo collection when using some applications. In some cases, this caused the users to avoid using those applications in which they did not feel that they were in control over their photos.

From our research, we confirmed what we read in the literature regarding annotation. Annotated photo collections are highly useful, as they provide a richer environment for searching through large amounts of photo. Few users took the time to annotate their photos, in particular in terms of renaming files, which is the most accessible way in desktop environments to add information to photos. The annotations, renaming, and tagging were mostly done for shared photos, and not for the larger set of photos that the user interacts with in their collection.

Our research analysis informs us that the users have various obstacles in accessing their photo collection. We have observed from our user research that it takes much effort and time for users to locate a specific photo or group of photos, and in some instances, they could never accomplish it. Our analysis found the main causes of those problems to have mostly derived from the following observations. As people capture more digital photos, their photo collection size has increased tremendously and it’s a great challenge for
people to organize them in a manner that allows efficient browsing or searching. Similarly, as photo collection size expands, the variety of repositories that users interact with photos is also increasing, which hinders their access to the extensive collection. Another problem identified from our research was that users tend to rapidly and repeatedly switch between the thumbnail overview and the detailed view. During our user research, users tended to browse through the thumbnail overview first, zoom into a detailed view, and zooming out again to browse through their photo collection. However, they were going about these steps solely because the different decisions they were to make weren’t supported in a single view. Specifically, most decisions including whether to share a photo or not was made in the detailed view, while browsing for a photo occurred in the thumbnail overview. As a result, people had to spend more time when managing, organizing, and sharing their photo collection.

Our team also observed in our research results that in addition to the primary owner of the photos, there are many individuals that have direct and indirect influence on the activities that take place around the collection. Particularly, users who were married demonstrated the strongest co-ownership of the photo collection and relied heavily on each other when making any decisions related to their collection. Although the influence wasn’t as great as that of the spouse, the audience also exhibited significant influence over their photo-viewing experience. The influences were primarily related to the kinds of photos that they receive from the owner and the viewing experience while selectively viewing photos from a greater collection. Also, they provided much feedback that influenced the owner’s approach to the photo lifecycle.

From our user research, we also found out that users do not usually devote much time during a single session interacting with photos. Although the participants of the diary studies intermittently interacted with their photo collection, they limited their activity to less than 30 minutes. This is also relevant to some of the publications that state users do not have much time to deal with their photos. When users are interacting with their photo collection in short intermittent sessions, most of them were using photos to create social presence among their audiences. The majority of shared photos were shared by the user to keep in touch or update their family and friends, or to create their identities on online communities. Both the viewer and sharer showed more interests in sharing and viewing photos of shared events and experiences, while the audiences weren’t much interested in those that weren’t closely related to them. These social aspects associated with photos were identified as the most critical motivation for sharing photos across all our explanatory research.
Design Implications

Based on the key findings from our exploratory research, our team decided on the following design implications that we will actively practice in our design phase so that our design supports efficient interaction for the users.

In terms of design implications, users’ privacy and control concerns mean that they need to know where their photos are and who they are currently being shared with, or have been shared with in the past. In terms of trust, we believe that user’s trust their personal computers more than web services to maintain their privacy. A model in which a user’s personal photo collection lives on their computer, and has software based portal to the web can help this sense of privacy, as well as give them control. Closely coupled with control is the need for clarity of system action, as users want to know how their photos are being handled within the system.

For annotation of photos, we can gleam a lot about auto-annotation from the literature review we have conducted. Many concepts, such as auto-face annotation can be used to supplement the triage system we wish to design. We also believe that we can extract contextually useful annotations from existing user actions. For example, when users share photos through email, the additional knowledge of whom they are being shared with, changed filenames, and email text can add information to the photo within the user’s collection. This information is then available for the user when they are interacting with their photos at a later time, making it a richer experience, and providing more data points for searching and triage.

Our design will utilize reliable automatic annotation techniques to leverage user’s ability to organize and access his/her photo collection. Some of our literature reviews have informed us of novel automatic annotation techniques using face-detection, face-recognition, semantic analysis, and information-at-capture. Also, we see an opportunity of capturing user actions and extracting useful metadata as annotation on the photos to enhance the user’s organization and accessibility. Users can make use of any captured annotation to sort or access their collection without having to go through the tedious work of doing them manually, resulting in a more efficient interaction and a sense of better organization during their intermittent short interaction with photos. However, we will also take to account the known failures of other automatic annotations in previous works.

We aim to design a system with extensive flexibility that supports diverse user behaviors and tasks related to photos. Different visualization methods will be provided for different
tasks conducted on photos. Users demonstrated that they select views dependent on the goals they are trying to accomplish. The ability for rapid view switching and customization of views would reduce the constraints that restrain users from achieving their desired needs effectively. Also, the system’s support for compatibility and communication among diverse repositories is beneficial as users experience difficulties integrating tasks across multiple systems. Tasks that are parts of a unified common goal should be supported by the system to an extent that it doesn’t overload with features that are not closely related. In addition, users should be capable of switching between tasks and recalling multiple states within the system as they frequently moved away from their original paths when dealing with photos and switched to others as they browsed the collection. The system should be flexible in order to not limit user behavior while only supporting those that are critical to accomplishing goals efficiently.

Our system will support the audience to easily change their viewing experience of photos. Users showed different preferences for the photos that they view and strong tendency to alter their experience with them, which heavily depended on their relation to the content. By allowing the audiences to rapidly change the display while viewing the photo collection, not only will the audiences not have to spend unnecessary time on viewing unwanted photos, but the sharers will also not have to put extensive effort into creating stories.
Future Direction

Our goal is to enhance the triage experience of photo sharers as they prepare to communicate the stories that are connected to their photo collection. These stories can include narratives, expressions of self-identity, experiences, and the promotion of social connectivity. Through the concepts and prototypes that we generate over the next three months, we will address this goal, as informed by our exploratory research.

As part of our next phase, we will use our key findings to begin ideation for our final design. From this ideation, we will further develop some of the concepts and perform concept validation to assess that we are addressing real user needs. From there we will design prototypes, and continue evaluation of our concepts. Through this iterative process we will refine our concepts into a compelling prototype.
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Appendix
a. Annotated Bibliography

1. Collaborative Multimodal Photo Annotation over Digital Paper


**Short Summary:**
In this paper the design team has introduce an approach for semi-automated labeling based on extraction of metadata from naturally occurring conversations of groups of people discussing pictures among themselves.

They have introduced a digital pen and paper where a single or group of people can annotate any picture. To promote their goal of supporting more fluid and natural types of interaction, they have included support for annotation over photos printed on digital paper. Participants of an interaction may perform annotation by handwriting on the photos themselves, as they would on regular paper documents. Users are thus freed from having to directly operate a computer interface, and can concentrate fully on the task. They have also mentioned the annotation via speech. Where the system can annotate while a group of people talking about a picture.

2. Learning from Human Support: Informing the Design of Personal Digital Story-Authoring Tools

**Summary:**

• Field study of the digital storytelling workshop offered by the Center for Digital Storytelling discovered that composing digital narratives using personal media requires a significant amount of storytelling and technical support. Looked to see how this human support could be used to inform how software can provide support.

**Highlights:**

• "Digital storytelling involves critical reflection on personal life events to establish their meaning. Our motivation lies in providing support for critical reflection on personal life events thereby enabling people who lack the storytelling and technical experience to engage in digital storytelling." pg1

• "In this paper, we show that supporting screenwriting (i.e. scriptwriting, character and plot development, etc.) is necessary for everyday people to engage in personal digital storytelling." pg3

• "A workshop facilitator then lectures on the seven elements defining a digital story [...] The seven elements are: point of view, dramatic question, emotional content, voiceover, soundtrack, economy and pacing. In general, the author should set the story's context for the viewer, build tension to a climax and provide a resolution." pg3

• "Four classes of challenges in the digital storytelling process. Those challenges were with *story development, content preparation, movie production* and *completion.*" pg5

• "We observed participants experience difficulty writing within the one page script limit. The workshop facilitators suggested the haiku as a metaphor to describe the level of conciseness participants should aim for when writing their scripts." pg5

• "When selecting photos for their story, facilitators advised participants to use a particularly good photo to represent an ideas versus a sequence of similar photos." pg5

• "The challenges to completion involved managing the process, overcoming obstacles with particular tools and dealing with fear of incompletion." pg5

• Pre-defined story models eliminated the need for participants to select a form and allowed them to begin the process of implementing the form. pg6

• Pre-defined (limited) toolset for media manipulation helped facilitate the creation of compelling stories with minimizing difficulty with tools. pg6

• Feedback increases story quality and eliminates software barriers, through a support network of peer digital storytellers or connecting directly with experts/expert recommendations. pg7
• Providing automated solutions is sufficient for addressing tasks not vital to producing a quality digital story, through providing abstractions for file organization and content management, and providing heuristics for navigating each stage of the story telling process. Also aiding the transfer of content from the capture device to the computer, and fine tuning the user's final cut of their digital story (post-production). pg7-8
• Clearly defining and managing the user's process in term of progress, time, and emotion facilitates completion. pg8
• Current movie making software does not support development of stories. pg9

Applications Mentioned:

• iMovie
• Windows Movie Maker
• Adobe Photoshop (for editing photos)
• Adobe Premiere (for assembly of movie)

3. Digital Photo Frame


User research: The design team has conducted CIs with 8 families. During the CI they have observed how families keep and display photos in their home and what kind of photos they had for display. They also studied the space where the photos were shared and viewed with families and friends.

Competitive Analysis:

Findings: The team found two basic places where photos were displayed or shared. a) formal space b) informal space. Formal spaces include living room, entrance ways and bath rooms, where photos were posed and taken professionally by a family member. The Informal spaces for displaying photos include bedroom, family living room, kitchen especially refrigerator. These photos were updated regularly with the recent photos. They also found that family member mostly don't organize photos but label them by time.
Design Solution: They have proposed a photo frame name Cherish- a smart home technology that can learn to recognize people in digital photos to have relationship with people they are being photographed with. It will also mediate digital photos to be displayed using social relationship as label and the user can direct which photos should be displayed in the picture frame.

4. Pushing The Desktop Metaphor


Summary:
This paper explores a virtual desktops behaving in a more physically realistic manner by adding physics simulation and using piling instead of filing as the fundamental organizational structure. They call this prototype Bump Top that coherently integrates a variety of interaction and visualization techniques optimized for pen input. They also talks about how objects can be casually dragged and tossed around, influenced by physical characteristics such as friction and mass, much like we would manipulate lightweight objects in the real world.

This paper also explores the use of Lasso Menu that combines selection command invocation and parameter adjustment in one pen stroke. When the user points the pen on the metaphor a semitransparent blue circle appears and the user can start selecting the pile with a lasso starting from the circle start point, once the user selects pile and returns the pen back to the circle the circular contextual menu appears on the screen with further piling options.
The authors have used piling technique as the primary interaction method. They have also mentioned the limitation of this interaction method “the main limitation of [piling] was that it did not scale well: pilers found difficulties accessing information once piles had begun to multiply”.

5. Table top Groupware


**Highlights**:
- Semi-automated labeling of photos based on extraction of metadata from naturally occurring conversation among a group of people.
- Digital pen and paper-based input device for photo annotation through speech and sketch recognition.
- Multimodal collaborative interface (digital tabletop) for photo visualization.
- User does not have to directly interact with a computer interface so user can concentrate fully on the annotation and conversation.
- This system takes advantage of rich communication that takes place when a group of people shares their experience on photographs.

6. The Unjuried Exhibition: Sorting and Selecting Personal Digital Photographs

- **Citation:** "The Unjuried Exhibition: Sorting and Selecting Personal Digital Photographs" Microsoft Next Media Research, Summer 2004
Summary:

- This was a report done after studying 9 participants, and with 4 publication references
  - 2003 Active Digital Photography User Tracking Study Conducted by Information Solutions Group Prepared for Microsoft Digital Imaging Group
  - Requirements for Photoware David Frohlich, Allan Kuchinsky, Celine Pering, Abbe Don, & Steven Ariss Hewlett Packard Laboratories 2002 ACM
  - How Do People Manage Their Digital Photographs? Kerry Rodden & Kenneth R. Wood 2003 ACM
- Separation anxiety: "I want to be able to archive [my digital photos] and forget about them but be sure that they will be visible throughout my lifetime"
- "Folder hierarchies were generally shallow consisting of only 2 or 3 levels"
- Annotation only really occurs for sharing purposes, not for organizational purposes
- Wanted control over sharee photo order view -> could this also expand to wanting control over sharee cluster or group view? e.g. when making a scrapbook of photos, you group photos together, so could the sharer be able to group photos together for the sharee?
- Sorting into piles, the participants could not think of needing more than 3 working piles at a time
- Participants want to have reassurance about where the photos actually "live" on their computer
- Habit: Import when...
  - "Their personal schedule"
  - "The capacity of their memory card"
  - "The number of memory cards they have"
  - "The resolution of the pictures they take"
  - "The urgency of sharing or working with images"
  - "The organization scheme of their photo collection"
  - "Their expectations regarding the number of pictures they would take in the near future."
  - "When their memory card is full or almost full"
  - "At the end of some fixed time period (day, month, etc)"
  - "Directly after an event"
  - "Directly before an event"
  - "After several events"
- Habit: Select photos based on...
  - Technical quality.
  - Humor & cuteness. (Especially with children and pets)
  - Infrequently captured subjects
  - Overall visual variety. Of color, layout, subject matter within a set of pictures
7. Understanding photowork

- Citation: David Kirk, Abigail Sellen, Carsten Rother, Ken Wood, Understanding photowork, Proceedings of the SIGCHI conference on Human Factors in computing systems, April 22-27, 2006, Montréal, Québec, Canada

Summary: Describes photowork as activities people perform with their digital photos after capture but prior to end use. Also highlights significance of these activities as an interaction practice.

Highlights:

- The shift from paper prints to digital images has caused:
  - an increase in the number of photos captured
  - people to capture highly similar things such as scenes and objects in subtly different views
  - retouching individual images by cropping, red-eye removal, altering color balance, and so forth
- Much research has been done especially with regard to more intelligent ways of browsing and searching through images.
- Because users are reluctant to annotate images with text, efforts to automatically extract information using CBIR algorithms have been made.
- Paper discusses the field study conducted to analyze user’s needs and behavior with photowork.
- After analysis, the study came out with a flow diagram of photowork lifecycle
- Key observations made in various stages:
  - Pre-download stage: participants habitually reviewed and deleted unwanted pictures on the camera itself.
  - Downloading was technically driven, event-driven, or goal-driven.
  - Folders were named in the form of a ‘date-event’ convention.
  - Before sharing took place, participants begin with photo “triage” where pictures to be shared were picked from a larger set of pictures.
  - Criteria for selection included good image quality, good composition, and more personal preferences.
  - Triaging and sorting were the most common and time-consuming activities observed among participants.

8. Designing appropriate affordances for electronic photo sharing media

- Citation: Siân Lindley, Andrew Monk, Designing appropriate affordances for electronic photo sharing media, CHI ’06 extended abstracts on Human factors in computing systems, April 22-27, 2006, Montréal, Québec, Canada
Summary:

Study of how people currently view & share photos, with particular focus on the social aspects & affordances. Found that people currently share by: passing around individual photos (affords 'huddling', gives the photographer control of the rate & order that pictures are viewed in, but not so good for larger groups - start breaking into multiple conversations), handing around photo albums (good for 2-3 people, but the album cannot be handed around easily), viewing photos on a computer (usually not in a social place; forces the viewer(s) & photographer to stand behind one another, though they like the larger/better size/quality. Issues of who controls the computer & flow/order of pictures) and viewing on a television by hooking a digital camera up to it (good for large groups; usually in a large-group social location, good quality though not as good as the computer, but forces one person to "hunch over" by the camera to control it). Found that; photographers like to be in control of the flow/order the pictures are shown in, but want to share some of that control too. A problem with digital media is people often don't remove redundant/boring/poor quality pictures before sharing them. Digital sharing situations also don't really support social sharing where people can point at pictures, share some control over what image is viewed, and see each other's reactions well. Mostly because of seating arrangements.

   Why we care:

The social aspects are interesting, but most of this has to do with physical constraints. We need to take into account the sharing of control, ability to quickly/easily triage photos for sharing, & maybe a good way to flip through the photos in a pre-ordered & non-pre-ordered way. We also should think of the dynamics of different group sizes (1, 2, 3, or more people).

9. Visualization and User-Modeling for Browsing Personal Photo Libraries


   Summary: The paper explores and tests (in cs-terms only; no usability testing) a method of evaluating & comparing images based only on three dimensions (which each are composed of more dimensions): color, texture & edges. The system rates every picture's similarity to every other picture along these dimensions. This can be used to find the pictures most similar to a "query" picture. The query is outlined in yellow below:
More interestingly, the user can put some pictures out on the screen where they want them & then the computer can group all the rest of the pictures available (or some other set of pictures) according to this grouping:

In the picture above the user placed the pictures in (a), and the computer placed all the other pictures, generating (b).

The picture association seems to do quite well and has the advantage that it does not require tagging the pictures first.

• **Why we care:** This informs us that there are ways of comparing and sorting pictures in compelling, easy ways without requiring the users to annotate or tag any of their photos.

10. **Personal digital historian: story sharing around the table**

• **Citation:** Chia Shen, Neal Lesh, Frédéric Vernier, Personal digital historian: story sharing around the table, interactions, v.10 n.2, March + April 2003

**Summary:**

• A tabletop projected interface for sharing photos.

**Highlights:**

• "In this system, users select stored digital archieves such as photographs, video, and text documents and display the images grouped by people, time, place, or events, while the story is being told. By using the term 'story sharing' instead of
storytelling. We emphasize in our design the supporting of interaction and conversation among the participants, rather than the performance of a storyteller.

- "Our first goal was to focus on developing content organization and retrieval metaphors that are easily understandable by users and can be used without distracting from the conversation."

- "A story-sharing system must support flexible narrative, rather than rigid, preauthored stories."

- "We adopted a model of organizing the material using the four questions essential to storytelling: who, when, where, and what (the four Ws)."

- "Documents are not defined by their physical location in a file system, but rather by their intended usage scenario. The user then can make selections among the four Ws and PDH will automatically combine them to form rich Boolean queries implicitly for the user."

- "The PDH table uses a circular display metaphor that can provide a continuous orientation for multiple people."

- "Invite another user to the table by instantiating an additional control panel."

- "We found the semantic use of AND/OR to be the most natural way for users to quickly form queries."

- "During a conversation, people often branch out to different topics and threads and then return to some previous discussion point. We facilitate this style of discourse in PDH by letting the user select an item on the desktop as a landmark by dragging it to the bookmark area."

