STORYTELLING FOR DIGITAL PHOTOGRAPHS: SUPPORTING THE PRACTICE, UNDERSTANDING THE BENEFIT

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Brian M. Landry

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STORYTELLING FOR DIGITAL PHOTOGRAPHS: SUPPORTING THE PRACTICE, UNDERSTANDING THE BENEFIT

Approved by:

Mark Guzdial, Committee Chair
College of Computing
Georgia Institute of Technology

Gregory D. Abowd
College of Computing
Georgia Institute of Technology

Elizabeth Mynatt
College of Computing
Georgia Institute of Technology

John C. Thomas
IBM T. J. Watson Research Center

Michael Smith
Centre for Information
Communications Technology
University of Trinidad and Tobago

Date Approved: August 17, 2009

To Dad and Jeanine,

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Your dedication to education will live on within me.

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SUMMARY

The emergence of digital capture and editing technologies make providing a more detailed and coherent description of the experiences depicted in photos possible. Through the combination of photos, music and voice, people can compose digital stories of their life experiences. However, communicating an experience using photos to people who do not share the experience, and are not co-located is a difficult endeavor, even with effective digital editing tools.

In this dissertation, I studied the online photo communication challenges that have arisen as a result of the transition from film to digital photography. I detail my studies of consumer desires and barriers related to online photo communication. Also, I present the design and user evaluation of the Storytellr system, which addresses those desires and barriers. The Storytellr system integrates storytelling activities with traditional photo activities to reduce the challenges of online photo communication.

Through this work I contribute to the understanding of the challenges encountered by consumers who desire to engage in sharing life stories through photos over distance. I also contribute a method – integrating storytelling activities into photo activities – for enabling people to overcome those challenges using a process they find satisfying, and that produces an outcome that satisfies authors and viewers alike.

CHAPTER I

INTRODUCTION

In the past decade the world has witnessed and experienced the revolutionary transition of consumer photography from film to digital media. This fundamental shift in photography from film to digital has significantly changed the way in which we archive our life experiences, as well as the way we interact with those archives. A recent report by the NPD Group market research firm states digital camera penetration has reached 76% in American households [61]. A study conducted in 2003 by the Pew Internet and America Life project found a sizable segment (44%) of the American population shared content online which included digital photographs (21%)[40]. These percentages may seem small at first glance, however; when considering the size of the American population, close to 60 million people are sharing photos online. Increasingly, life experiences are documented using digital media, whether converted to digital or digitally produced. While digitizing the records of our life experiences provides new possibilities for interaction and sharing, it also introduces some challenges.

While digital photography offers benefits, such as instant photo review and increased storage, digital photography has required consumers to adapt their photo practices to the constraints imposed by the digital world. For example, instead of dropping a roll of film off at the nearest development center for processing, consumers are tasked with acquiring the skills to "develop" the photos themselves. The photo development process has shifted from a commercial service to a consumer task. Currently, consumers must learn how to connect a digital camera to a computer to

download their photos. Furthermore, to obtain a tangible photo from the digital version, the consumer must purchase special paper and a photo printer, in addition to learning the art of adjusting the photo properties (*e.g.,* brightness, contrast, etc.) to achieve a desirable printed photo. While the shift to digital photography has made new ways of sharing and using photographs possible, some traditional photo activities either remain arduous (*e.g.,* organization and management) or left behind (*e.g.* rich communication or storytelling in the context of photos).

In particular, one advantage of digital photography is the ability to distribute photos to many people at once, in different places around the world. Whereas print photos required consumers to order duplicates and send them by mail, email and digital photo sharing websites allow consumers to distribute albums of photos to an array of people in varying locations. The ease with which consumers can share provides distant relatives and friends with the opportunity to gain insight into the lives of one another. However, this same benefit, is fraught with challenges. Vast storage combined with instant photo review has resulted in less discriminate photography. The film and development costs associated with film photography encouraged consumers to carefully consider what shots were worth capturing.

Today, people take many more photos of events in general because they can. Unfortunately, comprehensive photo-taking exacerbates the already difficult processes of organizing and managing personal and family photo archives. Comprehensive capture of events requires more time and effort to record event details for each photo (*e.g.,* titles, captions, tags, etc.), and organize the photos into collections. Furthermore, comprehensive photography can translate into comprehensive photo sharing. Comprehensive online photo sharing can turn the benefit of remote asynchronous sharing into a viewing burden – similar to that of watching the oft disdained vacation slideshow. Rather than provide a descriptive, interesting and succinct presentation of an experience, consumers risk presenting non-descriptive, boring and lengthy viewing

experiences. It is much easier to share a large set of photos as is, than to prune, edit, and tag. Though the visual representations of the experience are shared, the stories typically associated with collocated photo sharing are largely absent in the non-collocated case.

In a study of collocated communication around photos, Frohlich *et al.* documented "reminiscing talk" — the act of recounting an experience with people who were present — as a typical and natural process for telling stories using photographs [26]. Reminiscent talk tends to occur between people who share the experience documented by the photographs. However, conversations around photos with people who were not a part of the documented experience shifts to one of communicating or describing the experience vs. reliving the experience. While these types of interactions around photos are common in person, this type of exchange occurs far less between people separated by distance, especially where an asynchronous mode of communication is used (*e.g.,* email or photo sharing website). I believe technology can play a role in lowering the barriers to online photo communication while improving viewing experiences.

Digital photo capture and editing technologies make providing more detailed and coherent accounts of experiences possible. Through the combination of photos, music and voice, people can compose digital stories of their experiences. However, communicating an experience using photos to people who do not share the experience and are not co-located is a difficult endeavor, even with effective digital editing tools. Essentially the person who wishes to share their experience must make a number of non-trivial decisions. The person must decide the following:

- which presentation type to use (*e.g.,* movie, slideshow, photo album),

- whom the audience includes,

- the interests of the audience,

- which media (*e.g.,* which specific pictures) to include in the presentation,

- what to share about that experience using the medium and media,

- how to compose the various media into an informative and entertaining experience.