- "Users may explicitly request an association to be made [between photos]; we call these active associations. [...] Alternatively, the system can suggest associations spontaneously. Passive associations are displayed around the perimeter of the circular display."

Applications Mentioned:

- DiamondSpin circular tabletop Java toolkit
- Personal Digital Historian (PDH)

11. AutoAlbum: Clustering Digital Photographs using Probabilistic Model Merging

- **Citation:** John C. Platt, AutoAlbum: Clustering Digital Photographs using Probabilistic Model Merging, Proceedings of the IEEE Workshop on Content-based Access of Image and Video Libraries (CBAIVL'00), p.96, June 16-16, 2000

**Summary:**

AutoAlbum is a combination of a clustering algorithm and a user interface that helps find photos. This paper proposes techniques to automatically cluster photos into “meaningful” albums.

**Highlights:**
• Albums are very intuitive and desirable: users state that the most important feature of a photo organization tool is to automatically place photographs into albums
• Algorithms use metadata associated with digital photography. Two kinds of metadata – time and order of photos taken (when creation time is destroyed, order is preserved)
• Two types of clustering:
  • Time clustering – clustered based on time
  • Content based clustering – clustering based on image content
• Clustering techniques can be combined.
• Uses the probabilistic clustering to get best content based clustering performance

12. Image presentation in space and time: errors, preferences and eye-gaze activity

• Citation: Bob Spence, Mark Witkowski, Catherine Fawcett, Brock Craft, Oscar de Bruijn, Image presentation in space and time: errors, preferences and eye-gaze activity, Proceedings of the working conference on Advanced visual interfaces, May 25-28, 2004, Gallipoli, Italy

Summary:
This paper compares slide-show (sequential, RSVP), static thumbnail (static) and a mixed way (sets of four images displayed sequentially) of displaying photos given a limited amount of time and space.

It found that out of their 30 users, most preferred the mixed presentation mode. Their accuracy with the different modes in telling whether the image was in the presentation depended a lot on total time, presentation space, and presentation mode, but the statistics on that don't look very conclusive. It looks like slide-show mode did the worst in most of them though.

13. Does organisation by similarity assist image browsing?
• **Citation:** Kerry Rodden, Wojciech Basalaj, David Sinclair, Kenneth Wood, Does organisation by similarity assist image browsing?, Proceedings of the SIGCHI conference on Human factors in computing systems, p.190-197, March 2001, Seattle, Washington, United States

**Summary:**

• The studied images grouped by visual similarity versus by caption similarity versus random order. They were on photos that the participant was unfamiliar with, and phrased in terms of finding an image to appear in a travel guide.

• In their first experiment (visual vs caption), participants found the caption similarity to be useful, but that visual similarity was questionable
  
  o However, the caption similarity is only as useful as the captions themselves, with comments about semantic similarity and grainularity of captions

• In their second experiment (visual vs random), they found that participants were actually slower with visual versus random
  
  o This can be attributed to the loss of a pop-out effect, in that visually striking images are "hidden" next to many similar looking photos.

• In both experiments, there was some sense of getting disoriented when switching between views

**14. Supporting personal media authoring**

• **Citation:** Nicholas Diakopoulos, Irfan Essa, Supporting personal media authoring, Proceedings of the ACM workshop on Multimedia for human communication: from capture to convey, November 11-11, 2005, Hilton, Singapore

**Summary:**

• This is a very high-level paper about authoring experiences (papers, collages, etc.), the various factors that affect that authoring process, and how automation could possibly help. Mostly this paper describes the design space and is too vague to be very helpful. It refers to some other papers, however, and mentions a few interesting ideas:
  
  o intelligent suggestions as a good means for automation to support authoring
  o clustering pictures that are visually similar in order to “reduce redundant content”.
  o “automated within-frame highlighting could aid in the need to draw similarities between related photos”
  o juxtaposing pictures based on color and texture in order to increase visual variability.

**15. PhotoArcs: a tool for creating and sharing photo-narratives**
• Citation: Morgan Ames, Lilia Manguy, PhotoArcs: a tool for creating and sharing photo-narratives, CHI '06 extended abstracts on Human factors in computing systems, April 22-27, 2006, Montréal, Québec, Canada

Authors: Morgan Ames and Lilia Manguy (both from SIMS Berkeley)

Summary: The authors describe the design of a tool that would enable creation of photo narratives to encourage sharing and interaction. This interface aims at making creation and manipulation of photo narratives easy and fun. The paper discusses the formative user studies done using low fidelity prototypes.

Highlights/Findings:

• The PhotoArcs interaction to add narratives to online photo collection in a way mimics the face-to-face sharing patterns. Using this interface users can organize their pictures into linear arcs connected by textual descriptions.
• Users can also create narratives that intersect each other.
• The study found that one of the primary uses of photographs is for sharing.
• Advantages of face-to-face photo sharing is the narrative flexibility the sharer has. Existing photo-sharing mechanisms do not enable this kind of flexibility.
• PhotoArcs Visualizations

• Much of the photoArcs interaction is drag-and-drop. The prototype was implemented using the Prefuse package.
• Low fidelity Evaluations: First the prototype was constructed using foam boards and fabrics of various colors. The prototype used printouts of images the participant provided. The participants were invited to use scissors, tape etc to and create a narrative using these.

Insights: The exploratory low fidelity evaluations is something that we can look into. We could get our designs quickly evaluated at low costs.

16. Time quilt: scaling up zoomable photo browsers for large, unstructured photo collections

• Citation: David F. Huynh, Steven M. Drucker, Patrick Baudisch, Curtis Wong, Time quilt: scaling up zoomable photo browsers for large, unstructured photo collections, CHI '05 extended abstracts on Human factors in computing systems, April 02-07, 2005, Portland, OR, USA

Summary:

• This is a zoomable photo browser like PhotoMesa where the layout conveys temporal order while making better use of the screen space than a time line.
• User interacts with the interface by zooming the photograph he wants to view.
• This system provides representative thumbnail in a timeline to facilitate easy visual search.
• In contrary to PhotoMesa it proposes a “weaving” like straight timeline to achieve overall better aspect ratio. This “waving” layout is called time-quilt.

17. MediaBrowser: reclaiming the shoebox

• Citation: Steven M. Drucker, Curtis Wong, Asta Roseway, Steven Glenner, Steven De Mar, MediaBrowser: reclaiming the shoebox, Proceedings of the working conference on Advanced visual interfaces, May 25-28, 2004, Gallipoli, Italy

• Citation: Frank Bentley, Crysta Metcalf, Gunnar Harboe, Personal vs. commercial content: the similarities between consumer use of photos and music, Proceedings of the SIGCHI conference on Human Factors in computing systems, April 22-27, 2006, Montréal, Québec, Canada

Summary:

• The authors conducted research independently on how people use their music and how they use their photos. This paper draws comparisons in the behaviors based on data from the two studies. Their study on people’s behaviors towards photos sounds very much in line with ours. If we could, looking at their results & models would be excellent.

Highlights:

• Satisficing: “a stopping rule for sequential search, where an aspiration level is fixed in advance, and the search is terminated as soon as an alternative exceeds that level.” Generally searching through until you find something that matches your demands well enough.
  o The threshold for what is good enough may drop as the user gets bored or rushed, then they may go back and choose and earlier “almost good enough” option or making some compromise.
  o Sometime people give up, or keep a back-up option (it’s a breakdown if they actually use it though).
  o Satisficing is done when you have too many options to analyze each one fully.
  o In some cases "the fact that the photos and music people are likely to want tend to be convenient to access helps make saticficing a generally successful strategy."

• “Many times, our participants declared that they were looking for a particular photo... but in the end selected something else entirely.” “We explained this by speculating that people are actually just looking for certain features... and that the item they mention is one they remember having those features.”
• “Participants unintentionally started to browse through their photos during purposeful tasks.” “…they would start looking for other things they had not originally intended. These were not negative events, but allowed our users to rediscover media and reminisce about their past.”
• “[Our participants] picked the most easily available photos to send or share with others.” "We found that the most recently captured photos were the ones most likely to be sent out. We also found that the photo that is "good enough" and found quickly is more often sent than "the best possible" photo that is hard to find."
• Two-pass method of photo selection was observed; one satisficing pass to choose possible options, then another pass to pick the actual ones used.
• One user kept photos on her camera; “when I want to see it, I can pick up my camera and boom.”
• “Many times, our participants declared that they were looking for a particular photo...but in the end selected something else”. The authors guess this is because participants are really looking for specific features, not photos.
• Beyond satisficing, "we also saw people being sidetracked and browsing relatively aimlessly. Searching for specific items ... appears to be a fairly rare activity"
• Photos are "used when we are alone as much as they are used when we are together with others." That is, to reminisce, tell and remember stories, etc.
• "A relatively small number of photos represented the entire context around [a] particular instant in time."
• "All of our participants mention re-telling the stories of events using the photos to "update" friends and family and to brag about children..."
• The authors found a lot of the same organizational structures and habits that we did.

18. Lost in memories: interacting with photo collections on PDAs

• Citation: Susumu Harada, Mor Naaman, Yee Jiun Song, QianYing Wang, Andreas Paepcke, Lost in memories: interacting with photo collections on PDAs, Proceedings of the 4th ACM/IEEE-CS joint conference on Digital libraries, June 07-11, 2004, Tuscon, AZ, USA

19. Photo annotation on a camera phone

• Citation: Anita Wilhelm, Yuri Takhteyev, Risto Sarvas, Nancy Van House, Marc Davis, Photo annotation on a camera phone, CHI '04 extended abstracts on Human factors in computing systems, April 24-29, 2004, Vienna, Austria

Summary:

• Description of prototype for annotating digital photos upon capture on a camera phone. Suggestive tags about content are offered. Most participants only
expressed interest in annotating representative digital photos, and used only a couple words as identifiers for a caption.

**Highlights:**

- Wilhem et al. suggest that changes in context and time lag from camera to desktop reduce the probability that users annotate digital photo, and recall accurate information for metadata p1403
- The authors suggest that inherent functions of mobile devices, and collaborative applications via networking, contribute to understanding of “physical environment and usage situations” during image capture p1403
- In the system, user ID, time, date are tagged upon capture p1404
- Also, photo was compared against annotated images in network repository to locate suggestive tags, which were provided for “confirmation or correction” p1404
- Display real estate and interaction style of cell phone limited opportunity for correction of metadata p1404
- Annotations included multiple levels of abstraction “specific location ‘South Hall’ annotates as: US> California> Alameda County>UC Berkeley>South Hall)” p1405
- Suggestive tags “across four facets (Person, Location, Object, and Activity)” p1405
- ”Most participants only used the annotation system to complete required classroom assignments and even then, only annotated one to two facets per photo.” p1405
- ”Focus groups described a funnel effect . . . took many pictures, kept some of them, shared a selected group of those, and printed an even smaller subset.” P1405
- Participants “reported that they would like to annotate only a subset of those taken, mostly only those good enough to share.” p1405
- Users express interest in sharing digital photos taken on cameras over searching and retrieving p1406
- Users also shared digital photos via the mobile device itself p1406
- ”Annotations often took the form of captions rather than standard metadata: the reason why they took the picture, a witty remark, or something personal shared with the observer.” p1406

20. What goes Around Comes Around: An analysis of del.icio.us as a social space

- Citation: Kathy Lee, What Goes Around Comes Around: An analysis of del.icio.us as social space, CSCW ’06: Proceedings of the 2006 20th anniversary conference on Computer supported cooperative work, 2006, Banff, Alberta, Canada

**Summary:**
• Discussion of del.icio.us, an online web bookmark management application, in terms of its overlapping features for individual users and as a shared, social space. The social dynamics of this system are unique: they extend the value of posting bookmarks, which were initially motivated by personal organization.

Highlights:

• Tags were often the subject matter on the site or notes for later reference p191
• Users can subscribe and track bookmarks of other users p191
• Plus, users can provide brief annotations of bookmarks p191
• All bookmarks are open to public viewing online p191
• When users mutually subscribe to each other’s bookmarks, and proceed to incorporate each others bookmarks, feedback appears in the form of redundant bookmarks in the network section as social cues that may reinforce mindfulness of other users p192
• Annotations were found to be most social component, least used for organizing and identifying website, contrasting use of tags p192
• Increased network use and number of subscriptions of users correlate with greater numbers of annotation bookmarks p192-3
• Users can sign their webpage with personal and contact info p192
• Annotated bookmarks are more prevalent with users that disclose contact info, than personal info, least prevalent with no info p193
• Signing bookmarks acknowledges greater social community p194
• Usage patterns (between power users and novices) cannot alone account for correlation between annotations and social aspect of returning bookmarks p194

21. Position Paper, Tagging, Taxonomy, Flickr, Article, ToRead

Summary:

• Discussion of a model for social tagging systems. Marlow et al. provide a taxonomy of incentives and contributions for the analysis and design of tagging systems, that support sharing tags attached to resources.

Highlights:

• USER INCENTIVES FOR TAGGING: future retrieval, contribution and sharing, attract attention (“to get people to look at one’s own resource because they [use] common tags”), play and competition, self presentation (“leaving their mark on a particular resource”), opinion expression p5
• TYPES OF TAGS: identify properties of the objects (source, attributes, category membership, qualitative properties), self-reference (e.g. “mywork”), task-organization (e.g. “toread”) p5
• Folksonomy is the structure and language that develops from within a user group for the organization of information p1
• Metadata has increased value for all users of a system when tags are shared, 
  lessening the workload for metadata creation p1
• ”A unified user-tag-resource approach might be useful for many key web 
  technologies” p2
• Tagging systems have multiple semantic challenges: polysemy (one word-
  multiple meanings), synonymy (different words-same meaning), and the “various 
  levels of abstraction” p2
• Different methods of applying metadata include collaborative filtering, where 
  “user-contributed metadata [is leveraged] in the matching process [but] typically 
  used as a filter after a match has been made” p3
• Flickr users “are likely to tag for their own personal retrieval, but . . . the system 
  design encourages gaming and exploration of tag use.” P5
• Flickr has user-contributed photographs, allows self-tagging, aggregates tags into 
  sets, and allows for blind-tagging p5
• Flickr interface prompts user to add metadata: title, caption, and list of tags p5
• Flickr function to tag friends’ photos in not commonly used p5
• In Flickr, larger collections have greater numbers of tags p6
• In Flickr, tagging may be a function of social activity p6
• Tag vocabulary may be expanded consistently or in spurts with growth of 
  collection p6
• Findings indicate ”relationships between social affiliation and tag vocabulary 
  formation” p6

22. Labeling Images with a Computer Game

• Citation: Luis von Ahn, Laura Dabbish, Labeling Images with a Computer 
  Game, CHI ’04, April 24-29, 2004, Vienna, Austria

Summary: Image searching is currently very difficult, as is dealing with images on 
webpages for blind people. This paper talks about a method for adding keywords to 
al publicly available images through a game. This would help return better results 
when searching for images as well as better descriptions of images for blind people.

• Interesting points: This uses people to label images - it makes it fun to label 
  images by making it a game of "esp" - you try to guess what word your partner 
  (who you do not know or communicate with) will enter when the only 
  information you share is the image. People seem to enjoy the game & it appears to 
generate reasonably good labels. There's talk of making specialized gaming rooms 
for certain topics (art, biology, etc.) because experts in that field will generate 
better labels.
• I Don't think this will really work for people's own pictures, however, because 
  they probably won't want to share them with other people before they're labeled -
  that's kind of the point of labeling them - and they will have to know who their 
  partner is in the game, which ruins it.
• This also mentions that currently all automatic labeling programs do rather poorly.
• Also mentions the Open Mind Initiative - an initiative to use netizens to train intelligent software for various things.

23. Tabletop Sharing of Digital Photographs for the Elderly

• **Citation:** Trent Apted School of IT University of Sydney Sydney, Australia
tapted@it.usyd.edu.au
Judy Kay School of IT University of Sydney Sydney, Australia
judy@it.usyd.edu.au
Aaron Quigley Dept. of Computer Science University College Dublin Dublin, Ireland aquigley@ucd.ie
• **Summary:**

Tasks given to test it: Create a digital postcard from a collage of other photos. Learn how to use this, in pairs, using a given tutorial script.

Designing for elderly: Take into account limited abilities: "losses that are relevant ... are reduced visual acuity, loss in colour perception and increased sensitivity to glare ... declining performance of working memory and learning ... slower movements, poorer co-ordination and difficulties with fine motor actions"


24. Supporting Social Presence through Lightweight Photo Sharing On and Off the Desktop


**Summary:**

• Maximize social presence through lightweight photo sharing while maintaining simplicity - prototype name "Flipper"

**Highlights:**
"Highly simplified, group-centric sharing, automatic and persistent people-centric organization, and tightly integrated desktop and mobile sharing and viewing" pg599
"users found photo sharing easier and more fun, shared more photos, and had an enhanced sense of social presence when sharing with the experimental system" pg599
"to keep current in one another's lives [...] by posting and viewing photos on websites and sharing photos over email" pg599
"lighter weight [...] camera cell phones [...] Multimedia messaging service (MMS) [...] Blogs and photoblogs" pg599
"Web based photo sharing requires the most effort and works well for less frequent posting [...] becomes cumbersome for frequent posting" pg599
"mobile devices tends to be instance-based in that once a photo is sent and shared it is either deleted or lost in a long list of received messages [...] lacks organization and does not provide the space for group sharing" pg599
"First, usage barriers to sharing are minimized [...] group centric by default [...] automatically organized by buddy and persisted for the user [...] integrates desktop and mobile based sharing" pg599
"the importance of photo sharing as a medium for sharing life events" pg600
"Digital photos often were e-mailed and viewed while talking on the phone" pg600
"support for photo annotation and integration of mobile and fixed photo sharing applications" pg600
"creative social games, such as collaborative story creation" using mobile devices pg600
"synchronize to the camera's photo storage folder" pg601 - Mobile Flipper
"photos taken are automatically sent to the group of people with the user on their buddy list" pg601 - Mobile Flipper
"Users may view and add comments to any image, not just their own" pg601 - Mobile Flipper
"the user simply drags and drops images from his computer into the application and the photos will be shared out with everyone who has that user on his buddy list" pg601 - Desktop Flipper
"'I really like sharing photos without menus. It was just really easy to share.‘" pg605
"Most people, however, preferred the people-centric organization augmented with time-based organization" pg605
"With standard photo sharing people often share only a select few photos, a practice that eliminates the whimsical sharing just to have fun contact with someone. In contrast, reducing the barriers to sharing allowed people to 'share WAY more' photos and to 'share photos we never would have shared.'" pg605
"sharing photos with buddies that are fun and keep people posted on your life, but not necessarily photos you would archive" pg605
"participants in the field study almost unanimously supported additional commenting features, especially audio commenting" pg605
"group based sharing could be default, and individualized sharing a secondary option" pg606
"inserting a single immediate step of selecting a group with which to share" pg606

Projects Mentioned:

- Personal Digital Historian (PDH)
- StoryTrack
- Pix Pals
- Snapfish

25. Storytelling with Digital Photos


Summary:

- StoryTrack, an easy-to-use device that enables digital photos to be used in a manner similar to print photos for sharing personal stories. A portable form factor combined with a novel interface supports local sharing like a conventional photo album as well as recording of stories that can be sent to distant friends and relatives.