For example, if a person chooses to post photos on a photo hosting website (*e.g.,* Flickr ™) the user must consider who would be interested in the content and who is the appropriate audience for the content. The person must also decide what photos from the total collection should be shared online (in some cases all of the local collection are posted online). Based on the audience and photos selected, the user must set the viewing permissions of the photos appropriately. Most (if not all) photo sharing websites provide users with the option of sharing details of the experience captured by the photo using titles, captions and tags. Lastly, the photo album software creates an album for the user, which can be shared with the intended audience. Typically, the album provides a set of thumbnails as an overview of the collection. The thumbnails can be clicked to obtain a high resolution view of the photo along with the metadata that has been associated with the photo. The option to view the collection as a slideshow often is provided as well. In the case of photo albums, the composition of the photos into a final artifact is handled by the software.

While titles, captions and tags provide some context, much of the detail, expression and emotion embedded in the co-located synchronous experience is lost in the non-collocated, asynchronous case (particularly in photo albums). Movies can reclaim some of the rich experience usually lost when sharing over distance. Though the rich interaction that occurs in real-time may not be possible in this form, it is possible to enrich the sharing of details and stories through voice and music. While consumer-focused movie editing tools (*e.g.,* Adobe Premiere Elements[1] and iMovie[2])

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[1] http://www.adobe.com/products/premiereel/
[2] http://www.apple.com/ilife/imovie/

provide the capability to include expression through music and voice, the construction of movies remains a difficult proposition for the average consumer. In the photo album example above, the user provides only the media and information about the experience and the software handles the authoring of the photo album. Movie editing tools neither provide automation, nor support for the activities required to create an informative and effective movie. While photo albums are technically easier to author, I believe opportunities exist to lower the barrier of entry to producing the stories of our lives in movie format. As a result, this thesis explores what support is needed for remote asynchronous communication about personal experiences using photos, and how that support might be provided by technology.

In this thesis, I explore the online photo communication challenges that arise as a result of the digital revolution of consumer photography. I detail my studies of consumer desires and barriers related to online photo communication. Also, I present the designs and user evaluations of two interactive systems (iTell and Storytellr), from which I derived guidelines for designing tools for asynchronous online photo communication. Through this work, I contribute to the understanding of the challenges encountered by consumers who desire to engage in sharing life stories through photos over distance, and what types of support can enable to overcome those challenges. Commercially, there is no shortage of tools and services for sharing personal photos and video online. However, do these tools and services allow their users to overcome distance and effectively communicate with others through their personal media? I have engaged in a set of diverse activities aimed at understanding the challenges posed by remote asynchronous communication with digital photos, developing solutions to help users overcome them. I used a mix of qualitative and quantitative methods to develop a rounded understanding of the issues present. Based on that understanding, I generated design requirements and employed an iterative system-building approach to develop two fully functional media authoring systems. Through

an in situ evaluation of authentic use of each system, I developed a set of guidelines as recommendations to designers of media authoring technologies for consumers.

1.1 Eliciting the Challenges

1.1.1 Studying Digital Storytelling in Situ

To determine the challenges and how remote asynchronous communication with photos could be supported, I observed a workshop which teaches the process of communicating personal experiences through digital photos and other media which can then be shared in a remote asynchronous mode. I sought to understand the challenges associated with communicating through digital media by observing a workshop provided by the Center for Digital Storytelling. The Center for Digital Storytelling (CDS) is located in Berkeley, CA, but holds workshops across the U.S. and abroad aimed at teaching everyday people how to tell stories about their personal experiences using their own digital photographs and video. An example of the type of story produced in the CDS workshop and the type of story I aspire to support is embodied in the following example created in the workshop. Consider the following excerpt from the personal digital narrative MOMNOTMOM [56]:

> There's a picture of my mother that I always keep with me. It's a curious photo, because in most photos, I always imagine that people pose for the future, but in this time [pause], this moment [pause], this photograph [pause], I feel like my mom is searching for her past.

MOMNOTMOM relates the author's desire to know her mother in the roles prior to her birth. The story explores guilt the author experiences over the loss she thinks all mothers experience by having children. The author's images and video are set to music and synchronized with a voiceover creating an engaging presentation of her personal experience. MOMNOTMOM begins tightly focused on an image of a young lady gazing into a distant scenic landscape. As the author speaks, a guitar plays softly

in the background and the view slowly zooms past the young lady into the landscape. The narration continues with the author affectionately describing her mother, the various roles she has played, and those she continues to play (*i.e.* girl, young woman, doctor, wife and mother). The author uses an expressive photograph to depict her mother in each role. In the case of wife, she uses a video clip instead.

The story concludes: "It's hard to imagine my mother as her own woman, but I think she is beginning to." MOMNOTMOM presents the meaning found in a series of the author's personal experiences through retrospective reflection. The digital artifacts (*i.e.* photos, video, audio, etc.) used to illustrate the story bring this meaning to life for the viewer. It communicates multiple personal experiences of the author unified by the realization that her mother is reclaiming her identity as a woman.

The story presented above can be described as a plot-driven, retrospective narrative which intends to communicate a point. One of the primary observations I made at the CDS was that finding a structure by which to communicate an experience is key. CDS used plot-driven storytelling as a compelling means of conveying personal experiences. In addition to relaying experiences to others not present, storytelling encourages introspection affording storytellers the opportunity to derive meaning from their experiences [44].

While the level of storytelling support CDS provides seems ideal, I will show evidence that suggests reaching the level of refinement exhibited by CDS stories may not be necessary or desired . My goal is to initiate a research trajectory towards supporting communication via storytelling through interactive systems. My intention is to lower the barrier to producing photo-based presentations that communicate the details of a personal experience in addition to visually describing the experience. I use storytelling as a communication vehicle because provides a structure around which to base support for remote asynchronous communication.

In MOMNOTMOM, the author is reflecting on an experience and communicating that experience through representative photographs and other supporting media. I am interested in this particular type of storytelling, as opposed to other forms, such as slideshows offered by personal media management tools (*e.g.* iPhoto and Adobe Photoshop Album). I do not discount the importance of other forms; rather, I believe digital narratives are engaging, and have benefits to author and audience beyond communication (*e.g.* emotionally and psychologically [49]). Personal digital stories like MOMNOTMOM tend to capture noteworthy moments in a persons life. Digital media allow us to convey those moments visually through personal images and video and aurally through the individuality of voice and music. Through the development of personal narratives, experiences are made meaningful [44]. While personal digital narrative construction has a number of advantages, it requires more attention to writing and more technical skill.