![Figure 1: The device in use](image)

Highlights:

- "to share stories about experiences, travels, friends and family" pg1
• "the display device must be easy to hold and pass around like a regular photo album" pg1
• "easy to select, display and comment on a sequence of photos" pg1
• "With printed photographs, people spontaneously generate stories as they view the pictures and interact with one another" pg1
• "device that can naturally support similar activities with digital photos" pg1
• "Digital photo album software supports the creation of stories as an explicit authoring task separate from viewing stories[...]support online publishing of stories but are rarely used for local sharing" pg1
• "Digital photos have an advantage over print photos in that users can search for and retrieve them both by their content and by their metadata" pg2
• "people use very simple search strategies when telling stories with print photos" pg2
• "Imported stories[...]a set of photos downloaded from the camera in one session. Within an imported story, photos are ordered by time of creation" pg2
• "Authored stories are selections of photos that have been grouped and ordered by the user" pg2
• "Sharing photos in a natural setting requires a portable device that can be used in different locations throughout one's home" pg2
• "The device should also be large enough to show photos at a size similar to regular prints, viewable by more than one person" pg2
• "sharing photos requires that control pass easily from one user to another[...]not a single locus of control" pg2
• "people point at picture when talking about them. Using the same gestures to control the device might be confusing and produce unexpected behavior" pg2
• "all input controls are mounted on the edges of the device" pg2
• "simultaneously view stories, see their original unedited set of photos, and see the story they are creating" pg3
• "modeless support of sharing digital photos and stories" pg5
• "intuitive and simple to use" pg5
• "most of stories ranged in length from 3-7 photos" pg6
• "went through photos in order and commented on each [...] 'photo driven'" pg6
• "telling an anecdote and highlighted particular photos to illustrate points in the story [...] 'story driven'" pg6
• "it is socially inappropriate to be silent while showing your photos to someone" pg7
• "started with a photo-driven style when showing photos to a local audience and were more likely to use story-driven strategies when assembling photos to send to a remote audience." pg7
• "normally expect photos to be in chronological order and often explain the sequence of events as they go though each photo" pg7
• "When sending photos to a remote friend or family member, subjects first selected a set of photos, using a combination of photo-driven and story-driven browsing, then recorded an accompanying audio annotation" pg7
• "If subjects cannot think of a story to tell (or a photo to search for) until prompted by another photo, then browsing has to precede search." pg7
• "talked a great deal while showing photos to their partners" pg7
• "did not record these conversations, nor did they record audio annotations for their own use" pg7
• "record annotations for sequences of photos to be sent" pg7
• "use of audio may change with experience as suers become accustomed to multimodal albums" pg7
• "subjects reported using one or more of three different organizational tools [shoebox-1/3, album & shoebox -1/3, album & web site - 1/3]" pg7
• "the albums and web sites include short text annotations describing the photos" pg7
• "showed a preference for 'select then narrate' over 'select while narrating,' since the process of annotating a print album or web site typically occurs after the photos have been selected" pg8

Projects Mentioned:

• US Library of Congress (storage of oral histories)
• Isis
• MediaDesc
• FotoFile

26. Requirements for Photoware


Summary:

• The strengths and weaknesses of past and present technology for photo sharing.

Highlights:

• "Calfen proposes that [photos and videos] operate not as copies of reality but as statements people can make about themselves in 'home mode communication'" pg167
• "communication with images is an enjoyable activity that can help to deepen personal and community relationships" pg167
• "filtering and arrangement of 'favorite' prints into albums [...] the best way of archiving conventional photos for future sharing" - "complex and time consuming, [...] an isolated task without any immediate emotional payoff" pg168
• "some basic organization immediately [...] put recent photos into a temporary album in order to share them more easily with family and friends" - pg168
• "harder for families to keep up with the backlog of images" pg168
• "typical pattern [...] creating full albums with handwritten annotations" pg168
• "forgetting details of people and events depicted in old photos [...] better if they (annotations) were captured earlier in the lifecycle of the photo" pg168
• "specialized photo activities such as creating collages, putting together special 'milestone' projects to mark a significant life event [...], and creating an autobiography" pg168
• "archiving of digital photos appeared to be limited to active selection. Very few families reported systematically organizing their digital photo collections on the PC, and inspection of PC files stores revealed miscellaneous folders full of numbered photos downloaded in the same session" pg169
• "never saw the PC screen as a convenient vehicle for synchronously reviewing a sharing those photos with others" pg169
• "all families reported some level of digital photo sending behavior over email or web channels" pg169
• "joy from the feedback and subsequent conversation around the photos" pg169
• "The 'embedded' nature of digital photo sending made email attachments preferable to web publishing" pg169
• "publishing unusual digital photos to a wider audience than just family and friends [...] feedback from the audience appeared to play a significant role in people's motivation to put new material onto the web" pg170
• "discuss those photos synchronously over the telephone" pg170
• "sharing photos in person was described as the most common and enjoyable [...] seen as a way of re-creating the past and reliving the experience with others who were there at the time" pg170
• "many participants reported being 'turned off' by the notion of looking at digital photos on a computer [...] too abstract, lacking the tangibility and manipulability of physical photographs." pg170
• "storytelling was only present in a subset of conversation" pg171
• "reminiscing talk [...] jointly 'finding' the memory together" pg171
• "stories get told explicitly to others who weren't present at the time" pg171
• "story gets told collaboratively" pg172
• "not all stories relate to the photographs at hand" pg172
• "it is the memories and the conversation that are of primary importance in photo sharing" pg172
• "remote partners could select and organize photo collections together" pg173
• "The provision of ad hoc joint accounts shared by more than one household would facilitate this behavior" pg174
• "lower the overhead by improving the interface techniques for labeling" pg174
• "building on the foundation of printed photo sharing rather than replacing it with forms of screen-based photo-sharing" pg174
• "comments and conversations would be good to save and associate with the photos for future personal reference ans consumption" pg175

Projects Mentioned:

- Blacksburg Nostalgia website
- MS NetMeeting
• InChorus
• Instant Messenger (All)
• hpphoto.com
• Cieva(cieva.com)
• KAN-G
• HP Memories Disc
• ACDSee

27. Find that photo!: interface strategies to annotate, browse, and share


Summary:

• Short article overviewing the importance of annotation to how people browse with the end goal of sharing.

Highlights:

• Why annotate: "Successful retrieval is based largely on attaching appropriate annotations to each image and collection since automated image content analysis is still limited." pg69
• How our users see it: "Consumers typically put little effort into photo annotation; they are more focused on exploratory search and serendipitous discovery of photos with a stronger emphasis on entertainment" pg69
• Camera meta data: "Cameras are increasingly recording information about the photograph including time and date stamps, tilt sensors for orientation, light levels, focal distances, and even global position. Barcodes, RFID tags, or other labeling methods could enable a higher percentage of photo to be annotated automatically" pg70
• Manual annotation: "Many interfaces enable manual annotation of photography by 'painting' keywords or dragging and dropping names onto images. Commercial tools such as Adobe PhotoShop Album make tags dragable onto photo borders. Other tools perform temporal clustering to create a more manageable set of photo groups." pg70
• Representative photos: "These representative photos again help to provide landmarks in order for users to locate photos from particular events." pg70
• Social: "Recent innovations in social experiences on the Web have sought to encourage annotation by increasing satisfaction and making the benefits immediately apparent. A game-like approach to image annotation gets players to cooperate with anonymous, remotely located partners in assigning keywords for photographs. [...] Other communities, such as Flickr, allow users to share and annotate images on the Web site using tags. These 'folksonomies' have now gone past photos to Web pages and blogs as well." pg71
• the problem space: "We see significant work remaining, especially in metadata standardization to help users cope with their rapidly growing and increasingly valued collections." pg71

Applications Mentioned:

• Adobe Photoshop Album
• Flickr

28. Exploring the Potentials of Combining Photo Annotating Tasks with Instant Messaging Fun


Summary:

• Annotation while sharing using a whiteboard style of web interaction with chat. While this may encourage annotation of photos that are shared, not all photos will be shared so not all could be annotated in this manner. Also, it does not solve how one chooses which photos to bring up to share before they are annotated.

Highlights:

• "Truely meaningful metadata can only come from end users," pg11
• "To the best of our knowledge, it is for the first time that the photo annotating task is achieved by using the online whiteboard concept." pg12
• "Six annotation types are provided: general description, location of taking, time/date of taking, even of taking, persons in photo and objects in photo, as indicated by the buttons above the photo sharing area in Fig1." pg12

• "Talkim can extract annotations from messages sent by users. Four annotation types were worked out in our prototype system. They are location of taking, time/date of taking, event of taken and persons in photo.
• "There are several interesting observations during our user trials. First, participants from all groups liked the integration of photo sharing and chatting. The group of a couple continued to use our system for a while after their session was finished. Secondly, all participants liked the functionality that they can put annotations onto the photos and move annotations around. Our analysis shows that large amount of metadata were added to photos. Thirdly, for the group of teenage girls, right after they found that they could move annotations, they started to play a 'grabbing' game: one moves an annotation while the other tries to grab it and move it to another place. They thought it was fun and they played this game"
many times throughout the user trial. Finally, it was also found in the group of teenager girls that they often use the on-screen annotating functionality to chat, not only for annotating photos." pg14

Applications Mentioned:

- Adobe Photoshop Album
- ACDSee
- iPhoto
- PhotoFinder
- Minolta's DiMAGE Messenger
- Picassa Hello

29. A Scalable Service for Photo Annotation, Sharing, and Search

- Citation: Lee, Benjamin N., Wen-Yen Chen, Edward Y. Chang, "A Scalable Service for Photo Annotation, Sharing, and Search" MM'06 October 23-27, 2006 Santa Barbara California, USA. ACM 1-59593-447-2/06/0010

Summary:

- This group made a website called Fotofiti, which does automatic semantic annotation of digital photos, event management, and social network integration
- They found that semi-automatic classification and organization of photos using perceptual features such as colors and edges are not that effective
- They chose to focus on using the metadata from context and content to annotate photos
- Using camera data about f-stop, exposure time, etc, as well as user-tags, they were able to train their system to make differentiations such as indoor/outdoor and day/night
- They relied on the social network aspect to have more people providing tags for photos
- Perceptual Based Image Retrieval (PBIR)
  - Scale Invariant Feature Transformation (SIFT)
- For landmark recognition

30. How Do People Manage Their Digital Photographs?

Summary:

- "The six-month, 13-participant study included interviews, questionnaires, and analysis of usage statistics gathered from an instrumented digital photograph management tool called Shoebox" - p409
- "Shoebox is an application for organising, annotating, indexing, searching, and browsing collections of digital images." - p410
- "developed at AT&T Laboratories Cambridge" - p410

Highlights:

- "Shoebox has some advanced multimedia features: content-based image retrieval and speech recognition applied to voice annotations." - p409
- People find it easier to manage digital photos than non-digital ones, due to simple browsing features - p409
- "The advanced features were not used very often and their perceived utility was low." - p409
- "the principal users of a personal photo collection are the photographer and his or her family, who are very familiar with its contents, especially because they relate to memories of life events" - p409
- Shoebox - Windows GUI, Object-oriented database, conventional thumbnail-based browsing, audio annotation ("users can speak about their photos, and attach these comments to individual images or groups of images" "automatically transcribed, enabling subsequent text-based retrieval"), image analysis and indexing tools (allow searching by visual content) - all p410
- people "organize their prints by putting them into albums, but often this is a low priority task" & "usually only the 'good' photos are placed in albums, separating them from the 'bad'ones, which may be technically poor, or just boring" - p411
"albums are classified by specific events...Within an album, the photos are usually kept in chronological order" - p411
people "occasionally write notes (such as names, places, or dates)" - p411
Within Shoebox, "Almost all of the participants had changed the name of a roll, to help them identify the set of photos it contains" - p411
For digital photos people "did not need to record dates, as digital photos are automatically timestamped by the camera" - p412
"Most of the participants said that they would only ever want to annotate some of their photos, and that doing it for the whole collection would not be worth the effort." - p412
Shoebox's speech annotation often made mistakes for names of people and places - p412
Printed pictures that "are recently taken are kept handy for a short period before being put away with the rest of the collection" - p412
Digital photos: "recent pictures are kept in the camera's flash memory and shown to people using the LCD screen or a nearby television set" - p412
Three basic type of requirement when searching for older photos from a collection: 1."set of photos from a particular event", 2. "an individual remembered photo", 3. "a set of photos taken at different events, but all sharing a property, such as containing a certain person" - p412
People "remember the rough date if[photo] was taken" and "dip into the collection and then move backwards and forwards" - p413
Physical photos - "Organisation involves effort, and the main motivation for doing it is not that it facilitates searching, but that it results in an attractive presentation of the best photos, for showing to other people, and then keeping as part of a family archive." - p413
"An exhaustive search (looking through the whole collection for all of the photos matching a requirement) would normally only be carried out in exceptional circumstances, such as following a death in the family" - p413
"text-based indexing did not provide sufficient motivation to make the participants more likely to annotate their photos, because the type of requirement that can only be satisfied with a query is relatively rare; the most common requirements can easily be satisfied by browsing." - p413
"Visual queries can be used to specify general requirements involving visual properties of photos, but the participants expressed little interest in this" - p414
Systems that can automatically group together multiple shots of the same scene may assist the user in selecting the best ones" - p415
Personal photos are taken on special events to "remember the events or people involved, and record for posterity" - p415
"The most important use for personal photos is...looking at the most recent ones and showing them to friends and family, usually while describing what is depicted" - p415
Users prefer "stability to be more of a priority than range of features" - p415
It's important to ensure that "the basic features of a system for managing personal photos are efficient, reliable, and well-designed" - p415
• Two most important features: 1."automatically sorting photos in chronological order" 2."displaying a large number of thumbnails at once" - 415

Applications Mentioned

• PhotoMesa
• FotoFile
• PhotoFinder
• PhotoToc
• AutoAlbum

31. Visualization Methods for Personal Photo Collections: Browsing and Searching..

• Citation: Kang, H., Shneiderman, B., Visualization Methods for Personal Photo Collections: Browsing and Searching in the PhotoFinder, Proc. IEEE International Conference on Multimedia and Expo (ICME2000), New York City, New York.

Summary:

• "PhotoFinder provides a set of visual Boolean query interfaces, coupled with dynamic query and query preview features. It gives users powerful search capabilities. Using a scatter plot thumbnail display and drag-and-drop interface" - p1539

Highlights:

• "PhotoFinder employs the following strategies: powerful Boolean queries to rapidly filter and view results, dynamic queries to rapidly filter and view results,
query previews to show cardinality of result sets, special fields to handle missing data for an attribute" - p1539

- "direct manipulation interface" - p1539
- "three-window strategy: a search tool window (top level), a thumbnail browser window (intermediate level), a detail viewer window (bottom level)" - p1539 => "This follows the tried and tested visual information seeking strategy: 'Overview first, zoom and filter, and then details on demand" - p1539

32. **Photomesa: A Zoomable Image Browser using Quantum Treemaps and Bubblemaps**

- **Citation:** Bederson, B.B., PhotoMesa: A Zoomable Image Browser using Quantum Treemaps and Bubblemaps, ACM Conference on User Interface and Software Technology (UIST 2001), pp. 71-80.

**Summary:**

- "PhotoMesa is a zoomable image browser that users a novel treemap algorithm to present large numbers of images grouped by directory, or other available metadata." - p71

**Highlights:**

- people are "more likely to be interested in serendipity - that is, finding photos they weren't looking for" in home settings - p71
- Design goals: "Simple to use..., Work well for family-use settings, encouraging shared co-present use, Support collections of photos, and use screen space efficiently" - p72
- "Treemaps are a family of algorithms that partition two-dimensional space into regions that have an area proportional to a list of requested areas." - p72
- "Zoomable User Interface (ZUIs) .. give a consistent and easy to user interface for getting an overview of the information, and seeing more detail." - p73
- "users looking at images are primarily interested in groups of photos, not at the structure of the groups" - p73
- "automatically reduces the resolution and quality of images when they are dragged out of PhotoMesa" for emailing etc. - p74
- "The zoomable characteristics of PhotoMesa make it a good match with the Web, offering a potentially efficient manner to browse large image databases on the Web since only the resolution needed for teh current view needs to be sent to the client" - p79

**Applications Mentioned**

- PhotoFinder
- The Personal Digital Historian project at MERL
- ZIB (Zoomable Image Browser)
33. **Ordered and quantum treemaps: Making effective use of 2D space to display hierarchies**

- **Citation:** Bederson, B.B., Shneiderman, B., and Wattenberg, M. (2002). Ordered and quantum treemaps: Making effective use of 2D space to display hierarchies, ACM Transactions on Graphics 21, 4, 833-854.

**Summary:**

- Different visualizations, and some adaptations for photo display.

- Strip Quantum Treemap: This one was the best overall, in general; preferred when searching for items, wasted the least space, had very good aspect ratio. The usability tests were run with only 20 ppl, however, 80% of whom were CS or HCI.
- These algorithms use metadata to sort, but needs very specific metadata types; an ordering one (time taken?), a sizing one (in our case probably the number of photos in each group), a labeling one (the name of the group), and maybe another ordered one (could change the color of the background for each group).
- This visualization supports browsing and serendipitous photo finding, searching, clustering and is ordered (to a degree).

**Comments:**

- Canon ZoomBrowser EX
• This could be used for photo rating (color of background?), preferencing, or maybe viewing a preferred photo group but still seeing related photo groups.

See:

• photomesa
• open source implementation of this algorithm: [http://www.cs.umd.edu/hcil/photomesa](http://www.cs.umd.edu/hcil/photomesa)

34. Immediate Usability: A Case Study of Public Access Design for a Community Photo Library


Summary:

• This paper presents a novel idea of a community photo library access system called PhotoFinder kiosk. It also demonstrates how designer can design unrestricted photo annotation and uploading using a public access system. It enables members of the community to browse, annotate, share and contribute similar experience with other members of the community.