While studying the CDS process, I observed the need for a great deal of proficiency in multiple areas (*e.g.* photo editing, audio recording, video composition, writing) to produce a well executed story in the digital medium. The CDS approach is professional in nature (*e.g.* like that of a moviemaker). They focus on combining various media to communicate a message and teach everyday people to engage in this process. Studying the CDS process enabled me to learn about the challenges of creating digital narratives and what strategies can help mitigate those challenges.

1.1.2 Studying Authoring Challenges and Desires

While much is known about sharing photos in person, less is know about sharing photos online, in particular how the experience is impacted by distance and time (or asynchronous sharing). Many researchers have studied synchronous, collocated print and digital photo sharing (*e.g.,* [26, 10]); however, fewer have explored how people communicate about experiences captured in photos in the online, or remote

asynchronous case.

I explored the author-viewer relationship and the challenges each encounter when interacting through photos online. Also, I explored the barriers to sharing the stories represented by photos posted online and discuss the need for striking a balance between creator effort and recipient satisfaction. I surveyed and interviewed people about their preferences for online photo viewing and posting, as well as the challenges they face when sharing experiences with photos online.

Through the survey responses, I learned there is room for improvement in the viewing experience, particularly through plot as a storytelling device in photo albums. Creators do desire to create stories with their photos, but refrain from doing so. I found some reasons include lack of confidence and limited storytelling skills. In the next section, we discuss the results of our interviews to further explore the factors (*e.g.,* time, effort and recipient design) that impact communication with photos online.

The interviews underscored the importance of providing contextual details about an experience to non-collocated recipients. However, providing detail comes at the expense of time and effort on the part of the creator. Consequently, I decided to explore improving the process of communicating details of an experience through storytelling. Storytelling was reported as challenging in terms of narrative construction and media production. As a result, I explored techniques for supporting narrative composition in software based on lessons learned from CDS and written composition theories.

1.2 Designing Asynchronous Photo Storytelling Systems
1.2.1 iTell

My initial approach to creating the authoring tool iTell [38] involved embedding the strategies used in the CDS workshops within a storytelling software system. I identified three fundamental digital narrative composition activities which are not

supported by current tools: *story development, process management and collaboration* [39]. I developed iTell to address the first two of these concerns. To address the first concern, story development, I drew upon writing education research. We can explore studies of writing composition strategies to gain insight into supporting media composition strategies.

Bereiter and Scardamalia [13] provided a set of strategies for helping novice writers engage in writing more like professionals. I combined the process of the CDS workshops with two strategies in particular — procedural facilitation and goal concretization. Procedural facilitation involves creating support that "(1) provide cues or routines for switching into and out of new regulatory mechanisms while keeping the executive process intact and (2) minimize the resource demands of the newly added self-regulatory mechanisms." In essence, Bereiter and Scardamalia suggest using supports which help novices negotiate writing the way professionals do without those supports overburdening an already challenging process. Goal concretization involves providing goals which encourage "low road" thinkers to engage in "high road" thinking. Simply, goal concretization aims to encourage composers to engage in forward and backward analysis of their writing, as opposed to an only forward-looking approach. For example, a "high road" thinker would reconsider written text in light of new text and make modifications accordingly. A "low road" thinker would continually move forward with producing text without any consideration of how the new text impacts the previous text and final outcome. iTell provided supports (*e.g.,* prompts and concrete goals) to help users navigate the story authoring process and create stories about personal experiences.

While modeling the design of iTell on the CDS process and writing supports enabled users to successfully create personal stories, I found users had developed their own set of media practices which did not mesh well with the activities common in professional practice. It seemed that a balance between (1) adhering to the advice of

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successful digital storytellers and (2) leveraging practices that have developed around digital photographs was necessary. This observation led to the development of a new story authoring system. I sought to support users through the process of creating cohesive stories from their photo collections by situating tenets of storytelling practices within common photo activities. bThese storytelling activities included: eliciting the interesting aspects of their experiences, development of a plot, and the effective use of media to present the plot. The typical user activities I integrated with storytelling practices included: photo tagging, photo search, and media composition.

1.2.2   Storytellr

Storytellr is a story authoring application which integrates storytelling activities with common photo activities. Storytellr is a third-party Flickr application which leverages the storage and tagging systems of Flickr, while providing an alternative interface for uploading images and support for creating retrospective stories. Again procedural facilitation and goal concretization are implemented to provide users with support through the story authoring process.

The Storytellr interface comprises three distinct phases — tagging, search, and composition. The tagging phase prompts users, using a set of questions, to generate tags for their photos, which will be used for making sense of experiences in the search phase. The composition phase engages the user in the construction of their retrospective story. By providing users with supports, I hypothesized users would create stories which would resemble knowledge transforming outcomes versus knowledge telling outcomes. Bereiter and Scardamalia state knowledge tellers use cues such as intended genre or topic matter to retrieve information from memory, and then include the retrieved information as part of the final work. In contrast, knowledge transformers go beyond using memory cues to problem solving. Knowledge transformers engage in iterative resolution of their belief and understanding of a topic as they write. Also,

they iteratively work to resolve rhetorical issues to reach the goal of the composition. Thus, I suspected users who engage with the supports provided in Storytellr would use a knowledge transforming process rather than the knowledge telling process. To determine this, I conducted a laboratory user evaluation of Storytellr. In the next section, I discuss the specific questions I answered with the Storytellr evaluation. In the following section, I conclude this chapter with contributions of this thesis and a roadmap for the rest of this document.

1.3   Research Questions and Thesis Statement

In an article summarizing his speech at the 2006 International Consumer Electronics Show, Chairman and CEO of Eastman Kodak, Antonio M. Perez, stated, "digital products and services should not require our customers to be engineers or professional photographers, but rather, should inspire them to be artists and publishers as they capture the moments of their lives, as they see them, with intuitive ease" [34]. He goes on to say "consumers want the power to use their images to connect, create, preserve, entertain and inform." To that end, Kodak is committed to reinventing the digital imaging experience by bringing ease-of-use to the next level. I argue that moving to the next level involves a transition from ease of capture to ease of expression. Supporting story creation is one means for providing people with the power of expression. As a result, this thesis will seek to understand how to help users transition to the "next-level" of creating stories to help them connect, entertain, and inform people using their media. In particular, this thesis will address the following research questions (RQ):

- RQ1: What are people's desires regarding the creation and viewing of personal photo stories?