Highlights:

• The PhotoFinder kiosk is intended to encourage collaborative reflection, storytelling and interpretation of shared experience.
• It paper also provides a set immediate usability principles and guidelines for designers to develop and evaluate user interface for community oriented public access system.
• from the users study certain issues on privacy, security, copyright and control/management. The design team addressed these issues by using the feature of moderated or unmoderated option so that, in a moderated community the photos will be evaluated by a member before get posted in the community kiosk. They also added a feature where the user can contact the management if she wants any photo to be removed from the system.
• Here are some of the principles/ guidelines the paper presents for designer
  - Use the most attractive content to demonstrate the system and invite user
  - support zero-trial learning, user should be able to use the system after observing others using the system or using it themselves for a brief period of time.
  - Encourage user to immediate interact with the content
• From the user study of the installation in SIGCHI 2001 the design team also developed a web version of the interface called PhotoFinder called StoryStarter. The StoryStarter allows user to use the already existing images and associated date with the images to create a static webpage to share the story with other members of the community.

35. Photo annotation on a camera phone


Summary:

• BRQ-Layout - visualization for photos.
  o Requires some tagging: time could be sufficient though.
  o “Users can resize and reshape the windows, add or delete regions, or add more photos.” they can also move where the Primary Region (the big image) is.
  o Note that some regions can represent more than one tag each (Simmy, Lani)
  o Can filter regions based on other tags.
  o When images don’t fit, could shrink the thumbnails, re-size the regions, or put a scroll-bar on the region that’s too small.
  o Doesn’t really talk about how to switch what variable the photos are divided by or what regions are shown.

• User Study:
  o “The users clearly desired additional interactive features such as clicking photos to get more information, selecting a photo to be the primary region, and moving photos across regions.”
  o “they were sometimes surprised by the appearance of larger blank spaces and seemingly smaller-than-needed thumbnails”
  o thought a “linear approach” would be better for searching.

36. Semi-Automatic Image Annotation Using Event and Torso Identification

• Citation: Bongwon Suh and Benjamin B. Bederson, 2004. Semi-Automatic Image Annotation Using Event and Torso Identification. Human Computer Interaction Laboratory, University of Maryland, College Park, Maryland, USA.

Summary:

• Another visualization and browse tool. This one is designed to aid in annotating images. It groups images automatically into "event" groups and supports the user re-arranging these automatically generated groups. It does sub-groupings as well, and the user can merge and re-split groupings. The display is a zoomable spread
of photos with groupings indicated by boxes around the images. It also recognizes people in images (by their face and torso) and generates a view with only the people in each photo with the background cropped out. This is used to label who each person is. It uses a simple drag-and-drop interface.

- The paper does not really discuss any testing of the interface; user studies are listed in the "future work" section.

37. Peekaboom: A Game for Locating Objects in Images


**Summary:**

- "an entertaining web-based game that can help computers locate objects in images." - p1
- It can be used to tag images, but doesn't seem appropriate for personal use images.
- Can be used tag images online while sharing photos, but doesn't seem to fit with the motivation of why people are sharing photos.

**Summary:**

- The point of the web game Peekaboom is to get users to create a database of image object location data, which then can be used for training computer vision algorithms.
- This has been successful as a way to generate these annotations on public images.
- The game is two player game, where the "Boom" is given an image an a tag for that image, he then reveals the part of the image that would allow the "Peek" to guess the tag. This generates the location data for the object in the image. The tags were previous generated through another game called ESP.
- However, this type of annotation would likely not be possible for personal collections, as people would not want to release their private photos for strangers to see.

38. Faceted Metadata for Image Search and Browsing


**Summary:**
• This is another product design paper. This product is a means to search and browse images based on semantic tags that the system assumes are already assigned to each image. It is aimed at professionals "e.g., journalists, designers, and art directors". They did develop an algorithm to semi-automatically convert paragraph descriptions into "meta-data categories". The system allows users to type in a prompt, browse through hierarchical semantic categories, and browse horizontally by adding/removing certain search criteria.
• The system seems to work well enough for its target, but I see limited usefulness to people working with their own personal photos. We saw this semantic search rarely enough with the users that the system does not seem worth the initial effort necessary to tag all the images.

Summary:
• This project focused on using faceted metadata to allow users to navigate images by their conceptual dimensions. This was tested on a collection of art photos (aka: non-personal photos, more like stock photos)
• They question the usefulness of searching according to low-level visual properties such as color and texture, and instead suggest that category labels are better for people exploring a collection of photos.
• Faceted means that the metadata is composed of orthogonal sets of categories (aka: various measures by which it can be organized)
• The metadata can be flat or hierarchical, where hierarchical is like location "USA > PA > Pittsburgh > CMU > etc" whereas flat is like an author "this paper is by Ka-Ping Yee"
• The metadata can be single or multi valued, where single is like height, and multi is like qualities
• Their project focused on allowing users to narrow down to a specific photo, and be given various paths that they could follow to find other related photos of interest.
• The ideas expressed appear to be suitable for an exploratory approach to personal collections (that have been prior annotated) however do not appear to address how one could triage photos for sharing.

39. Joking, storytelling, art sharing, expressing affection: a field trial of how children and their social network communicate with their social network in leisure time


Summary:
This paper presents a case study on how people use digital images in leisure activities and discusses the advantages of filed trial as a part of product design process.

**Highlights:** Some of the major findings

- Images were used for joking, expressing annotations and creating art
- User's perception of images changed from memory support to the expression of current activities and feeling
- Usage of images for communication process depend on the user's willingness to develop a picture language with the receiver.
- Images should provide possibility for annotation with text and video.
- Grand parents are extremely interested in seeing images taken by grandchildren. This brings them a step closer to their grandchildren.
- Children discovered their own way of using the device by taking pictures of computer screen to show games to their friends.
- Children created stories to communicate with their friends by using the device.
- **Images are insufficient for storytelling or 'functional communication' without being supplemented with text or audio** [Ben]

40. Managing and Searching Personal Photo Collections

- **Citation:**

**Summary:**

- "a prototype system for managing and searching collections of personal digital images. The system allows the collection to be stored across a mixture of local..."
and remote computers and managed seamlessly. It provides multiple ways of organizing and viewing the same collection. It also provides a search function that uses features based on face detection and low-level color, texture and edge features combined with digital camera capture settings to provide high quality search that is computed at the server but available from all other networked devices accessing the photo collection." - p1

**Highlights:**

- **Existing Barriers of using web sharing:** "slow Internet connections, storage cost, and privacy restrain people from uploading all their photos to the web" - p1
- "The problem is that applications on these different devices are not directly linked to each other." - p1
- **What differences do personal photos have over stock photos:** "the number of images in such a collection is usually limited compared to professional or business image databases. Therefore many of the traditional database performance issues do not arise." "The majority of images in such collections are acquired from digital cameras which insert metadata at the time of capture into the image headers." "A limited number of digital cameras (usually one)is used; therefore the metadata fields present in all images are the same or form a consistent set" "The semantic search problem in this space is easier to objectively evaluate." - p1
- "A collection is organized into a number of top-level albums" - p2
- "The location of the album is indicated by color coding" - p2
- "simple drag-and-drop or cut-and-paste" to transfer files - p2
- "we provide a system that let users manage their photo collections on different locations through a single client" - p2
- "One design goal is to allow this metadata and organizational information to be combined with thumbnails of the image to create a portable compact version of the entire image collection" this allows portable index of the entire collection - p2
- "Our system allows multiple ways of viewing the same photo collection." without additional storage cost - p2
- "the virtual album, is introduced in the system to let users easily create customized views of their photo collections for different purposes" - p3
- "Photos in virtual albums contain links to images in other albums." - p3
- "A virtual album can also recursively contain virtual subfolders of file links." - p3
- "For identical albums that are located at different places,changes to one location copy that the user makes to any image or album are automatically propagated to all other locations." - p3
- "The visual similarity search function is based on a low level image feature representation." - p3
- "A neural-network based face detection algorithm[10][6] is used to detect faces within the entire database." - p4
- "time-based similarity outperforms all other methods when it is available." - p5
- "visual similarity has the advantage of always being available, regardless of the image source or condition. Using camera metadata and face
detection improves performance over visual similarity alone." - p5

• "From our observations people use different criteria to judge semantic relevancy but these can be grouped into event, appearance or person-based similarity." - p5
• "We believe that being able to access one’s photo collection from a variety of devices and in a variety of organizational views allows users to derive value from their photos." - p6
• "Users use a variety of criteria when searching for relevant photos and different similarity metrics map well to these criteria" - p6
• "we see that in many cases users tend to group their photos based on time events" - p6

Applications Mentioned:

• PhotoFinder
• FotoFile

41. Managing Digital Memories with the FXPAL Photo Application

• **Citation:** John Adcock, Matthew Cooper, John Doherty, Jonathan Foote, Andreas Girgensohn, and Lynn Wilcox Proc. ACM Multimedia 2003. pp. 598-599, November 2, 2003

Summary:

• "The FXPAL Photo Application is designed to facilitate the organization of digital images from digital cameras and other sources through automated organization and intuitive user interfaces." - p1

Highlights:

• "Researchers have found that organizing photos by time improves users’ performance in retrieval tasks." - p1
• "content-based image similarity is often less useful for photo clustering or event detection than metadata." - p1 => because "visually dissimilar photos often belong to the same event" - p1
• "When photos are imported into the application, events are automatically detected and assigned." - p1
• "Three different fixed thumbnail sizes for the light table" - p2
• "colored title-boxes delimit the start of each category .. in the light table" - p2
• "The tree view has a sub-tree for each of several different categories: Dates, Events, People, Places, and Labels" - p2
Calendar view displays images based on date, and user can add dates to images. - p2 => "Photo dates may be set by dragging a selected images or images onto a date in the calendar" - p2

Applications Mentioned:

- Adobe Photoshop Album
- Canon Zoombrowser
- Apple iPhoto

42. Semantic Image Browser: Bridging Information Visualization with Automated Intelligent Image Analysis


- Citation:

Summary:

- Proposes "a novel, scalable, semantic image browser by applying existing information visualization techniques to semantic image analysis. This browser not only allows users to effectively browse and search in large image databases according to semantic content of images, but also allows analysts to evaluate their annotation process through interactive visual exploration." - p1

Highlights:

- "target search: The search for a precise copy of the image in mind, or for another image of the same objects found in an image of interest" - p1
- "search by association: The search is an iteratively refining process which at the start has no specific aim other than finding interesting things related to example images" - p1
- "category search: The search aims at retrieving arbitrary images representative of a specific class" - p1
- "facilitate the abilities of users to explore and search large image databases, but also allow expert image analysts to evaluate and monitor automatic image classification processes using their own judgment, innate pattern understanding abilities, and knowledge discovery." - p1
- "integration of the interactive visualisation and automated image analysis techniques in such a way that it gives a powerful, new exploration capability" - p1
- "our prototype is the first system that allows users to directly perform visual queries through a high dimensional visualization where contents of all individual images are explicitly conveyed along with query results." - p3
- "we developed an image browsing interface with the following goals: (1) to provide users an image overview of a large collection so that they can know what kinds of images are in the collection at a glance; (2) to provide users a content
overview of the image collection so that they can learn the contents of a collection, their distributions, and their relationships at a glance; (3) to provide users a rich set of interactions for conducting visual queries and analyzing images in detail through simple mouse and keyboard input." p4-5
• "MDS image layout based on semantic similarities that provides promising image overviews for large image collections" -p8
• "VaR content display that visually represents the content of a large image collection" -p8

Applications Mentioned:

• PhotoFinder
• PhotoMesa
• Microsoft Explorer

43. Push!Photo: Informal Photo Sharing in Ad-Hoc Networks

• Source: www.viktoria.se/fal/publications/2006/pushphoto-ubicomp.pdf
• Citation:

Summary:"Push!Photo is a mobile photo sharing application where photos can be made public and immediately accessed by anyone nearby. The application also automatically searches for photos on nearby devices to find interesting and relevant photos." -p1

Highlights:

• The majority of camera phone pictures are taken with the intention to share them with others [3]." -p1
The common ways to share photos in a mobile setting include using MMS, Bluetooth, IR, or getting the pictures off the phone and share them on the Internet." but they are cumbersome, require a certain threshold, and do not allow spontaneous informal sharing.

- Push!Photo: "uses wireless ad-hoc networking" "users can make photographs on their devices public, which mean that they are immediately accessible to anyone nearby" "photographs are automatically tagged...when...who took the picture..who else was present at that time" -p1

- "photos are shown as a multi-picture slideshow" -p2

- "To decide whether two photos are from the same event, information about whom else was around and the time of shooting is used." -p2

- "it is possible to make sharing photos in social settings as easy as passing around old-fashioned photographs, but with the added advantage of digital storage and searching. Furthermore, by having access to anyone’s photo collection, it creates a local mobile community where you can meet potentially new friends." -p2

Applications Mentioned:

- Push!Music
- MM2
- Flickr

44. Online Media Sharing for the Elderly

- Citation:

Summary:

- "The main challenge we see is the need for education and guidance in future services. The main opportunity is the already existing motivations and needs of the elderly to communicate with digital media and the willingness to spend time in creating valuable and refined media objects, such as photo books." -p1

Highlights:

- "The elderly today, and even more in the future, are more active and healthier than ever before." - p1
- "creating media in the form of photo albums, framed pictures, or family histories is nothing new to seniors." -p1
• "They are active in the internet, they enjoy viewing and commenting photos shared with them over the network, and they have a long history of taking photographs and putting them in albums." - p1
• The active grandmother: 61 years old. Shared with 23 different people. Share photos of grandchildren, hobbies, parties, and other events. Shared with family, friends, new acquaintances from events, colleagues in a senior association. "More familiar with digital technology and the internet than an average senior". Shared to keep in touch with her family, and to document her everyday life & occasions. - p2
• other elderly people were "very keen on commenting and viewing the photos shared with them" - p2
• the non-active ones were due to difficulties learning the new technology - p2
• "One of the main challenges in designing for the elderly is that the basic components and devices in multimedia services (i.e., mobile phone screens and keyboards, consumer digital cameras, web browsers) are not designed with the elderly in mind." - p2
• "Another challenge is to educate elderly users on the basic concepts and metaphors in multimedia services. Also, the basic computer and internet technology can be alien to some of the elderly. easier to create and can handle larger amounts of media than its fully physical counterpart." - p3
• "the elderly in the future will have more knowledge on information technology so this problem is diminishing in the long run. However, educating the elderly users remains a key challenge in the near future." - p3
• "often older people have more trouble understanding abstract concepts" - p3
• "the role of guidance and user support is exceptionally important in systems designed for the elderly." - p3
• "the older users valued the documentation of important people, places, and events for future reminiscing." - p3
• "elderly have also always been active in creating and sharing media in the form of photographs, photo albums, and family histories." - p3

Applications Mentioned:

• MMM-1
• Mobshare
• PhotosToFriends

45. Direct Annotation: A Drag-and-Drop Strategy for Labeling Photos

• The paper presents a novel idea of organizing personal photo library through direct annotation. It allows the user to drag and drop labels such as name, place etc. from a list. Eventually it helps in photo search based on name, place etc.

Breakdowns:

• System does not learn from the previous interaction with the user and user has to do the same thing again and again to annotate each photo.
• User has to add labels manually to the database

46. On Electronic Annotation and Its Implementation

• Citation: Fogli, Daniela, Giuseppe Fresta, Piero Mussio, "On Electronic Annotation and Its Implementation" AVI'04 May 25-28 2004 Gallipoli (LE) Italy, 2004 ACM 1-58113-867-9/04/0500

Summary:

• This article is actually on document annotation.
• It talks about how annotation facilitates two-way communication, and how e-annotation can help increase community knowledge.
• In document annotation, symbols (visual identifiers) are used to mark a place in the document to which an annotation is linked. The annotation itself can be within the document or outside of the document (stand alone).
  o Photo correlation: on Facebook, visual identifiers are placed on the photos when people tag them (previously the boxes, now they are the tag name). However the annotation is outside of the photo, at the bottom. Of course, this depends on how you define a photo to be a document.

47. Efficient Propagation for Face Annotation in Family Albums

• Citation: Zhang, Lei, et al. "Efficient Propgation for FAce Annotation in Family Albums", MM'04 October 10-16 2004 New York, New York, USA. 2004 ACM 1-58113-893-8/04/0010

Summary:

• This paper describes a multi-selection face annotation system. In this, a user selects multiple photos, and tells the system to annotate it with names of people in the photos. Using algorithms, the system propagates these names down to the faces recognized in the photos based on face similarity between photos.
• In prior work, name annotation for faces could be done on a photo-by-photo level, with the system suggesting possible names based on prior annotations.
• The limitations in this system are still on the computer face recognition side, as people change poses and facial expressions across photos.
• Additional flaws in the system include ambiguous photos, where more than one individual appears jointly in all the photos selected by the user (in other words, the system cannot decide who is John and who is Tom when they both appear in all photos).
• The "smart thumbnail" technique was used, where when a user hovers over a thumbnail, it zooms to the most relevant part of the thumbnail (in this case the face). If there are additional interesting areas, the thumbnail would start panning through the image on an optimal path. This helps the user avoid switches between thumbnail and image views.

48. MiAlbum - A System for Home Photo Management Using the Semi-Automatic Image Annotation Approach

• Citation: Wenyin, Liu, et al, "MiAlbum - A System for Home Photo Management Using the Semi-Automatic Image Annotation Approach" ACM Multimedia 2000 Los Angeles CA USA, ACM 200 1-58113-198-4/00/10

Summary:

• In this system, photo annotations are proposed based on the annotations given to similar looking photos. The annotation suggestions get better over time, as well as the keyword search.
• Since the system is learning the user's habits, it requires training and hence is not very usable right out of the box. It needs user feedback to refine its capabilities.

49. The social life of cameraphone Images

Authors: Nancy A. Van House & Marc Davis (both from SIMS, UCB)

Motivation: The authors wish to understand how cameraphone imaging fits into existing photographic practices and also how it fosters new practices.

Summary: To study this the authors used the MMM2 (Mobile Media Metadata) sharing system. 60 participants (mostly Master’s students at the SIMS Berkeley) were given Nokia phones preloaded with the MMM2 sharing system. The MMM2 system has two components: the mobile component and the web component. All the images/content were posted to the web component.

The usage of the system was observed over a period of 10 months where the number of pictures shared and uploaded exceeded 24,000. The authors also interviewed 15 people comprising of both cameraphone and non-cameraphone users.

Highlights/Findings:
This paper identifies four higher-order uses of personal photography (from interviews with non-cameraphone users):

- Creating and maintaining social relationships
- Constructing personal and group memory
- Self-representation
- Self-expression

Image creation is increasingly becoming a collaborative activity due to: networked imaging devices, contextual metadata, online image sharing, and reuse of digital content.

Ubiquity of cameraphones facilitated the capture of unplanned and opportunistic photos.

The nature and type of images captured using cameraphones were different: more casual (mundane) pictures were taken.

New practices emerged within the group such as labeling social events as important, funny, etc.

Cameraphone images were often taken specifically for sharing.