- RQ2: Can integrating storytelling with common photo activities promote knowledge transforming?

- RQ3: Can integrating storytelling with common photo activities lead to a satisfying authoring experience?

- RQ4: Can integrating storytelling with common photo activities lead to outcomes satisfying to the author?

- RQ5: Can integrating storytelling with common photo activities lead to outcomes satisfying to the viewer?

The following thesis statement summarizes the contributions of this thesis:

Using procedural facilitation and goal concretization to situate storytelling activities within common photo activities (1) leads users to engage in knowledge-transforming processes when storytelling, which (2) produces stories satisfying to the author, (3) satisfying to viewers, (4) using a process the author finds satisfying overall.

1.4 Contributions & Overview of Dissertation

This thesis makes several contributions to the body of knowledge in the area of computer-mediated communication. First, I have uncovered some of the barriers which prevent people from engaging in asynchronous storytelling with photos. Second, through the design and evaluation of two photo story authoring systems, I have developed a viable system for supporting asynchronous storytelling with digital photos. I have shown combining common photo activities with supports for storytelling can lead people to engage in knowledge transforming behaviors when storytelling (RQ2); however, the supports must be used as intended. In some cases, participants even developed plot-based stories. Lastly, I have shown the process by which users created their stories was not only satisfying to those users (RQ3), but the stories created were satisfying to the author (RQ4) and viewer (RQ5) alike. Authors found the process challenging at times, but reasonable in terms of time and effort.

The rest of the document is organized as follows. Chapter 2 provides a review of the literature available concerning common digital photo activities, in particular works that focus on understanding and supporting these activities. Chapter 2 will also provide additional motivation for this thesis in the context of prior research. Chapter 3 presents my exploration of author and viewer desires concerning asynchronous photo storytelling (RQ1). Chapter 4 continues with my study of asynchronous photo storytelling in digital storytelling workshops, which unearths challenges and potential solutions to problems encountered during storytelling. Chapter 4 goes on to detail the design of iTell to address the barriers to storytelling and concludes with reflections based on an evaluation of iTell. Chapter 5 builds on the lessons learned through the evaluation of iTell to present a new approach to designing asynchronous story authoring tools: using procedural facilitation and goal concretization to situate storytelling activities within common photo activities. This approach is detailed in a discussion of the design of the Storytellr system. Chapter 6 presents my methodology for evaluating storytelling and the results of the evaluation. Chapter 7 presents design guidelines for asynchronous story system design and concludes this dissertation with a discussion of future work.

CHAPTER II

BACKGROUND AND MOTIVATION

The literature on supporting personal digital media activities covers a range of topics including: editing, tagging, viewing and sharing. Despite its benefits and the role it plays in society, storytelling with personal digital media has received less attention. In this chapter, I will explore prior work in the photo activity domain to frame my work on asynchronous photo communication through storytelling. Also, I will provide a brief overview of work which demonstrates the benefits of storytelling with media (including digital photos). Finally, I will summarize a set of strategies for authoring stories that inform my approach to supporting storytelling.

2.1 Studies of Consumer Photo Practices

The photo practices of consumers provide a context in which to study how asynchronous photo communication can be supported. I will review these practices as discussed in prior work and summarize at the end of each section the applicability of these works to mine.

2.1.1 Management

I use the term management to represent the set of photo activities including development/downloading, editing, triaging, organizing and labeling. Researchers have studied these activities in both print and digital photography. These activities provide a lens onto how everyday people engage with photography, and thus suggest design implications for new photo applications.

Richard Chalfen provided one of the earlier (if not earliest) accounts of consumer

photography practices [15]. He studied the use of photography to document life experiences among the consumer demographic he refers to as the Kodak Culture. His musings on the topic illuminated the conditions under which people take photos. He found people tend to take photos at points of life transition (*e.g.,* births, adulthood) and at events marking accomplishments (*e.g.,* graduations). He also discussed the conditions under which people tend not to take photos (*e.g.,* death of loved ones). His work spanned the gamut from the awkward pressure to pose felt by the photographed, to the experience of photo exhibition events (the good and the bad). He detailed the organization of photo albums and how content was chosen for the album. In a particularly relevant finding, he discovered few, if any, attempts to sequence photos to create any kind of storyline or plot. He suggests people do the actual storytelling, not the photos. Many of these behaviors have persisted in the digital photo culture. However, the digital revolution has introduced some new challenges. Digital technologies (*e.g.,* digital cameras, cameraphones, and social media services) make capture and distribution of digital photos significantly easier than capture and distribution of print photos. While these advances bring people closer through media, they also fall short regarding storytelling. This thesis aims to address this shortcoming.

Rodden and Wood uncovered the photo management practices of consumers as they transitioned from print to digital photography [51]. They found only simple features for browsing and managing photos (*e.g.,* chronological photo sort and displaying a large number of thumbnails) were necessary for digital photo management. They also determined free text search was unnecessary. Their partcipants typically found photos through browsing. This was also confirmed by Kirk *et al.* [33]. More recently, Kirk *et al.* conducted a study of the digital photo workflow of consumer households, which documented the practices of people after photo capture, but prior to use [33]. They discussed photo activities including downloading, organizing, editing, and sorting. These activities comprise a mixture of tasks from print photography and new

tasks introduced by digital photography. While this work helps my understanding of how users manage their photos, they do not tell us about the creation and sharing processes of users. However, it does provide implications for tools focused on photo sharing. In particular, they suggest people may be most willing to carry out extensive work just prior to sharing. My work complements this work by exploring how people are sharing their photos online once they reach the end of the photowork pipeline. Furthermore, it leverages the willingness of users to make a significant effort when sharing by providing appropriate storytelling supports.

During the age of print, labeling photos with dates, persons pictured and ages were common activities. The social software and user-created content movements presented users with mechanisms for labeling their photos, tags, which could be shared and searched. Despite the benefits of tagging (*e.g.,* better search, cues for reflection), it is difficult to motivate users to tag photos. Ames and Naaman studied motivations of people that do annotate photos on Flickr and their mobile photo tagging software ZoneTag [1] [7]. They classified motivations for tag creation along two dimensions: function (organization and communication) and sociality (self and social). Implications of this work include providing multiple functions for created tags, and providing relevant tag suggestions. In summary, people engage in a variety of activities to manage their photos for future use. Technologies which support photo management activities need not be advanced, but simple, flexible and based on the practices of users. Photo management has history dating back to the introduction of the first camera intended for consumers. The works above suggest minimal interfaces that provide benefit commensurate with the effort required. Furthermore, users are more likely to expend effort in the pursuit of sharing. I leverage this behavior, and the other management activities I have discussed above in this thesis to support storytelling.

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[1] http://zonetag.research.yahoo.com/

Figure 1: Time Space Matrix

2.1.2 Sharing and Communicating

Photographs are taken for many reasons. Some photos are meant to archive a particular experience, while others are used as a means to sustain awareness among distant relatives and friends. Recent efforts have explored how technology can further enhance collocated photo viewing experiences, photo sharing, and asynchronous photo communication.

Frohlich *et al.* engaged in one of the earlier studies in the Computer-Supported Cooperative Work (CSCW) community on photo sharing [26]. They explored the print and digital photo practices of families and prescribed a set of requirements for what is now referred to as *photoware*. Photoware refers to technologies designed to support photo activities which occur across time and space. Frohlich *et al.* adapted the time/space matrix [22] to describe current and needed support for interactions around photos. The time/space matrix classifies groupware interactions along two dimensions: time (synchronous or asynchronous) and distance (collocated or remote) (See Figure 1).

Collocated asynchronous photo sharing was one aspect of this exploration. Besides the recent popularity of digital photo frames and photo display on flat panel

televisions, innovations in photo display in the home have remained stagnant. Swan and Taylor have explored this domain through their work on photo display [57]. Swan and Taylor studied the display of photos in the homes of families and enumerated "properties of display" to consider when designing photo displays for the home. They discuss design concepts as examples uses of their properties.

Crabtree *et al.* expanded the community's understanding of *photoware* with their study of the interactions that take place during collocated photo sharing [18]. They used studies of collocated synchronous photo sharing in groups to derive requirements for sharing with groups of non-collocated people. I take a different approach to a similar problem. Rather than study collocated group photo sharing to develop requirements for non-collocated sharing, I studied the level of satisfaction with current methods for presenting personal experiences through photos. I also studied people's creation and non-collocated sharing practices to learn about the difficulties they encounter. From this understanding, I developed tools to support communication over distance and time.

Miller and Edwards conducted a study of online photo sharing on Flickr [46]. They discovered a dichotomy of users — Kodak Culture and Snaprs — the former whose practices were not well supported. They reported disparities between the features of flickr and the practices of the Kodak Culture. In particular, they point out flickr's focus on tag-based search as opposed to more relevant activities, such as telling stories about an experience. In this thesis, I probe deeper into the communication challenges posed by online photo sharing and develop systems to support asynchronous photo-based communication.

2.2 Photoware: Systems Supporting Photo Practices

2.2.1 Post-Capture Management

Post capture management tools tend to revolve around annotation (labeling photos with metadata) to provide multiple methods for browsing and searching photos. From automated to manual generation of metadata, researchers have explored many methods for tagging photos. For example, the FotoFile [36] system combines automated and manual annotation by supporting feature extraction (*e.g.* faces) and bulk annotation respectively. Abowd *et al.* also combined automated and manual techniques along with zooming interfaces to improve browsing and annotation of large video collections [5]. Other researchers have also used interactive means for labeling images with useful information. Von Ahn and Dabbish harnessed human effort by casting the process of photo annotation as an online game [60].

2.2.2 Post-Capture Sharing

Much of the research in the HCI community on photosharing has focused on collocated, synchronous photo sharing. For example, Balabanovic *et al.* extended the common practice of storytelling around print photos to digital photos [10]. While their work supported ad-hoc storytelling around digital photographs, it focused less on how a user might provide a similar storytelling experience for a remote audience. Frohlich *et al.* identified the need for supporting asynchronous photo sharing with a remote audience through a study of the use of digital and print photos within a family context [26]. My work on supporting personal storytelling through digital media attempts to provide people with the option to share their experiences with non-collocated audiences.

The Multimedia community has explored the development of authoring tools for multimedia documents and presentations [9, 25]. However, much of the research has

focused on supporting professional authors and screenwriters in composing with digital media. Our work differs in our concern with supporting novices in the multimedia composition process. Multimedia-authoring tools assume a writing and video production competency typically found in professionals. Our focus is on supporting people lacking the domain and technical experience to engage in digital storytelling. Commercial video editing tools (*e.g.,* Apple iMovie, Microsoft Windows Movie Maker) also make a similar assumption. While they support movie production and in some cases provide a simple interaction experience, many tools target professionals or assume proficiency in screenwriting and video production.

Many commercial photo management tools (*e.g.* Apple iPhoto, Adobe Photoshop Album [1]) support creating digital artifacts from personal media to share experiences with others. These tools typically focus on packaging the media in some form (*e.g.* email with attachments, website, slideshow) and less on communicating an experience or storytelling using the photos. We recognize the value of allowing people to create and share artifacts including their personal media; however, we hope to bring effective asynchronous communitcation into the reach of everyday people. This thesis aims to support people with communicating their personal experiences through digital images through storytelling.

2.3 Supporting Asynchronous Photo Communication via Storytelling: Benefits and Strategies

Humans commonly communicate through storytelling. Some researchers have uncovered the power of digital storytelling in educational and social domains. Others have focused on the development of multimedia story authoring tools. I explore works from both of these to demonstrate the benefit of storytelling, and discuss storytelling strategies I employ in this work.

2.3.1 Benefits

The following works represent examples of digital storytelling in use. In each instance, human support was readily available. I seek to understand what level of support software can provide in the absence of human support. While studying middle school students in an after-school program engaging in the practice of digital storytelling, Davis discovered that the construction of personal narratives in the digital medium could be used as a tool for personal development [19]. As the students recalled the life-changing experiences they would share in their stories, they arrived at better understandings of themselves.

Ellis and Bruckman used storytelling through digital media in the Palaver Tree project to support history education [23]. Students contributed oral histories in digital form to an oral history database, which in the process connected generations of a family around that family's history. However, the stories created by students in this work were not personal and were not presented in video form. Similarly, Banaszewski used storytelling in the classroom to engage reluctant writers [11].