Lack of seriousness of cameraphones facilitated candid and humorous shots. Also observed were a large number of self-portraits captured at arms-length.

For some the act of taking the photo was more important than the photo itself.

Images were shared with people who were in the picture or with people who missed a social gathering/event.

Very less sharing observed on the phone; most of the sharing was observed on the MMM2 web interface.

There was a consensus that if the sharing doesn’t happen immediately it is forgotten.

Many images captured on the cameraphone had little expectations of future value.

**Insights:**

- Possibly concentrate only on quickness of sharing?

- Have a mobile component tied to our web based system/ stand alone system

- So many photos? Is it because there was no serious triage? Only sharing?

- Recency is a crucial factor.

**50. Interview Viz: Visualization Assisted Photo Elicitation**

**Authors:** Nancy A. Van House (from SIMS, UCB)
Motivation: The author describes a new method that is a slight variation of photo elicitation, a social science research method.

Summary: This method could be useful for studies where photo diaries are useful. This method was an outgrowth of conducting photo elicitation interviews for the MMM2 project. This method can be used using any available photo organizing applications.

Highlights/Findings:

- In traditional interviews there is often a slip between reality and retrospective accounts. Often the retrospective accounts tend to be inaccurate or incomplete. To overcome this the method of photo elicitation was developed. This interviewing technique uses photos to guide the interview process, stimulate memory, or instigate conversations about a particular topic.
- Photo diary technique and similar studies have the problem of interference. They can interfere with the activity that is being performed; the record keeping may interrupt the activity. The other problem in diary studies is that the answers tend to be either too brief or incomplete. So this can lead to inaccurate analysis of user behaviour.
- Advantages of this method are manifold. The images resulted in more detailed information about the participant’s activities that is lost in a traditional interview setting. The evidence of photos refreshed or contradicted the participant’s memories, thus resulting in accurate data gathering.
- Observed behavior: Image making was greater when they had more leisure time.
51. Leveraging Face Recognition Technology to Find and Organize Photos

**Authors:** Andreas Girgensohn, John Adcock, and Lynn Wilcox (from FX Palo Alto Laboratory)

**Summary:**

The paper presents a semi-automatic approach designed to facilitate the task of labeling photos with people. This approach uses the accurate face detection technology and couples the strengths of the not-so-accurate face recognition technology with an intuitive user interface design. This combination is effective for quick and easy face labeling.

52. Leveraging Context to Resolve Identity in Photo Albums


**Summary:**

- Prototype software that automatically separates photos out by event, and suggests names to attach to each image using no face recognition.
• The system predicts who may be in any given photo based on the time it was taken, place it was taken, and the names of other people at the same event. Metrics used to predict who may be in the photo are:
  o Popularity; how often an individual shows up in images overall.
  o Co-occurrence; how often individuals appear in the same photo or event.
  o Temporal re-occurrence, "Within a specific event, there tend to be multiple photos of the same person."
  o Spatial re-occurrence. People tend to show up in the same places.
• The system appeared to do quite well, based on their tests.
• It requires geographic tagging, however. It calculates what an event is based on time and location.
• The system could be integrated with face-recognition software to significantly improve its reliability.
• It can also be used to retrieve images that have not been tagged (with names) based on the likelihood that the desired individual would be in that picture, as predicted by this software.

53. Does Zooming Improve Image Browsing?

• Citation: Combs, Tammara T. A., Benjamin B. Bederson, "Does Zooming Improve Image Browsing?" HCIL Technical Report No. 99-05, February 1999

Summary:

• This paper focuses on a Zoomable User Interface (ZUI), and compares it with other image browsers, such as the thumbnail grid (ThumbsPlus) and 3-D browsers (Simple LandScape, PhotoGoRound). The results showed that the ZUI and the thumbnail grid were the best for performance time and user satisfaction when browsing for a given photo (not "searching" however, which would have involves using keywords or other queries).
• "The ZUI is a visualization technique that provides access to spatially organized information." In the ZUI, users can zoom in and out, as well as pan around in the space (similar to google maps but for your photo collection?).
• The 3D browsers made the images into billboards that always face the user, and allowed hte user to either "fly through" the images, or spin them around in a lazy-susan type of metaphor.
• Interestingly, in the study many participants in the ZUI did not zoom in to view the photos, and stayed at the zoomed out state. This may be because the task was to find a specific photo, so there was no inclination to look at other photos in more detail (which is unlike a leisurely view through one's own photo collection)

54. Fotofile: A Consumer Multimedia Organization and Retrieval System

Authors: Allan Kuchinsky, Celine Pering, Michael L. Creech, Dennis Freeze, Bill Serra, Jacek Gwizddka
File: Attach:p496-kuchinsky.pdf
Summary:

* Discussion of a product, Fotofile, for organizing and viewing photos. It's pretty old (1999) and seems like a predecessor to many existing products.

Interesting Ideas:

* "an Image Palette, which provides functionality analogous to a light table." "serves as a temporary storage area for creating albums."
* Bulk Annotation
  * Turning the organizational process into a storytelling activity. "the organization of photos into stories can provide us with a significant amount of information that can serve as metadata."
    o Allowing users to organize photos into short story segments ("scraplets").
    o "Using the same photos in multiple scraplets links [the scraplets] implicitly."
    o When looking through a scraplet, links to other scraplets are displayed (supports dynamic storytelling).

Key Findings:

* "Keyword-based search was the easiest concept for home participants to grasp. " But they recognized it was time-intensive and to set up and that it was prone to generate false hits when searching.
  * "Participants readily grasped the benefits of automated indexing. However home participants thought that they would use keyword-based search more frequently."
  * "Home participants reacted ... much more favorably than did business participants" to the notion of browsing.

Also: "In many cases, serendipitous discovery is a significant (but often unstated) goal."

55. Posing for Posterity

Authors: Pauwels

Citation: Pauwels, L. 1999. Social perspectives: posing for posterity. interactions 6, 6 (Nov. 1999), 26-31. DOI= http://doi.acm.org/10.1145/319404.320259

Summary:
* Social rules permit what is shared by photography, but photos are no longer limited to important events and special moments

Notes:

* Now photographs are captured more often, and young people record their peers and not their family members

* Photographs manipulate their environment by constructing an image of it, a form of enhancement that does not require digital manipulation

* Family images provide social information, recognition and identification are primary in importance and not composition and photographic skill

* People share images that incorporate visual messages in order to communicate, and certain understandings are now shared internationally

* Images are used to identify affinity towards the content of an image, but also to provide proof of an activity or visit; social purposes include sharing images to assure that the people are healthy and happy and support long-distance communication

* Public photosharing websites do not meet the same needs as tradition photo albums, since there are limited ways to provide common private spaces

* There is a trend towards sharing images that were once considered personal in a very public medium, but the selection of these shared images now involves triage that incorporate public relations

56. Image Browsers: Taxonomy, Guidelines, and Informal Specifications

- **Citation:** Plaisant, Catherine, David Carr, Ben Shneiderman, "Image Browsers: Taxonomy, Guidelines, and Informal Specifications"

Summary:

- This paper talks about the techniques for browsing within a single image, rather than browsing through a collection of images.
- Some of the challenges faced were overlapping windows that obscure parts of views, and maintaining proportions for tasks in which size values are important (such as a ship builder).
- One tool suggested to browse an image was a fisheye lens, where the point in focus is magnified, but everything is still kept on the screen, just distorted.
• Some automation was also suggested, such as saving points in an image where a user has browsed, and automating navigation, such that the computer explores an area of the image and the user can stop, explore manually, and resume automatic navigation. This could be a more advanced feature than the current slideshow option on photo collections. A slideshow is a linear path, but perhaps there could be a more interesting path through a collection of photos that the computer could take, similar to the critical path of photos for a story that we discussed before.

Some of the definitions given:

• Detail view: shows a magnified portion of the image (in our case, this would likely be a single image from a collection)
• Coordinated pair of views: detailed view with an overview as well (similar to how google maps works)
• Global view: a view of the entire area that can be explored (in our case, the entire photo collection)
• Field of view: in the coordinated pair, the overview shows the location and the shape of the detailed view

57. prefuse: a toolkit for interactive information visualization


Summary:

• Perfuse is a visualization toolkit for programmers. It provides a wide range of visualization application helping programmer make quick visualization using ready-made “widgets” which are very similar to the buttons, check boxes of traditional GUI tools.
• Vizster is an online social network built using perfuse visualization. It provides an ego-centric view of a person's social network.
• The user's network list loaded from an external database.
• It also supports manual panning, zooming and semantic zooming to view high resolution images for people within the connected with the network. It connects different photos of the user's friends in the network by creating a node for each friend's image.
• The tool kit supports 2D visualization for any discrete data entries, such as graphs, trees, collection and time line.

58. Six Themes of the Communicative Appropriation of Photographic Images


Summary:

• Lascaux; an instant messenger program that supports embedding instantaneous snapshots from a webcam into an im conversation.
The paper talks about "narrative visual expression" and the different ways people made use of the photos.

"The connection to other people and the capability to entertain them are ends in themselves"

They talk about the accessibility of this mode of communication:
"Literacy is about access to the expressive potential of a medium. To the extend that any technical capabilities of a system are out of reach, any classes of communication that rely on that specific technical capability are also out of reach."

Six themes of appropriation:
- The image as amplification
  - Images used for "amplifying some communicative intent".
    Example: emoticons.
- The image as narrative
  - Images used to tell a story.
- The image as awareness
  - Awareness of the environment, of activity, etc. Example; an image of the place where the sender is.
- The image as local expression
  - Images that "are appropriated as a way to create and maintain identity within a subculture. Example: graffiti. Something like inside jokes, but for images.
- The image as invitation
  - "The image as an artifact that invites others to sociality." Example: postcards, or an image of the sender offering a strawberry to the camera.
- The image as object/instrument
  - This theme "reflects more of a continuum between viewing the image as an object and the image as an instrument" the difference is whether "the focus is on the image... [or] through the image. This one is not very well explained in the paper.

Summary: "a prototype system for managing and searching collections of personal digital images. The system allows the collection to be stored across a mixture of local and
remote computers and managed seamlessly. It provides multiple ways of organizing and viewing the same collection. It also provides a search function that uses features based on face detection and low-level color, texture and edge features combined with digital camera capture settings to provide high quality search that is computed at the server but available from all other networked devices accessing the photo collection." - p1

**Highlights:**

- Existing Barriers of using web sharing: "slow Internet connections, storage cost, and privacy restrain people from uploading all their photos to the web" -p1
- "The problem is that applications on these different devices are not directly linked to each other." -p1
- What differences do personal photos have over stock photos: "the number of images in such a collection is usually limited compared to professional or business image databases. Therefore many of the traditional database performance issues do not arise." "The majority of images in such collections are acquired from digital cameras which insert metadata at the time of capture into the image headers." "A limited number of digital cameras (usually one)is used; therefore the metadata fields present in all images are the same or form a consistent set" "The semantic search problem in this space is easier to objectively evaluate." -p1
- "A collection is organized into a number of top-level albums" -p2
- "The location of the album is indicated by color coding" -p2
- "simple drag-and-drop or cut-and-paste" to transfer files - p2
- "we provide a system that let users manage their photo collections on different locations through a single client" - p2
- "One design goal is to allow this metadata and organizational information to be combined with thumbnails of the image to create a portable compact version of the entire image collection" this allows portable index of the entire collection -p2
- "Our system allows multiple ways of viewing the same photo collection." without additional storage cost - p2
- "the virtual album, is introduced in the system to let users easily create customized views of their photo collections for different purposes" - p3
- "Photos in virtual albums contain links to images in other albums." - p3
- "A virtual album can also recursively contain virtual subfolders of file links." - p3
- "For identical albums that are located at different places,changes to one location copy that the user makes to any image or album are automatically propagated to all other locations." - p3
- "The visual similarity search function is based on a lowlevel image feature representation." - p3
- "A neural-network based face detection algorithm[10][6] is used to detect faces within the entire database." -p4
- "timebased similarity outperforms all other methods when it is available." - p5
- "visual similarity has the advantage of always being available, regardless of the image source or condition. Using camera metadata and face detection improves performance over visual similarity alone." - p5
• "From our observations people use different criteria to judge semantic relevancy but these can be grouped into event, appearance or person-based similarity." - p5
• "We believe that being able to access one’s photo collection from a variety of devices and in a variety of organizational views allows users to derive value from their photos." - p6
• "Users use a variety of criteria when searching for relevant photos and different similarity metrics map well to these criteria" - p6
• "we see that in many cases users tend to group their photos based on time events” - p6

Applications Mentioned:

• PhotoFinder
• FotoFile

59. Digital Family Portraits: Supporting Peace of Mind for Extended Family Members

Authors: Mynatt, Rowan, Annie Jacobs, Sarah Craighill

Summary:

* The authors implemented a digital picture frame as a prototype for awareness of the health of an elderly family member

Notes:

* The authors implemented a digital picture frame as a prototype for awareness of the health of an elderly family member
* The prototype intends to provide a sense of daily activity and well-being by communicating sensed information
* Privacy was a concern for information sharing and this was addressed by investigating reciprocal displays and by having a local display of broadcast information
* The field study found that phone conversation was both initiated from and grounded in the shared artifact of the picture frame, which was both consistent and ‘fresh’"
60. Augmenting photographs with audio

Authors: Frohlich, Adams, Tallyn


Summary:

* This study investigates providing audio to facilitate the communicative value of photographs

Notes:

* Participating family that were provided devices that recorded both photographs and audio clips of ambient information
* Provided cues for richer recollections of the event and to provide mood
* Various prototypes were provided to families and were ranked by preference
* Families enjoyed holding photographs and passing them around; individuals were able to decide how long to linger at certain photographs and when talk about them
* Certain prototypes required that a single family member control their display and time their showing to correspond with the recorded audio; families spent longer than they wanted to looking at certain photographs and rushed through others with no sounds quicker than they wanted too
* The computer interface was preferred to certain other audiophotos, despite having a single user at a time in control of playback
  
  o Observers would shout suggestions or take control of mouse in order to control actions  
  o The group of observers could still pace the conversation since a manual action initiated the audio playback

61. Active photos

Authors: Kindberg, Tallyn, Rajani, Spasojevic

Summary:

* This paper studies augmented photos that link to multimedia from its visual content

Notes:

* Active photos involve a user indicating areas of a photograph with a pointing device that elicits corresponding content to the user from an associated device
  * Links were made to audio, images and video
  * Six conference attendees who were photographed were invited to provide annotations, and some “wanted an album to tell a story with active photos”
  * Some expressed uses involved recording family memories for later recall, personal notes for an individual record, and experience sharing
  * The rarity of printed digital photographs made them cherished
  * Users wanted active sites to be visible but not obscure the image and forget where hotspots were placed on the photographs in a week

  * Adding visual content to the image, such as associated images, video or web pages, was reported as distracting from rather than supporting viewing the photograph

62. Automated Annotation of Human Faces in Family Albums

Summary:

- This paper talks about automatic annotation of family photographs using Content-based retrieval algorithms.
- Face detection algorithms are robust enough. On the other hand face recognition algorithms are unsatisfactory.
- The authors propose a new technique designed using a Bayesian approach.
- They use probabilistic models to automatically annotate photos with names.
- This technique requires the algorithm to learn from an existing dataset (photos).
- This approach has significantly improved the accuracy of results.
- Experimental results show that the framework is effective and efficient.

- As a result, this approach reduces users’ labeling efforts.

Caveat: This approach only helps in labeling the 'who' of photos, and not 'where', 'what' etc..
Appendix
b. Annotated Competitive Analysis

1. Picasa

Application Type:

- Picasa is a photo management desktop application software from Google, that you can download and use free of charge.

Novelties

- Uses labels to create sub-sets of photos to share with friends or family
- Automatically scans computer for image files
- Allows Geotagging using Google Earth

Breakdowns

- Although Picasa models your folder structure of your photos, there is no way to edit the folder structure through Picasa, making organizing many folders of nephew photos into one consolidated folder a task to do outside of Picasa
- It's sometimes annoying when Picasa will automatically update photos when I place them on my computer.
- And then more annoying when it doesn't and I had expected it to (and then I have to open the file in Picasa for that folder of images to load).
- Non-photos are also automatically updated into Picasa, such as images worked on for a class project (not photos I want to organize)
• Importing photos defaults into one folder, assuming one event, although the photos imported may be from several events. Discourages making appropriate annotations, although fields for "location" and "date" are available.
• Hierarchy of photos is lost in Picasa display
• Visual search for a folder within the non-hierarchical display in Picasa is difficult with many folders. If can remember the name of a folder, using the search box is faster.

2. iPhoto

Application Type

• A desktop application for Mac OS X, that allows user to import, organize, edit, print and share digital photos.

Novelties

• Works fine with almost every digital camera or scanner in the market.
• Can sort photos into "Albums"
• Easy manipulation of photos (cropping, red-eye removal, rotating, effects, full screen editing etc)
• Support for different ways of sharing (email, website, within network, Photocasting etc)
• Many ways of output (calendar, books, slideshows-can add sound etc)
• Search capabilities (mainly by date and keywords)
• Sorting methods (preset criteria with manual sorting support)
• Displays Month/Year when scrolling down the library
• Excellent compatibility with iPods
• Similar interface with popular iTunes
• Plugins available to connect with popular web services (FlickrExport, Picasa Web Albums Exporter)
Breakdowns

- Cannot actually see where the photos are being saved (multiple copies are made in different locations) - can be huge problem for searching and disk space
- Certain capabilities are only available to users in certain markets (especially hardcover book/internet photo/calendar printing)
- Some menus are not intuitive (e.g. "Share Desktop" - what does it do??)
- Rotates only counter-clockwise using the icon (it can be done the other way under Menu)
- "Enhance" doesn't do a very good job of enhancing the colors automatically
- What does "Retouch" do?
- Can't select images to import (just imports everything from camera)

3. Cyworld

Application Type

- A social networking website (launched initially in Korea, now available in US, China, Japan, Taiwan, Vietnam) that encompasses a photo gallery, message board, guestbook, and personal bulletin board on each member's Minihome.

Novelties

- You can establish special relationships with specified people ("my neighbors")
- Can notify "neighbors" of a new post.
- Can create folders to organize photos (can select to display all photos or by folders)
- Allow clipping (taking photos from others' Minihome and posting it on own Minihome) by other members.
• You can set the level of accessibility (public, neighbors only, private) for clipping, commenting, posting
• Photo Tool allows editing capabilities (cropping, rotating, framing, adding patterns, drawing etc - Korean service provide creating animations also)
• Korean Cyworld allows access from cell phones (posting photos from cell phone cameras, receiving updates new postings).
• Build Minirooms that include personalized avatars, wallpapers, accessories etc)
• Collaborated with NateOn (a Korean instant messenger service) that has overtaken MSN Messenger in Korea.
• Videos can be shared
• Extensive tagging capabilities (tag by "neighbor" names, themes etc. to view by tag categories), allows to search others' posts with tags also

Breakdowns

• Many functions are not Mac compatible (creating photo animations, photo editing etc)
• You cannot see who "clipped" an images from your Minihome, but only how many members "clipped"
• Restricted file size and formats for uploads (500KB for Korean version, 2MB for US version) (only JPG and GIF supported)
• Small real estate limited display size, therefore sometimes forcing a lot of scrolling

4. Kodak Easy Share Gallery (also known as OFoto)

Application Type
Kodak EasyShare Gallery is a website for digital photograph viewing and sharing.

**Novelties**

- Through the website, you can both order prints and use digital photographs to order personalize products or "photo gifts."
- Subscription services include viewing photos by cell phones, and premium settings.
- See who has viewed their albums and commented on their photos.
- Order prints for in-store pickup.
- Manage groups of friends and family for album sharing.

**Breakdowns**

- Users, not viewers, "choose to allow [their] guests to view [their] photographs without signing in."
- Sharing involves viewing photographs of limited resolution and size.

### 5. Yahoo Photos

**Application Type**

- Online photosharing tool

**Novelties**

- Creating album, sharing album with family and friends
- Can create multiple album and print at home or order prints

**Breakdowns**
• Decreases file size and loses picture quality
• Don't have features like, commenting, tagging etc
• Does not support basic features like zoom, rotate etc.

6. Facebook Albums

Application Type

• Online social network feature

Novelties

• Tagging of Facebook friends in photos
• Facebook group or event pages can link to photos uploaded in albums

Breakdowns

• Lack of control over who sees photos that include yourself (eg: if someone else posts a photo of you, you cannot change their restrictions placed on the photo, however you can remove a tag of yourself)
• Limited album management capabilities
7. Windows Explorer

Application Type

- Windows folder management system, special folder for photos

Novelties

- Is the real representation of how your photos are stored
- Basic photo sharing tasks available directly from folder structure
- Import wizard can change the base name for the image files

Breakdowns

- Limited viewing to within the folder structure
8. Pxn8

Application Type

- Online photo editing software

Novelties

- Can do basic editing tasks like, cropping, resizing, changing contrast and brightness
- Can be purchased and install in any other website
- Edited photos can be uploaded to any third party website like myspace or Flikr

Breakdowns

- Limited number of editing feature.
- Can not move or position the desired text on the image.
9. Flickr

Application Type

- Flickr (www.flickr.com) is an online for photo management and sharing Web 2.0 service. Flickr mainly aims at making photos shareable to people and making photo organization easier and fun by using tags and notes.

Uploading

There are four different ways to upload photos to Flickr.
- using the web-based upload form
- using upload tools to transfer batches of photos from desktop
  - E.g. jUploadr (for Linux, Mac OS X, and Windows), iPhoto plugin (for Mac OS X), plugin to upload via Windows XP Explorer, Flickr Uploadr for Mac OS X, etc.
- using email
- using a cameraphone (m.flickr.com)

Organizing

Tags: a keyword or a category label associated to a photo, such as location, place, name, or any meaningful word. They help in retrieving photos with something in common. They are limited to a maximum of 70 tags per photo.

Privacy settings: set privacy levels on each photo and decide who can see them and comment on them, such as family, friends, everyone, and private.
Albums: Flickr allows you to organize photos into albums using a simple drag-and-drop interface.

Geotagging: You can tag your photos with a physical location using a map interface shown below.

Other features for organizing photos include:
- making many photo sizes, such as thumbnail, medium and large
- rotating photos easily
- setting privacy levels on each photo and decide who can see them and comment on them

Sharing/Social Interaction

Flickr also has social networking in its service. You can add people as friends or family in your network and even create groups for special events/interests etc. People can leave comments on photos/albums, enhancing both the social and sharing experience.

Viewing Experience

Flickr has a simple well-designed interface for viewing slideshows of albums. It has a thumbnail view at the bottom and a auto-hide slideshow settings panel at the top.
Other Services

Flickr Mobile: A mobile version of the website so you can share & explore photos on your web-enabled cell phone or PDA

Flickr Mail: An e-mail service offered to all users

Flickr API: Flickr has an open APIs. Developers can use these APIs to present and create new utilities/applications using Flickr data. API support for following programming languages: ActionScript, Cold Fusion, Common Lisp, curl, Delphi, Java, .NET, Objective-C, Perl, PHP, PHP5, Python, REALbasic, Ruby.

Conclusion

Flickr’s growing popularity and success as a photo management and sharing application can be attributed to the following factors:

• clean and well designed web 2.0 interfaces focusing on usability
• easy to understand and caters to the needs of diverse audience
• social interaction functions like tagging, groups, commenting, evaluations and friends
• organization of photos in a collaborative way (tagging)

Breakdowns

• No structured way for tagging.
10. Adobe Lightroom

Application Type

* Desktop application for managing, editing, publishing digital photos for photographers.

Novelties

* support different modules (library, develop, slideshow, print, web)
* different import options (referencing, copying, moving etc)
* attractive UI design
* support extensive number of RAW files
* easy-to-use tools for editing photos (white balance, contrast, etc)
* various views both for multiple photos (thumbnail, loupe, compare, survey) & individual photos (fit, fill, 1:1, 1:4)
* flagging feature (flag, unflag, reject) & rating (5 stars)
* synchronizing multiple photos with same changes
* very clear visual feedback across modules (develop, print, web etc)

Breakdowns

* not intended for novice photographers (too many tools & features)
* published website doesn't perfectly work
* difficulties in setting the filenames as desired format for importing
* image sorting, ranking, keywording not very easy when there are billions of photos
11. Sony Imagestation

Application Type:
Web based photo sharing site

Features:
* Images can be uploaded using a drag-and-drop technique. But a plugin has to be installed to be able to do this.
* Images can be edited, enhanced with special effects using online tools.
* Users can order prints and personalized photo books, calendars, greeting cards and more.
* It organizes photos into albums.
* It offers slideshow feature to view albums.
* Pictures can be uploaded via mobile phones.
Appendix

c. Contextual Inquiry Models
(These models as well as each user’s individual models are also available on our project wiki page)

Flow Model: Top Right Corner
Flow Model: Bottom Right Corner
Flow Model: Bottom Left Corner
Artifact Model: Emails with Photos attached

- Email address of sender is associated to ownership of attached photos
- Limited storage capacity
- Ease of sending is directly proportional to personal communication
- Links to new photos at sharer’s online photo albums & blogs
- Password to protect folders on his/her personal website
- Limited attachment file size
  - File name changes to descriptive title only for interesting images
  - File name in email is not same as name in the system (version management issue & context loss)

- Impersonal title
  - Non-descriptive title repeated for many emails
  - Personalized comment in auto-generated email from online photo album
  - Salutation
  - Text body can hold details of photos
  - Text body may not hold any information about the attached photos

- Viewers
  - Links to new photos at sharer’s online photo albums & blogs
  - Password for sharer’s protected folders on his/her personal website
  - Preview of attached photo
Artifact Model: Photo Websites
Appendix

d. Contextual Inquiry, Interview Breakdowns & Insights

User 1 (U1) - College student working on a class project

Summary:
We observed U1 search for images on the iStock Photo website. She used her desktop as a temporary workspace for storing the photos and a text file for recording her thoughts about the photos. She referred to this when making decisions later. Images of interest that she did not save to her desktop were opened in new tabs or saved as bookmarks on her web browser. After collecting images, U1 triaged the photos opened in the tabs, saving some to her desktop, and closing unwanted image tabs. She then triaged the ones on her desktop, selecting a few to use for her project. The selected images were renamed and moved into a folder to keep within her school work folder structure.

U1 Breakdowns:
1. User does not use iPhoto because she wants complete control over where images are saved.
2. Graphic Converter takes too long to load, though it is otherwise good. U1 would prefer Photoshop.
3. When U1 opened an image in Graphic Converter it was zoomed in too much – it was too big.
4. Bluetooth makes U1 uncomfortable. She keeps it off most of the time.
   a. Note: we believe this is due to privacy and security concerns.
5. U1 clicked "Browse Recent" while on the "Browse Recent" page. This did nothing & had no feedback.
6. U1 saw how many results there were in the "Browse Recent" collection & how many were currently displayed but could not find the "next page" or "page 5" buttons for a bit.
7. The same image shows up multiple times. U1 frequently was verbally annoyed by this.
8. U1 wanted random images, not recent images, but she used the “Browse Recent” collection as a work-around.
9. Search does not return the results the user wanted.
10. Interesting feature for narrowing down or expanding the search is unclear & confusing.
11. Whenever U1 returns to the “Browse Recent” folder or goes to another page within the “Browse Recent” folder the images are re-organized.
a. Note: we believe that the “Browse Recent” folder is constantly updated and the user was simply taking enough time between one page and the next that some photos were added, pushing the photos U1 had already seen further down in the collection.

12. U1 does not always trust that things have been downloaded properly if she just checks for the file by filename. Once she re-saved an image just to make sure, despite seeing and recognizing the file already on her Desktop.

**U1 Insights:**

1. U1 used a “multi-pass” approach to triage. U1 went through iStockPhoto downloading some images & opening others in tabs. After this triage phase was over, U1 went through the ones opened in tabs, downloading some and closing others. Then U1 opened some images she was not decided on yet and looked through them. This is a multiple stage triage process.

2. U1 opened textEdit, specifically because it opens fast, to take notes on certain images while doing the triage process.

3. U1’s process evolved throughout the process. At first U1 strictly downloaded images of interest, then later U1 started opening some in new tabs. Even later U1 bookmarked a few images in her browser.

4. U1 uses the Desktop on her computer as a temporary workspace
   a. U1’s Desktop was clear except for a few folders and the images she had selected.

5. U1 attempted to search photos randomly and used the “brows recent” in order to achieve this.

6. U1 seems satisfied with Preview for viewing and comparing images.

7. U1 hates images with meaningless names.

**User 2 (U2) - Photo hobbyist**

**Summary:**
U2 showed us how he imports his camera photos to his My Documents folder at work. He showed how he uses Dreamweaver to post artistic photos on his personal website gallery and on PBase, and how he shares snapshot photos with his friends and family on Kodak EasyShare Gallery. The contextual inquiry also revealed his storage behavior, which involved transferring photos between his work computer, home laptop, and an external hard drive.

**U2 Breakdowns:**

1. U2 has no place to record his decisions about photos. He keeps track of everything in his head.
2. One title cannot “represent all the pictures, explain all the picture”. It is challenging to come up with good names for files.

3. U2 has to pause and think about which direction to rotate photos. It is not immediately obvious.

4. Images are too big to be uploaded to websites unedited.
   a. DreamWeaver cannot be used to edit photos as it messes up the resolution.

5. Photoshop opens to the wrong directory.

6. U2 cannot remember the filesize he wants photos to be for his website.

7. Difficulties remembering and writing HTML.

8. U2 does not remember the password for his website. He has to search his gmail to find it. Nor does he remember the name of the website he uses to upload photos.

9. U2 does not know where to go to find his own gallery

10. U2 needs to rotate photos before uploading them and he cannot from the upload dialog box

11. U2 reviews all the photos in a folder again before uploading them to Kodak.

12. Kodak requires downloading software in order to upload multiple images at once.

   a. U2 chose not to install this software.

   b. U2 uploaded 70 photos to Kodak at one point, but now said “I can’t imagine uploading 70 photos”.

13. The file chooser dialogue opens every time in details view rather than in thumbnails view or in whatever view it was last. This meant that U2 had to manually switch to thumbnail view every time he opened the file chooser.

14. U2 does not use “friends & groups” link.

15. Kodak’s feedback does not indicate that the photograph was shared when it was.

16. Kodak presents a whole bunch of other services available to the user, which is confusing and distracting.

17. U2’s computer is old and has limited memory, so U2 moves most of his photos to an external hard drive and keeps a select few on his computer.

18. Linking one album to another is not supported, which U2 thinks is a problem.

U2 Insights:

1. U2 does not use keyboard shortcuts for navigation

2. U2 did not save his photos in the My Pictures folder but in the My Documents folder.

3. U2 sets the title and caption for each folder instead of explaining all the photos

4. The albums are presented in chronological order.

5. U2 labels folders of photographs on his laptop based on where he stores them on the web; his home website, PBase (his art gallery), or Kodak (which he uses for snapshot photos).
6. U2 said “I didn’t know that I had an order to what I do”

**Users 3 (U3m & U3f) - Couple with a baby**

Summary:
U3m & U3f showed us their folder and file name based organization strategy for storing their photos, and their evolving sharing practices. They each have different practices for uploading the images onto U3m’s laptop, but come together to preview the photos and make decisions about what to share. They currently only share photos via email, mostly with their family, and we discovered some interesting cultural influences on the text content of those emails.

**U3 Breakdowns:**
1. U3f could not figure out how to get the card reader out of the computer at first.
2. It is difficult to configure the permissions on Flickr
3. It is difficult to upload to Flickr on Firefox. They had to use Internet Explorer.
4. Users tried Hello, Picassa and Ringo but did not like them. They are dissatisfied with all the programs out there.
5. U3m has different photos in different places
   a. We expect this is difficult and confusing to manage.
6. Before password protecting online albums, the users got spam based on their albums.
7. The users share more photos with others than others share with them. This makes them uncomfortable because others know more about their life than they know about other’s lives.
   a. “It’s the curse of being technically savvy”
8. Work photos do not fit into the organizational scheme that U3m has developed.
9. Photoshop is a pain to use to fix images. Users have to open each image up, crop them or do other actions to them, and re-save them.
   a. The U3’s now rotate images using the button on the photo viewer they use.
10. In the computer’s slide show one cannot go back & forth; the U3’s wanted to see related photos to some images.
    a. U3’s set the slideshow to show images from a selected folder in random order, but wanted to be able to affect which photo was shown next.
11. Photos are too big to share unedited.
12. If sharing more than 4-6 photos, gmail hangs up and is slow.
13. U3m has limited file space for his email account.
14. The U3m’s means of coordinating files, Photoshare, is unclear about how much
the folders are mirrored. It does not ask permission before applying changes made
in one folder to the mirrored folder.
15. Occasionally U3f forgets her passwords and logins.
16. U3f does not like the interface on Yahoo! and it sometimes causes her problems.
17. U3m does not like downloading plug-ins, but U3f downloads one onto his
computer without asking him.
18. U3m could not find photos his brother sent him. He could not tell if photos he was
looking at were taken by him or by his brother.
19. U3m has had multiple previous computers and occasionally forgets where files
are stored.
20. Inconvenient sharing method: U3m does not want to copy email addresses from
his email account to Flickr. U3f, on the other hand, uses Yahoo!’s sharing
capabilities.

U3 Insights:
1. In terms of editing, we only heard mention of rotating images, changing their
contrast and adding boarders to them.
2. The U3’s used to share everything. They just dumped images onto a website.
Now they select very few of their images to share, and they take care that they are
good ones.
3. The U3’s are very concerned with privacy. They want control over who sees their
photos.
4. When sharing photos via email, U3f puts nothing about the photo in the content of
the email. She changes the names of photos to draw attention to important parts of
them. If the name she wants to give a photo is too long, then she will write about
the photo in the body of the email.
5. The body of emails with photos attached varies tremendously based on the
audience.
6. U3m searched for photos by opening up likely-looking folders and visually
scanning thumbnails of the contents.
7. U3m is very proud of his file organization structure and naming convention.
8. U3m appears to keep his college website up just to store the images and files that
are there.
9. Right after importing photos the U3’s look through them.
10. Used to be that U3f would prepare photos to share on U3m’s computer and then
he would email them to her so that she could email them out.
11. U3m does not care much about photos others send to him. Both U3’s tend to file images sent to them either loose or in folders by the sender’s name.

**User 4 - Master’s student who also has a full-time job. Married.**

Summary:
We observed U4 upload and organize his photos on Flickr, which he used as his primary photo storage instead of his computer. We also saw him put photos on his personal blog. These he put up, mostly without comments attached, as links to slideshows automatically generated by Flickr. So his blog ended up mostly being a series of “covers” to photo slide-shows about his life. The slideshows contained every photo he had taken at that event, and he chose the cover photo by glancing through the large thumbnails in Flickr. U4 also scanned and uploaded some images for his in-laws and edited photos his wife had taken of things she intended to sell on eBay.

U4 Breakdowns:
1. User 4 uploaded only the new photos, though they were in a folder with ones that had already been uploaded. To know what is new, U4 goes to Flickr and sees what the most recent photo is. This is a work-around; the user forgets what he’s uploaded.
2. When you click on the representative photo in U4’s blog, it goes to the corresponding slideshow on Flickr. But U4 must do a work-around (copy links by hand, write the appropriate Html) to set this up in his blog.
3. When U4 goes to Flickr, before he signs in he can brows his photos at only one size; thumbnails that crop (and scale) the original photos in order to fit a square. In order to browse the photos as larger, un-cropped thumbnails, which he does to brows and select photos, U4 must log-in and set the view to larger thumbnails.
4. The user has copies of the same photos in the Visiting Grandmother Set and in the general March Set. But he says he doesn’t have any photos in multiple sets.
5. U4 wants to upload directly to a Set but he cannot because he wants them in a different order than the order Flickr uploads them in. U4 has to upload them to the general dump of photos, create a new Set and then drag the photos into the new Set one at a time.
6. U4 doesn’t use the private setting because he doesn’t want to keep updating the list of people who can view his photos on the private setting. He also doesn’t know who all will want to view each set of photos. His parents pass the links he sends on to extended family.
7. U4 has 1790 photos on Flickr, all of which are in the “photo dump”. This is 90 pages of photos. There are some there that are not in a set; “I don’t know how to
get at them. Don’t know how to write a script to find them. I can’t even view them smaller”

8. U4 cannot do the edits he wants to the photos quickly, easily, or by batch. He must do each one individually.

9. Flickr displays the upload date, not the capture date when the user browses the photos, so it’s not useful for setting up Sets the way user 4 does.