Mazalek *et al.* recognized the ability of digital storytelling to provide a social and collaborative experience and leveraged a tangible computing technology to support communal exploration and development of digital stories [45]. Balabanovic *et al.* extended to digital photos the common practice of storytelling around print photos [10]. While their work supported ad-hoc storytelling around digital photographs, we focus on supporting retrospective stories of life altering events illustrated by personal digital media. In both cases, the technologies support the sharing of personal experiences with a relevant audience.

2.3.2 Strategies and Support

While storytelling with photos is my primary concern, exploring the general process of storytelling provides guidelines for story development. In this section I will briefly

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explore tools (digital and non-digital) that support the story development process.

Bailey *et al.* used digital storytelling in a school setting to promote technology and character education [8]. By creating animated vignettes (or short stories) presenting situations involving moral and social issues, students learned to use technology and develop moral character in the process. An explicit writing activity was supported to encourage students to write a story. Although this work supports telling digital stories, the students stories were fictional and they created the visual content during the authoring process. In contrast, retrospective digital stories present personal experiences using content typically captured prior to the authoring process.

In the commercial domain, Dramatica provides story development support for various genres of writing (*e.g.* novels, screenwriting, etc.) by providing the user with tools for defining their story elements (*e.g.* plot, characters)[14]. Dramatica and tools like it emphasize taking a structured and planned approach to developing a story and writing it. Dramatica supports the user by providing various forms for the writer to complete to help with organizing and laying out the elements of the story. Dramatica belongs to a larger class of writing tools that are traditionally designed for professionals or at the least proficient amateurs. While this class of tools assists writers with developing and conveying their ideas, it does not guide the user past writing into designing the visual portion of a story. This thesis will present our approach to supporting novice storytellers through the writing and media production processes.

In addition to tools that assist story writers, a number of professional screenwriters and moviemakers have written books about the process of writing for a visual medium. Howard and Mabley suggest the key to good storytelling is "telling exciting stories about exciting people in an exciting form" [30]. To do this, they suggest common techniques such as introducing a protagonist, involving the protagonist in a conflict, and explaining how the protagonist overcomes or resolves the conflict.

In his book on digital video, Collier discusses the basics of filmmaking from story creation to distribution. In particular, he stresses the notion that "it all begins with a strong story" [17]. Similarly, Hacker suggests engaging in a brainstorming process to set a "tentative focus" for the writing process [28]. Again the theme of organization surfaces in Collier's recommendation of using index cards to track story elements (*e.g.* scene cards, character cards, etc.). Collier also suggests activities such as holding readings and working with writers to improve the script. He also gives practical advice to "just write."

In the education literature, Bereiter and Scardamalia discovered the importance of up front planning in the writing process [13]. They reported that novices engaging in planning produced more expert-like writing. To support novice writers, one of their methods included using a series of writing prompts to help the novices engage in the writing process like experts.

The works presented in this section suggest a few key requirements for telling stories:

- engaging in storytelling planning activities,

- maintaining an organized view of your story, and

- writing a structured story (*e.g.* using a dramatic arc).

This list is in no way complete, but simply outlines a few activities that are found to positively impact the successfulness of a storytelling endeavor. The designs of tools for storytelling I will discuss (including Storytellr) incorporate these requirements.

To this point I have presented work that frames my efforts to support storytelling. These works provide motivation, context, and design guidance for this thesis. In the following chapter I will discuss my exploration of online photo sharing from the perspective of authors and viewers. The results from this study answer RQ1 and further

inform my design decisions related to supporting asynchronous photo communication through storytelling.

CHAPTER III

DIFFERENT PLACE, DIFFERENT TIME: A STUDY OF DISTRIBUTED PHOTO SHARING

3.1   Introduction

Photography is often used to preserve life's special moments. Some use photos to present experiences to those not present, while others use photos to relive experiences with those who were. The advent of the digital camera paired with the emergence of social media websites, such as Facebook[1], Flickr[2] and Photobucket[3], has provided more widespread access to the photos of relatives, friends and even strangers. Photos which were once confined to the shoebox, and mostly shared in person, now can be freely shared online with people in distant lands. While photos provide a sense of what it was like to be present, the stories shared during collocated viewing of photos bring the photos to life. Often, these stories are absent from the online photo viewing experience. In this research, we explored the impact remote asynchronous photo-sharing has on the online photo viewing experience. Furthermore, we examine the factors which inhibit people from producing richer online photo experiences.

While much is known about sharing photos in person, less is know about sharing photos online, in particular how the experience is impacted by distance and time (or asynchronous sharing). Researchers have studied synchronous, collocated print and digital photo sharing (*e.g.,* [26, 10]); however, fewer have explored how people communicate about experiences captured in photos in the online, or remote asynchronous case.

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[1]http://www.facebook.com
[2]http://www.flickr.com
[3]http://photobucket.com

Distance and time present unique challenges to sharing the stories behind the photos. The detailed stories and rich interactions that occur in person are often reduced to photo titles and captions in online photo albums. In many cases, non-descript photo names (*e.g.,* IMG_2752) and empty captions comprise the standard sharing experience. As noted by Chalfen, "pictures don't literally 'say' anything — people do the talking" [15, (p. 70)]. However, constructing an artifact which displays the photos but also tells the associated stories is challenging. The creator must engage in recipient design — anticipate what the audience might want to see and hear and develop a presentation which maintains the recipient's interest — while providing the appropriate amount of detail.

In this chapter, I explore the creator-recipient relationship and the challenges each encounter when interacting through photos online. Also, I explore the barriers to sharing the stories represented by photos posted online, and discuss the need for striking a balance between creator effort and recipient satisfaction. I surveyed and interviewed people about their preferences for online photo viewing and posting, as well as the challenges they face when sharing experiences with photos online. The results of this study provide an answer to RQ1 of this thesis (*i.e.,* What are people's desires regarding the creation and viewing of personal photo stories?).

First, I describe the study I conducted in more detail. Next, I present the results of the study. Last, I provide suggestions for how the results of this research might be applied to the design of better tools to support digital storytelling.

3.2 Methods: Studying Viewing and Creation Perspectives

I aimed to learn about how people experience online digital photo sharing. Online photo sharing inherently involves a creator and a recipient. In the case of photo albums, the creator creates an album which is shared with a recipient or set of recipients. In addition assessing experience, we were interested in how the rich experience

of collocated storytelling translated into the online world. I explored barriers to on-line storytelling with photos, and how those barriers impact the viewing experience. I used a survey to determine how digital photo sharing could be improved from the recipient's point of view. Also, I surveyed creators about the types of artifacts they would like to create to share their experiences online. I conducted interviews with creators to elicit challenges to creating a more detailed sharing experience. I col-lected data on several types of social media (*e.g.,* home video); however, I limit the discussion to online photo sharing because it is most relevant to this thesis.

I recruited people who engage in digital photo activities as a means to share their life experiences. I recruited participants in part from online digital photography forums, because this is a common place people who engage in photo activities go for help. I was careful to exclude more experienced media producers, because I was specifically interested in people who use photos to archive personal experiences as opposed to those who engage in photography as a profession. I also recruited participants through advertisements on Craigslist[4] and by word of mouth. None of my participants were compensated for their participation.

3.2.1 Survey

The survey covered three major topics: demographics, recipient viewing and media creation. The demographics section collected information about age, gender, and occupation along with frequency of computer and digital camera use. The recipient viewing and creation sections used 5-point Likert scale questions to collect responses about authoring and viewing practices. Participants responded to the survey either on paper or, through an online survey system. Fifty-four people began the questionnaire and 51 people completed it.

The viewing section collected data about frequency of viewing photos online and

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[4]http://craigslist.org

satisfaction with various aspects of the experience. Participants were asked to rate their preferences for various forms of online photo sharing on a scale of Strongly Agree to Strongly Disagree. The following forms were included on the survey: digital photo slideshow and digital photo album. I chose these artifacts because they are typical ways in which people share their own experiences, and view the experiences of others. A slideshow is an alternate way of viewing a photo album provided by a photo hosting service (*e.g.,* Picassa[5]). However, there are also software applications (*e.g.,* iPhoto[6]) which allow users to create slideshows of photos which include music, slide transitions and other effects, which can be shared as video. The photo slideshow category represented both the photo album feature and tools dedicated to creating slideshows.

To learn whether people desire more from photo albums and photo slideshows over distance, for each media form I asked participants if the inclusion of particular elements would improve their viewing experience. Chalfen discussed the proclivity of do-it-yourself manuals to recommend professional-like techniques to help consumers improve their creations [15]. While he finds people do not desire to engage in professional-like process, he does not discuss whether recipients of personal media would appreciate more polished presentations. Therefore, I wanted to determine whether recipients would find tips recommended by professionals appropriate for improving the viewing experience.

As a result, I asked participants to indicate their preference for particular media elements in photo albums and slideshows on a 5-point Likert scale. These elements were selected from a collection of resources on media production for amateurs [17, 59, 28, 37] based on their commonality across the professional resources I explored. The elements were: soundtrack, sound effects, vocal narration, visual effects, introductory

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[5]http://picasaweb.google.com/
[6]http://www.apple.com/ilife/iphoto/

sequence and plot. I was particularly interested in how participants would respond to the use of plot to communicate personal experiences. The concept of plot provides structure by which to communicate an experience and works particularly well in remote, asynchronous media (*e.g.,* movies and television). For plot and other less obvious elements I included a description of the media element on the questionnaire.

The authoring section of the survey focused on collecting data about photo projects my participants created in the past, as well as projects they desire to create in the future. Participants indicated whether they had created digital photo albums, slideshows and stories using digital photos. I included storytelling because of the pivotal role it plays in society as a "dialog between people, cultures, and times" [44]. Moreover, storytelling has been repeatedly documented as an integral part of photo sharing [26, 51, 36]. In addition, I asked participants to rate their perceived level of skill regarding writing and telling stories. I asked about photo capture and manipulation abilities of my participants to determine whether technical skill is a barrier. I asked about the written and oral storytelling abilities of my participants to help me understand if communicating about an experience becomes a challenge in the remote case.

3.2.2   Interview

I also conducted semi-structured interviews with 7 of the participants who completed the survey. Five of the interviews occurred in-person and two by telephone. Each interview lasted for approximately one hour. The interview participants were selected based on their availability and their indication of at least occasional photo-taking and sharing on the survey. I discussed each interviewee's survey responses prior to beginning the interview to gather insight into their responses. I used the interview to engage participants in extensive discussions about exchanging photos with non-collocated people. Participants recounted occasions when they shared photos over

Table 1: Capture and Viewing Frequency

Type	Daily	Weekly	Monthly	On Occasion	Never
Photo Taking	18%	27%	18%	37%	0%
Album Viewing	22%	37%	10%	24%	8%
Slideshow Viewing	12%	31%	25%	24%	5%

a distance (*i.e.,* created a viewing experience for a distant recipient). They also recounted occasions when photos were shared with them by a distant creator. In both cases, participants were invited to discuss difficulties they encountered and ways in which the experience could have been improved. I also discussed participants' expectations and appreciation of viewing experiences provided by creators.

The interviews were recorded and transcribed for analysis. I used a data driven inductive coding process to analyze the interview transcripts and generate themes to categorize my findings [43]. A set of themes emerged through a review of the transcripts and those themes were used to code the transcripts.

3.3 Results

First, I will present descriptive statistics about the participants' viewing and authoring habits, and continue with their reported desires for improving photo album and slideshow viewing. Next, I report the participants' creation desires, and possible barriers to meeting those desires.

I surveyed 51 people (26 male, 25 female). The age of participants ranged from 19 to 67. The average participant age was 31 ($\sigma = 11.658$). The participants' occupations included attorney, insurance claims adjuster, photographer, student, stay at home mother, chemist, and educator. Table 1 shows the frequency with which our participants reported taking digital photos and viewing online photo albums and slideshows.

All of the participants reported using a computer on a daily basis. Also, participants reported regular (monthly or more) viewing of photo albums and slideshows.

These results echo the findings of Miller and Edwards [46]. Many participants agreed[7] photo slideshows could be improved the most with visual effects (67%), followed by soundtrack (63%), vocal narration(55%), and the inclusion of plot (51%). Participants agreed photo albums could be improved most through plot (59%), followed by visual effects (55%). These findings show that recipients would appreciate some improvements to the viewing experience. In particular, online photo albums could be best improved by plot (or storytelling).