U4 Insights:

1. U4 trusts Flickr.
2. Visually looks through his photos to find clusters from the same event/day.
3. U4 uploads photos to Flickr every 10 or 15 days?
4. “So I just looked at the pictures for this blog entry and pick the best one” (by comparison).
5. Events influenced what photos were taken and what U4 blogged about. The blog entries were inspired by the photos, not really the other way around
6. Upcoming events influenced when photos were posted: “These pictures [of my baby with bunny ears] I didn’t put on the blog because it’s not Easter yet.”
7. U4’s wife does triage on the camera, though she does not delete things; She looked through the photos on the camera and kept showing one to other people.
8. “One of my main goals is to get these pictures to [my child’s] Grandparents.”
9. U4 does not upload photos from other people to his Blog, but he will upload them to Flickr
10. Feature request: U4 wants to allow people who can view his photos to be able to order prints
11. “If I see a use for tagging I might start doing it eventually.”
   a. “If I did I would probably tag everything in the same set with the same tag.”
   b. “I haven’t been tagging because of time, and a need to get these pictures out to people.”
12. User 4 doesn’t write about the photos he puts on his blog much at all because of time; a lot of his posts have no words at all. The only ones that do are ones that have extra details about them – the stats on a model he built, the weight & birth time for the first photo of his daughter, etc. Basically when it’s really important to describe what’s there.
   a. “I don’t really see a need to comment on a bunch of pictures if I put them in my blog; people come to see the pictures.”
13. U4 uses Flickr as a means of storage, but uses his blog as an interface for sharing. He rarely sends people directly to Flickr. He abstracts away that he’s got stuff on Flickr (via Hotlinking)
14. U4 compares photos his wife took of things to sell on eBay using slideshow. He used this to pick one out of several photos of the same item.
15. “My wife wants to see the environment the object is in, so I leave a bit of the background when I edit the picture.”
16. U4 wants to resize, crop and re-center the image for this process.
17. When U4 edited the photos he gave them sensible names, versus the automatically generated names.
18. U4 looked at his images in thumbnail view on Windows Explorer, and seemed very comfortable making judgments as to where the different sets began and ended there – the visual breaks were clear enough at this size.
19. Some photos taken at Grandma’s were put in the general March photos folder because they didn’t have Grandmother there or anyone else. These are just clothes type photos. “[My baby] looked cute so we took pictures. They’re not specific to being at Grandmothers or to remembering the event – they’re not associated with it.”

**Users 5 - Master’s student and photo enthusiast**

Summary:
We observed U5 sort through some new photos and decide which ones to upload to Picasa. He gave us good insights into some of the concerns around companies respecting individual’s privacy and giving them control over their photos.

U5 Breakdowns:
1. The name of the folder (mostly the date) doesn’t help U5 know what is in the folder. The preview images on the folders do help (those four photos in the thumbnail view shown on each folder). U5 recognizes the contents of the folder by that.
2. “I cannot remember what happened before what, it was a long day and I took a lot of pictures.” But “when I look at the photos after a long time I can remember this is [the order in which] it happened.” It jogs his memory.
3. Right now there is no faster way for U5 to select which photo out of many photos of the same thing to share with people than to open the photos up full-size in Windows Picture and Fax Viewer and click next, next, next.
   a. This is how he selects the “good” photos.
   b. “I glance through the thumbnails but they don’t give me a good idea of it. [of the quality of the picture]. They are not clear enough, so I have to go through them one by one to see which one is the best.”
4. “Picasa just grabs everything from your computer and that’s not what I want it to do. I just want it to manage the pictures that I want it to manage.”
   a. “I find it annoying and like an intrusion of privacy that it goes through my entire computer and finds all my photos.”
   b. “I might have some photos that I don’t want to share with others. I may want to have a friend here and show them some pictures, so I open up Picasa and all those pictures (that I don’t want to share) are there.”
   c. “It’s just annoying to me. It’s just too much to handle.”
   d. U5 does not use Picasa because of this.
5. U5 would like to change the thumbnails on his picture folders, but it’s too time-consuming.
6. U5 does not remember the Picasa web URL.
7. “I have a lot of friends, so when I am looking for this friend’s picture, I would like to be able to type in his name and see his pictures, but I cannot do that. Because that sort of information is not stored there.”
8. U5 wants a faster, easier process. He cannot re-name every file
   a. “I took 137 pictures in one day last time. I’m not going to sit down and write every detail.”
9. U5 does not share all his photos; “I don’t want my friends to waste time going through lots of pictures. It also wastes my time – it takes a lot of time to upload them.”
10. Every time U5 goes to select another picture to upload to Picasa web he has to scroll down to the picture he wants. Picasa does not remember what state he was in last time, nor does it allow multiple selection
11. Picasa web only allows uploading 5 photos at a time, and all the photos upload at once.
   a. “What I would like it to do is start uploading as soon as I’ve selected one image and then let me continue working”
12. “Most of Google’s products force you to download all these applications - it is pretty intrusive. I don’t like their policy on that.”
   a. “Whatever application you download, it passes information back to Google.”
   b. “I don’t think Picasa does.”
   c. “Just because it is a free software I do not want it to infringe on my privacy.”
13. “I’ve got other software here. I use the picasa application sometimes, but it uses too much of my processing time because I have too many photos.”
14. U5 does not use Cannon Zoom Browser because “it is quite slow. It uses tones of memory and processing time”, but he really likes its interaction.
15. Picasa offers too many functions
   a. “It gives you too much stuff and it’s not user friendly.”
16. “If pictures are too big to send I might edit a picture.”
   a. U5’s editing process: right click – edit, then he uses stretch/skew to resize the picture when it opens in paint, then he saves-as: “[original file name]_Edit”
   b. I would only resize a picture if I was going to send it.
17. U5 treats other peoples photos as follows: “If they are not my pictures, then I might have duplicates in other places, and in that case I don’t know that they exist. When I find out I have a duplicate, depending how many I have I’ll organize them.”

U5 Insights:
1. U5 thinks about photos by event. So if an even spans multiple dates, such as a trip, he’ll group them together in a folder for the event they’re from.
2. U5 likes that within his folders photos are displayed in the order they were taken in. He seems to like the time-line view of the photos from each event
3. U5 has many photos of the same thing; “I keep taking pictures until I get a good one.”
   a. He does not get rid of extra versions of the same shot because he doesn’t care and he has plenty of space.
4. “Pictures are not so important to me. It’s not like work where if you lose a year it will hurt you a lot.”
5. “Good pictures” are ones that are clear enough that they impress people.
6. U5 takes a lot of photos but only shares a small subset of them.
7. When U5 selects photos to share, he remembers the filename of the photos so when he goes to his sharing medium he can find them. It actually looks more like he’s recognizing the thumbnail; the appearance of the picture.
   a. U5 can find his pictures based on the 4 thumbnails on each folder in the Thumbnail view in Windows; “It’s all because of these previews. These previews are extremely important.”
8. U5 names his folders by place and event (not date).
9. U5 only re-named his pictures in order to share them.
   a. However, U5 did not re-name his artistic photos because “They can just look at this picture and know what it is.”
10. “When a picture is downloaded onto my computer, I would like to know more about it: who took it, where it was taken, some details like who was in the picture, etc. that I can later use to search the picture.”
11. U5 likes simple processes and full control. “What photos I want to upload, I like to select them myself”
12. “I don’t like waiting for anything.”
13. “This Zoom Browser is really simple. All you have to do is zoom through the folders.”
   a. “I would like to have something that gives me more information. Like these [thumbnails] are so tiny it doesn’t tell me anything. But then again you get some you lose some, you can’t help that.”
14. Okurt only allows sharing 12 photographs, which means that it is not a repository but rather a selection condensed down to the “best” or most important photos.
   a. “All of these pictures need to say something about me. They have to be very descriptive, and come from very diverse backgrounds. So when I do something new, one of those photos has to go in here.”
   b. This is to represent him to the Okurt community; it is targeted at his friends
   c. “Even though we [U5 and his distant friends] can’t see each other, we want to be a part of each other’s life. I want to see what they are doing, they want to see what I am doing. I want them to see what I’m doing now, but also these are my memories from my earlier days and I really like them too.”
   d. “So these pictures change every few weeks. Some stay, some change.”
15. “There is no reason I should [print out photos]. Printed out photos you have to care for them, handle them properly, they take up space”
16. “I have a folder called ‘People I know’. Inside there are pictures I got from other people. I don’t want other people to view these pictures; they’re other people’s, not mine.”

**User 6 - Grandmother living with husband, near two children, far from third child**

Summary: 
We observed U6 perform Image retrieval and request new pictures from family members through email. She taught us about some of the concerns less computer savvy people have, as well as some interesting things with kiosks and printing.

U6 Breakdowns:
1. “I have been trying to go back [and] organize [my photos]”. U6 does this by putting them in folders by year.
2. U6 does not save image to her own photo library with the same name as in the email she received it in (file name or description in email body).
   a. Pictures that u6’s daughters and daughter-in-law have sent her go into the filing system of her photos.
   b. As a result, sometimes things get lost
   c. For example, a folder of pictures of one grandchild also had pictures of another grandchild taken at the same time.
3. U6 is known to change names [of folders over time].
   a. She will lose track of what is in the folders.

U6 Insights:
1. U6 has “a bunch of really horrible photos – I get rid of them... but I keep a lot of bad pictures.”
2. “The only time I name photographs is when I am going to email it to somebody.”
   a. U6 only shares photos by email; she does not post them to albums.
3. U6 does not print photos at home very often.
   a. She would like to print at a kiosk.
      i. One reason that she doesn’t is that it does not have red-eye reduction.
   b. She is thinking of printing off a whole bunch using Snapfish or Kodak EasyShare Gallery.
      i. She is not thrilled about ordering pictures through the mail.
      ii. We believe this is a control/privacy/trust issue.
4. When U6 wants an image she saw in her daughter-in-law’s online gallery, she sent an email asking them to please attach this picture and that picture.
5. U6 says “I’ll go in alone to look at photographs.” She does not do this with her husband.
a. She’ll look at it first without waiting for him. She says it’s not necessary for them to look at the photos together.

6. U6 uses Kodak EasyShare Gallery because, when her granddaughter was born, the other Grandmother sent out pictures in Kodak.

7. Occasionally she’ll send some photos, as email attachments, to her sister-in-law and a few cousins.
   a. Those emails are more chatty than photo emails to her children: “Here’s a picture I’d thought you’d like to see . . .”
      i. This is because her children are more closely connected to the photos that she tends to share.

8. “I am not worried about not remembering people in pictures ... There are not too many strangers in my pictures.”

**User 7 - elderly photographer with his own darkroom**

Summary:
U7 showed us how he goes through the raw photos from a recent vacation and chooses the best ones to keep. In most cases he had taken multiple photos of the same thing, but he only wanted one, and he made the decision of which one to keep based only on the thumbnails. He judged his photos mostly by composition, blurriness and brightness. Then he checked his decision by opening the chosen one up to edit it and save it onto a new DVD, renamed. We also gained some good insight on how the decision making and sharing processes have changed over the past 50 years or so, from the perspective of an expert. Included in this was the trade-off between high-quality, large display and quick execution of decisions using slides verses the ease of editing and printing using digital photos.

**U7 Breakdowns:**

1. U7 told us that he wants software where each folder can hold photos with descriptions and descriptions without photos. So he can keep his references centralized and in order, even when some photos are not on his computer

2. “I have a piece of paper that tells me where I took most of the pictures so I can keep track of them...and put a name to them.” “...there are names of places and dates, and of people. I have to write these things down because otherwise you’re home and you have no idea where all these pictures came from.”

3. U7 was clearly irritated by how long it took Photoshop to load.

4. U7 uses lots of programs; it wasn’t clear if this was a problem or not. He has and uses both Photoshop Elements and CS2. “Elements is simpler but it doesn’t do as much.”

**U7 Insights:**

1. U7’s slides are in chronological order, grouped mostly by event.
2. U7’s negatives are in chronological order, one binder per year (or occasionally a several years in one binder), plus one binder for a specific person and one for a specific photo workshop.

3. Each page of negatives tagged; date, who’s in it, event, location.

4. Metrics for selecting photos:
   a. Sharpness
   b. Composition:
      i. “don’t have your subject with his nose up to the edge of the picture.”
      ii. Putting the horizon in the middle of a photo “makes the picture boring and quiet and serene. “
   c. Brightness
      i. Primarily cares if detail is lost because it’s too light or dark.
      Generally goes for lighter images
      ii. “I wonder if this one is too light. I’ll see if there’s any shadow where the cloth is folded or if it’s purely washed out.”
   d. When choosing a photo, it’s always a trade-off between these; it seems that composition tends to me more important than either of the other two, but if it’s not got enough detail in it then composition doesn’t matter.

5. U7 often takes 3 or 4 photos of the same thing but he only wants one.

6. During a trip every 6 or 7 days U7 transferred all images from his camera to one folder, labeled automatically by the camera, on a DVD using a portable DVD burner. He then wrote the location(s) those photos were from on the top of the DVD.

7. Comparing three photos from the trip of the same item: “Now I have to find which I like best, which will probably be the lighter one, so I don’t have to lighten the darker ones... and get rid of the other two; I don’t need them.”

8. Photos of grandchildren: “They don’t bother sending me a picture, they just email and it’s up to me to print it.”

9. U7 has a CD of photos of his granddaughter, ordered chronologically, that he’s constantly adding to – he gets new photos frequently.

10. U7 seems to keep all his photos on DVDs or CDs.

11. Capture NX; “I don’t use this, I use Photoshop.” used this “Because that’s what it’s in. I haven’t transferred it over to photoshop yet” “I only transfer over the ones I want.”

   a. U7 seems to have a very odd mental model about how images are stored and accessed on computers. He also spoke of deleting an image when he actually left it on the original DVD.
   b. Capture NX appears to auto-rotate images so that they are upright!
   c. “The histogram tells me if it’s too dark or too light and how to change it easily by moving the slides.”

12. U7 chose an image out of three of the same thing.

   a. U7 chose the one with the best composition based solely on the thumbnail, then opened it in Capture NX.
i. “I’m satisfied to look at these three pictures without opening them. ... Sometime I have to open them because they’re too dark or too light.”

ii. U7 can make decisions on photos very quickly
b. “This shows the sharpness and the detail here, so I can lighten it and not lose detail.”

c. U7 then opened Photoshop. He said he would use “get photo” to choose which ones he wants to transfer, but in reality Photoshop just imported all the images from the DVD automatically.

13. U7 talked about liking the decision process with physical slides better:
   a. It’s faster: “I can throw all the slides in a projector, go forward and backward, I like this one better, so the others are out. I just pull them out and throw them in the trash can.” “I put them in a projector, project them on a while, and make a decision by flipping through them, seeing how they look. I generally know what I’m looking for with what I took.”
   b. He also likes it because the projection is bigger and has higher quality.
   c. He likes the computer better for printing

14. “All I want to do is make [the image] what I saw, which of course the camera doesn’t take, unless you’re using film.”

15. It is hard to tell, but it appears that U7 goes through his photos, picks one and edits it, renames it, prints it if he wants to, saves it to a new disk, then goes back and picks out another one.
   a. When U7 prints out an image, he checks to see how it turned out and may go back to edit it more based on that. He recognizes the difference between the computer screen and the printed version.
   b. U7 re-names this particular image [location]_[date in mm-dd-yyyy format].
      i. “Travel photography I don’t need to put a name of the person. Where I am is all that’s important to me
      ii. If there’s another photo in the same location and date, then U7 appends the name with a descriptor of the image. If he knows the subject then he appends their name. If he only met them there, he appends their full name.

16. When U7 is done with the images in this file, he saves all the good ones that he selected, edited and re-named to a new DVD just of photos from that one folder (one or a couple locations)
   a. “When I’m done editing the images from this folder, I’ll end up with a CD of pictures just of [location]. It may be 5 pictures, it may be 50. And they’re there and I can print them any time I want.”

17. Depending on what’s going on with his friends, U7 may make a slide show of this part of his trip.
   a. U7 uses powerpoint for his digital slideshows because of the comment bar at the bottom.
   b. Choosing the photos for the slideshow is “storytelling”
Photoshop Elements:
1. Shows the name of the image tiny next to the scroll bar while scrolling.
2. Lets you “hide” a photo, so it’s not deleted but it doesn’t show up in the program. U7 says he hides photos, but we did not observe this.
3. “You can tag these. I haven’t gotten into it too deeply. I have with other pictures, not with these. I’m still trying to decide what I really want out of these.”
4. Photoshop Elements has a mode for editing a photo. It shows the photo before & after editing. It looks like it just supports quick fixes though.

Retrospective Account Breakdowns & Insights

R1 – Housewife

Summary:
One retrospective account of particular interest was with a housewife (R1). She was not that familiar with computers, but she showed us her photo albums and talked with us about a trip she went on. She used Target’s photo kiosk quite a bit to print out photographs to put into albums, using notes she took while on her trip to write about each photo. Her husband and she discussed all the photos taken, either at home or at the Target kiosk, before she printed them. She mostly shared pictures via her photo albums, but she also sent out a photo Christmas card every year, which her daughters asked not to be included on. Through her we learned a lot about co-ownership and social dynamics of photo sharing.

R1 Insights:
1. R1 only deletes images on the camera if it is a “total waste of a picture.” She is able to do this because the screen on their camera is big enough.
2. She keeps one currently shared photo album on the coffee table; She (the author) is the one who looks at it most frequently.
3. Her other albums are achieved away into the basement; if they (typically her and her daughters) go looking at them, they “can lose a whole day” reminiscing.
4. R1 goes to Target to print out large amounts of photos (eg: 120), but uses the photo printer at home to print out small amounts, for example to make another copy to send to someone. The photo printer hooks up directly to the camera.
5. She does triage and cropping on the Target system.
6. If R1 and her husband have not discussed the photos beforehand, they will both go to Target together to view and print them there. If, however, they browsed and discussed the photos beforehand, then R1 will go to Target alone and print them. But they always go through the photos together before making a decision – they share ownership of the photos.
7. R1 typically only shares her photos in person with photo albums or occasionally by mailing physical photos in a card. Usually she only mails a photo as her Christmas card to extended family. However, her daughters say “we’re too old to have our photos sent in Christmas cards”.

8. For her sister and brother who went on a trip with her, she made a CD (at Target) of all the photos from that trip.

9. R1 looks at photos she has received only on the computer; she does not print them out.

10. R1 keeps a journal while on trips to record notes that she later refers to while annotating the photo albums/scrapbooks of that trip. She says of writing things down that “you need to do it right away or you’re not going to do it.”

11. Documentation photos (eg: of building a pool at her house) do not go into an album but into an envelope in a drawer because “I won’t be looking at them.”

12. R1 does not want to put other people through slideshows as it “puts them to sleep.”

Note: all of our retrospective accounts informed our intuition, but many of them we did not record specific breakdowns or insights.
Appendix

e. Glossary of Terms

Methods

Contextual Inquiry
- Consists of an interviewer observing a participant while they do a task of interest the way they usually do in the place they normally do it.
- Gives the researchers information about what users actually do, as opposed to what they think they do.

Directed Storytelling
- Consists of an interviewer asking a participant to describe in detail the last time they performed a task, also known as a retrospective recall.
- Can be done anywhere and can gather data about infrequently performed tasks.

Journal Study
- Involves participants keeping a journal of certain activities of interest, with information such as when, why, and how they did it as well as other details.
- Can get data about intermittent activities and reveal changes in behavior over time.

Survey
- Can be used to gather information about large groups of people at the cost of the reliability and richness of the data collected.

Think-Aloud usability studies
- Involves a participant performing a task while talking aloud as if they were talking to themselves.
- This gets the most unadulterated information about what and how the user thinks.

Terms

Album
- A collection of snapshot photos.

Artistic photos
- Photos valued for their intrinsic aesthetic qualities only.

Attachment
- File sent in an email.

Authoring
- Creating a file or experience. For example, if a user has created a webpage with the intent of giving the people who visit that site a particular experience, they have ‘authored’ that experience.
Breakdown

- A failure in a system, process or interaction. Anything that frustrates, confuses, misleads, or hinders a user.

Download

- Transfer files from a website or email client to a computer or other device.

Gallery

- A collection of artistic, representative photos.

Import

- Transfer pictures from a camera or cell phone to a computer.

Organizational structure / organization

- The manner in which files/photos are organized on an individual’s computer; the file structure, folder and file names, any mirroring software or organizational software used, and when and how files are archived.

Metadata

- Information attached to a photo, such as file name, timestamp, where the photo is stored, GPS location, captions or descriptions, personal or public rating, tags or keywords.

Sharing

- Any form of communicating photos to another individual or group. Sharing includes emailing photos, uploading photos to a website that others can view, and showing photos to others who are physically there with you.

Snapshot photos

- Photos whose primary value lies not in the image itself but in the memory or people it records.

Story

- Any manner of communicating an experience including telling a story, describing an event, or talking about an individual or item. This includes representation of a person’s identity and communication of social status.

Synchronicity

- How dynamic and close to real-time an interaction is. In-person is synchronous, email is not.

Tagging

- Attaching keywords to a photo.

Triage

- The process of sorting through some items or people, usually by level of importance or quality.
- Photo triage is the decision making process involved in sorting through & organizing photos.
Upload

- Transfer files from a computer or other device to a website.
Appendix

f. Survey Results

1. Response rate of survey

415 / 420 - Accepted consent
5/ 420 - Denied to take survey.

2. What types of cameras have you used in the last twelve months? Select all that apply.
3. In the last twelve months, how frequently have you taken photos of the following?
4. What else have you taken photos of in the last twelve months?

<table>
<thead>
<tr>
<th>What else have you taken photos of in the last twelve months?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open-Ended Response</td>
</tr>
<tr>
<td>cars</td>
</tr>
<tr>
<td>Dancing</td>
</tr>
<tr>
<td>vacation.</td>
</tr>
<tr>
<td>sporting events (baseball games), concerts</td>
</tr>
<tr>
<td>Mainly, more than anything else, I use my camera to record information on paper. I consider it a very portable scanner.</td>
</tr>
<tr>
<td>adorable babies!</td>
</tr>
<tr>
<td>aeroplanes</td>
</tr>
<tr>
<td>things I needed to remember (upc symbol of something needing exchanged) on my cell phone camera</td>
</tr>
<tr>
<td>Food, public events.</td>
</tr>
<tr>
<td>apartments, interiors of hotels and function halls, amusement parks/Disney World</td>
</tr>
<tr>
<td>a sign that says 'free ham'</td>
</tr>
<tr>
<td>Food, table settings</td>
</tr>
<tr>
<td>I try to take pictures of funny things. My camera also records short videos, which is especially good for this</td>
</tr>
<tr>
<td>Traffic accidents</td>
</tr>
</tbody>
</table>
Text I wanted to read back later or wanted to show other people. I also took pictures of homework problems in the bookstore out of a textbook I had homework due out of which bought online but hadn't arrived yet.

- motorcycles I've ridden - my leg after surgery - my soccer team after our championship game

crowds of people sporting events

my boyfriend!

food

Teachers on 'Change your hair color' Day Rooms in a new house

Museum exhibits

Home

lab instruments/experiment apparatus

dress pattern, apartment for ad

By far the most photos I take are on hiking or backpacking trips; I'll take infrequent shots at home, more on holidays, but then large batches of mostly landscape scenes when on hiking trips.

PC Screens, Important Documents, Important references for design.

Food!

Flowers, objects

Office interiors, home interiors, beaches

Photos of design(UML dig., object dig., etc...) during the modeling day of the scrum methodology being followed in our project.

Performances
<table>
<thead>
<tr>
<th>Nature Closeups</th>
</tr>
</thead>
<tbody>
<tr>
<td>food--stuff I cook or meals at restaurants. Also, pictures of funny things (typos on signs, etc.) to send to friends.</td>
</tr>
<tr>
<td>people I don't know, famous people (for a magazine), individual plants (in greenhouses, gardens, etc), interiors (particularly at my house, but also in public buildings and other spaces), books and artworks (for documentation of things I've seen), stuffed animals (for kicks), the lunar eclipse...</td>
</tr>
<tr>
<td>Weather (almost to the exclusion of everything else), my desk at work, funny local signs, computer parts, meteorological instrumentation (as part of my research), text (in lieu of a photocopier).</td>
</tr>
<tr>
<td>things to put up for sale on craigslist... probably more than 12 months ago though</td>
</tr>
<tr>
<td>anything that worth taking a pic..</td>
</tr>
<tr>
<td>Birds, people, sky..</td>
</tr>
<tr>
<td>of the house</td>
</tr>
<tr>
<td>Like to capture some expression faces about their feeling.</td>
</tr>
<tr>
<td>boyfriend</td>
</tr>
<tr>
<td>The list above is very thorough, so nothing.</td>
</tr>
<tr>
<td>events</td>
</tr>
<tr>
<td>studio projects</td>
</tr>
<tr>
<td>Colors</td>
</tr>
<tr>
<td>What I take is more event-based, so for example in the last 12 months I've been to 2 weddings, 2 trips, many social events (so I took pictures of friends, but it wasn't because of them necessarily, but because I wanted to capture what happened... sometimes it's people I don't know, but they were still part of the event), and a lot of school-related assignments.</td>
</tr>
<tr>
<td>people i don't know...in places or events i want to document</td>
</tr>
</tbody>
</table>
I mainly take pictures of me, my friends, my family, vacations (landscapes + cityscapes), wildlife, my house and my pets. I took a photography class in which we had to pick a concentration to photograph...so then I took pictures of decay in an urban environment.

text that I encounter and want to remember/record. sometimes it's easier to take a picture than to copy something down with pen and paper.

whiteboards.

photos of my apartment to put on craigslist for subletting, event photography—decorations, crowd shots, guest speakers, etc., as well as photos of whiteboards and sketchbooks to capture progress

food, tropical beaches, underwater scenes, shows and events, dances

the inside of our home

I can't think of anything else...but I take a lot of photos.

sketches process

strangers. india. colorful airplanes. people acting stupid

everything

processes -- cooking, crafting, etc.

The items in number 3 refer to my trip to Africa

A lot of projects, and photos to be used in design projects--other people’s design work, environments to be used as references for design projects

funny signs or landmarks

motorcycles!

Drawings and illustrations, in lieu of scanning them because it's easiest and fastest to just take a picture. I did this occasionally.
<table>
<thead>
<tr>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>hotel room, food (raw, being cooked, and already prepared), documents &amp; print photos (for lack of a scanner!), books/bookcover (for book reviews), portraits (for magazine profiles), themes (ie find everything gay in china), prototypes and processes (for design class), apartment interiors (for reference while apartment shopping), interview pictures (for ethnographic research aka work) -- that's the top-of-mind stuff at the moment</td>
</tr>
<tr>
<td>drawings</td>
</tr>
<tr>
<td>people</td>
</tr>
<tr>
<td>My house (exterior/interior remodel) and yard</td>
</tr>
<tr>
<td>Art nudes in a studio, Motor racing</td>
</tr>
<tr>
<td>photos while traveling</td>
</tr>
<tr>
<td>whiteboards/chalkboards, rotting fruit, instruments, furniture, coffeeshops</td>
</tr>
<tr>
<td>sports</td>
</tr>
<tr>
<td>kids sporting events</td>
</tr>
<tr>
<td>documentation of car damage due to accident, samples of my jewelry, costumes and clothing I've made, fitting issues for clothing, photographic lesson plans for fabricating jewelry pieces</td>
</tr>
<tr>
<td>Theatrical Musicals</td>
</tr>
<tr>
<td>crowd, shadows, interesting lights, portraits</td>
</tr>
<tr>
<td>Views from aircraft windows</td>
</tr>
<tr>
<td>models (people)</td>
</tr>
<tr>
<td>Whiteboard sketches and notes, computer screens, my office, gray card</td>
</tr>
<tr>
<td>studio still life, products, models</td>
</tr>
<tr>
<td>specific prints for internet</td>
</tr>
<tr>
<td>Category</td>
</tr>
<tr>
<td>----------------------------------</td>
</tr>
<tr>
<td>travel</td>
</tr>
<tr>
<td>Vacation travel</td>
</tr>
<tr>
<td>Many of the photos that I've</td>
</tr>
<tr>
<td>taken in the Friends/co-workers</td>
</tr>
<tr>
<td>category above are really what I</td>
</tr>
<tr>
<td>'classify as 'sports photography'.</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Random people on the street</td>
</tr>
<tr>
<td>Weddings, paid portraits</td>
</tr>
<tr>
<td>I have been shooting sports and</td>
</tr>
<tr>
<td>portraits lately.</td>
</tr>
<tr>
<td>sports</td>
</tr>
<tr>
<td>Landmarks (think: Pyramids),</td>
</tr>
<tr>
<td>statues, flowers</td>
</tr>
<tr>
<td>Documented projects - home</td>
</tr>
<tr>
<td>renovation, whiteboards at work,</td>
</tr>
<tr>
<td>home inventory, etc.</td>
</tr>
<tr>
<td>Portrait sessions for models,</td>
</tr>
<tr>
<td>Glamour &amp; nudes</td>
</tr>
<tr>
<td>Ultimate Frisbee and other</td>
</tr>
<tr>
<td>sports.</td>
</tr>
<tr>
<td>flora</td>
</tr>
<tr>
<td>the Moon;</td>
</tr>
<tr>
<td>astronomical objects</td>
</tr>
<tr>
<td>bands/concerts</td>
</tr>
<tr>
<td>Shadows (which I differentiate</td>
</tr>
<tr>
<td>from patterns)</td>
</tr>
<tr>
<td>Sports</td>
</tr>
<tr>
<td>Events like workshops or symposiums</td>
</tr>
<tr>
<td>-----------------------------------</td>
</tr>
<tr>
<td>signs</td>
</tr>
<tr>
<td>Pictures of screen images of my laptop, because print screen wouldn't work there in that program.</td>
</tr>
<tr>
<td>Nothing else I could really think of...</td>
</tr>
<tr>
<td>Newspaper Coverage.</td>
</tr>
<tr>
<td>Life events</td>
</tr>
<tr>
<td>Events (not parties), cars, clouds, water</td>
</tr>
<tr>
<td>Youth sports</td>
</tr>
<tr>
<td>I like taking pictures of clouds and sunlight coming through trees. Also I take a lot of pictures of still and running water (lakes, seas, rivers, ponds...)</td>
</tr>
<tr>
<td>weather, musicians, people in costume</td>
</tr>
<tr>
<td>products, performances</td>
</tr>
<tr>
<td>Roses, BBshop Harmony Quartets &amp; Choruses</td>
</tr>
<tr>
<td>I shoot photos daily for newspaper reporting job-- mostly of people in meetings, politicians, interviewees, and public events.</td>
</tr>
<tr>
<td>demonstrations.</td>
</tr>
<tr>
<td>Furniture, sports, cars</td>
</tr>
<tr>
<td>to scan documents,</td>
</tr>
<tr>
<td>interiors of homes</td>
</tr>
<tr>
<td>dolls.</td>
</tr>
</tbody>
</table>
I am compiling typologies of various urban objects, such as chairs, garbage, the automotive infrastructure, etc.

<table>
<thead>
<tr>
<th>food, garden, children</th>
</tr>
</thead>
<tbody>
<tr>
<td>artwork</td>
</tr>
<tr>
<td>travel-related pictures, things around the house</td>
</tr>
<tr>
<td>everything that would hold still! I've been participating in a project to take self portraits every day for a year, so that makes my number of self portraits disproportionately large. I love nature shots (I live near the ocean so I take alot of sea creature shots) and often find myself as an impromptu event photographer.</td>
</tr>
<tr>
<td>boats, castles, interiors, agricultural animals, clothes, strangers, sculpture, lights, fruit, vegetables, earth, performances.</td>
</tr>
<tr>
<td>Local concerts/bands.</td>
</tr>
<tr>
<td>travel photography</td>
</tr>
<tr>
<td>Family and social occasions</td>
</tr>
<tr>
<td>human beings fashion related</td>
</tr>
<tr>
<td>friends, models, portraiture, flowers, architecture, events</td>
</tr>
<tr>
<td>abstract detail images</td>
</tr>
<tr>
<td>performers</td>
</tr>
<tr>
<td>Strangers</td>
</tr>
<tr>
<td>water, smoke, light (tho all could count as objects or patterns/designs), moon/stars, people i don't know/strangers (also, people i know, but am not friends/relatives/co-workers with)</td>
</tr>
<tr>
<td>as described in '3'</td>
</tr>
<tr>
<td>Just about everything.</td>
</tr>
<tr>
<td>You name it, I've taken it. Obsessed photographer.</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
</tr>
<tr>
<td>Indoor school play performances (rehearsals)</td>
</tr>
<tr>
<td>Interior shots: light falling through a window into a room.</td>
</tr>
</tbody>
</table>
5. In the last twelve months, how frequently have you done the following?
6. In the last twelve months, when have you imported your digital photos to your computer? Select all that apply.
7. In the last twelve months, when have you viewed your digital photos on your computer? Select all that apply.

![Bar chart showing frequency of viewing digital photos]

- Right after the event when I captured the photos
- When I had free time
- When I wanted to share photos
- When someone asked to see my photos
- When I had some other need for them
- When I was bored
- Others
- At the end of a fixed period

Number of respondents = 333
8. In the last twelve months, when have you managed your digital photos on your computer? Select all that apply.
9. In the last twelve months, how frequently have you used the following desktop applications to manage or view your digital photos?

![Bar chart showing usage frequency of various desktop applications for managing digital photos.](image-url)
10. If you used any other desktop applications to manage or view your digital photos in the last twelve months, please list them below.

11. In the last twelve months, how frequently have you used the following websites to manage or view your digital photos? (Note: we will ask about using them to share photos in a later question)
12. If you used any other websites to manage or view your digital photos in the last twelve months, please list them below.

Others: Smugmug, windows live journal, snapfish, Personal webpages, Pbase, Sony Image Station, webshots, shutterfly, myspace, Cyworld, Orkut, blogs
13. In the last twelve months, how frequently have you used the following types of annotation to help describe your photos?

- Very Frequently
- Frequently
- Occasionally
- Rarely
- Never
- N/A

![Bar chart showing frequency of annotation types](chart.png)
14. In the last twelve months, how many of your digital photos have you changed the file names of? (example; rename DSCN0846.JPG to "NYC_John_TimesSq")
15. If you have renamed photos, when did you change the names of your photos? Select all that apply.
16. In the last twelve months, when you organized or sorted your digital photos, how do you group them? Select all that apply.

![Bar chart showing the grouping methods used by respondents. The most common method is "By Event," followed by "By Date," "By activity," "By project," "By people in the photo," "Other," and "By the person who sent me the photo." The number of respondents is 324.]
17. In the last twelve months, what kind of Internet connection have you used while uploading and downloading digital photos?
18. In the last twelve months, in what ways have you shared your digital photos?
19. In the last twelve months, how frequently have you used the following websites to share your digital photos online? (note: we will ask about viewing other people's photos later)
20. If you used any other websites to share your digital photos in the last twelve months, please list them below.

Others: Snapfish, MSN spaces, .Mac, smugmug, personal website, blogs, istock,
21. In the last twelve months, when have you shared your digital photos? Select all that apply.

Others:

1. I try to post to Flickr once a day.
2. When I've finished editing them.
3. after a trip or event
4. After I've triaged and edited them
5. When I have pictures I think others would enjoy seeing.
6. If a picture is especially fine
7. after editing
8. when I have a good photo to share
9. Annual Christmas letter; Also, after events
10. when a project dictates it
11. part of a story, like show & tell
13. when something happens that reminds me of an event or a person and makes me want to share a particular photo, or when i've submitted photos for publication
14. I don't know how!
15. i don’t share photo over internet sites, only share thru email.
16. Don't remember sharing photos, but I occasionally email photos to people (may have been more than a year since I've done this) and I'll show photos to people on my computer.
17. When I think others want to see them only
22. In the last twelve months, why have you shared your digital photos with other people? Select all that apply.
23. In the last twelve months, how frequently have you shared the following kinds of digital photos with your family members?
24. In the last twelve months, how frequently have you shared the following kinds of digital photos with your friends?

![Bar chart showing frequency of sharing different kinds of digital photos.]

- Family events
- Other events
- Family trips
- Other trips
- Hobbies
- Family
- Daily life
25. In the last twelve months, how frequently have you shared the following sets of digital photos with another person at one time?
26. In the last twelve months, when have you viewed others' digital photos?
27. In the last twelve months, how frequently have you used the following websites to view others' digital photos online?
28. If you used any other websites to view others' digital photos in the last twelve months, please list them below.

Smugmug, Livejournal, Pbase, Blogs, Personal Websites, MSN Spaces, Imagestation, Snapfish.
29. In the last twelve months, when other people shared photos with you, which photos were you most interested in?
30. What is your age?
31. What is your gender?
32. What is your occupation?

Programmers,
Software Engineers,
Hardware Engineers,
Designers,
Photographers,
Scientists,
Marine biologists,
Students,
Teachers,
Writers/editors,
Sales Director,
Counselors,
Managers,
Architects,
Professors,
Artists,
Usability Specialists.
33. What is your living situation? Select all that apply.
34. Do you have children? Select all that apply.
35. Where are you located?

Iran 1
Israel 1
Ireland 1
Belgium 3
Korea 2
France 1
Germany 3
Singapore 1
Australia 1
Bahrain 2
Nepal 1
UAE 1
36. Please rate your comfort level and knowledgeability in digital photography.
Appendix

g. Insight Models

Triage Types
Triage Influences

Audience
- Relationship
- Geographical proximity
- Involvement in photo
- Knowledge of photo-context

Communication Medium
- Synchronicity
- Frequency of use
- Effort required
- Modality
- Bandwidth

Organizational Structure
- Interface
- Usability
- Interaction
- Adherence
- Multiple structures
- Type of structure

Photograph
- Recency
- Rarity
- Quality
- Context
- Content
- Input/Output
- Quantity

Triager

Time
- Time available
- Intermitency
Sharing Synchronicity