Where authoring is concerned, Figure 2 shows participants created photo albums and slideshows most often, and that they desire to continue creating them. The only other artifact a substantial number of participants (55%) were interested in creating was a digital story (a story told with digital photos); however, few reported actually doing so (7%). While many were confident in their ability to produce photo slideshows (87%) and photo albums (87%), fewer were confident about creating a digital story (53%). It seems confidence may be part of the reason people tend not to share the stories that go along with the photos they post.

Along with confidence, participants reported less experience with both conversational and narrative storytelling than I expected. Only 33% of participants reported advanced or expert experience with writing narratives about their personal experiences. Perhaps more surprisingly, only 38% of participants reported advanced or expert experience with conversational storytelling. Storytelling is a common way people share life experiences with one another; therefore I expected more people to consider themselves advanced storytellers. Concerning narrative composition, it is more plausible that few people engage in writing about personal experiences given the demands of work and family life on time. From these results it seems communicating the stories behind photos through asynchronous media may prove challenging.

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[7]The percentages presented as agreement are a combination of the participants who selected either Strongly Agree or Agree as a response.
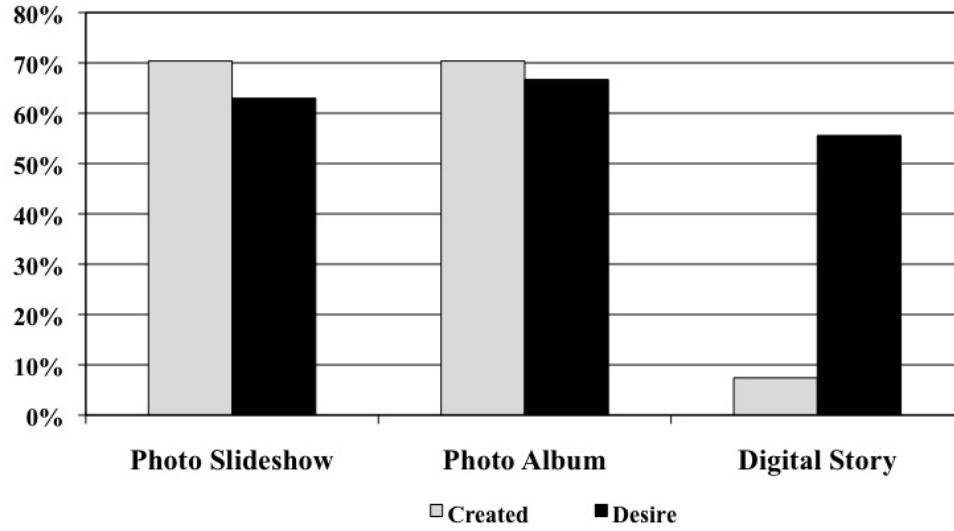
Figure 2: Artifacts Participants have created vs. Artifacts Participants desired to create

In summary, I find there is room for improvement in the viewing experience, particularly through plot as a storytelling device in photo albums. Indeed, creators do desire to create stories with their photos, but refrain from doing so. Some reasons may include lack of confidence and limited storytelling skills. In the next section, I discuss the interview results to further explore the factors (*e.g.,* time, effort and recipient design) that impact communication with photos online.

3.4   *Balancing Creator and Recipient Concerns*

I interviewed a subset of the survey participants about sharing and viewing photos. I decided to focus on digital photos because they constitute the medium through which many experiences are captured and exchanged in various social media (*e.g.,* blogs and social network sites). I frame my discussion of creator and viewer experiences around this central theme: creator-recipient balance. I explore this theme in terms of supporting themes, which include balancing creator investment with recipient satisfaction, details and storytelling challenges, and the interplay between expectation and appreciation. I explain the conditions that give rise to the central theme, strategies used

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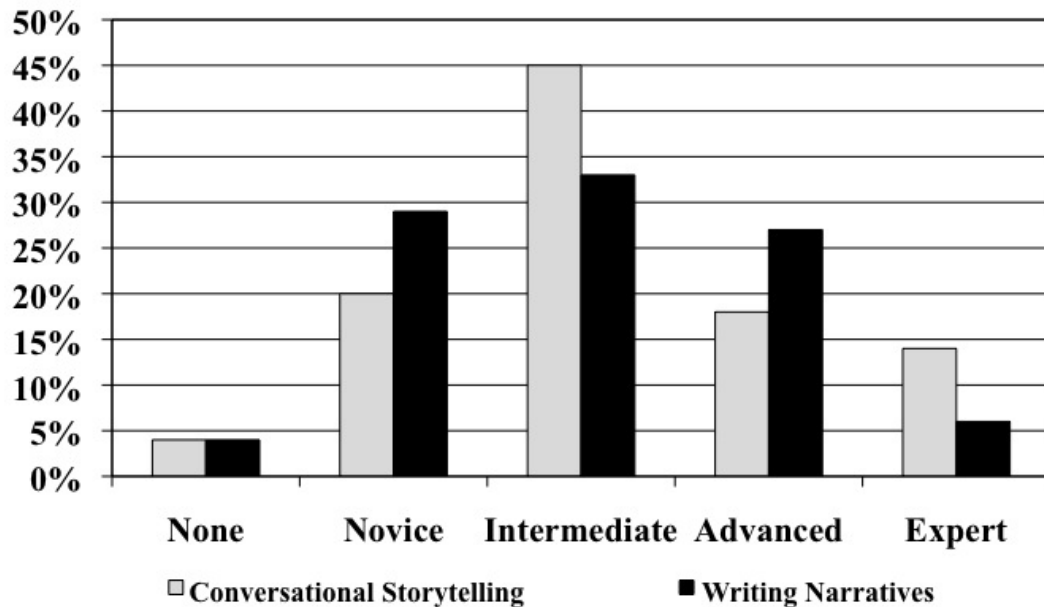
Figure 3: Reported level of skill concerning Conversational Storytelling and Writing Narratives

in the process of authoring, and challenges that impede communication.

3.4.1 Balancing Creator Investment with Recipient Satisfaction

Participants' reported their sharing experiences with distant recipients were typically preceded by an event or experience worthy of capturing. Often they indicated the intended recipients of photos were not a part of the experience, and therefore no shared context or memory existed. Though topics ranged from daily status updates to significant life events, sharing instances described by participants tended to favor special occasions.

As might be expected, participants reported the act of communicating through personal photos was typically initiated in one of two ways. One way communication was initiated was through requests from people (usually family and/or friends) who were aware of the participant taking a trip or having a particular experience:

> *P14: A friend of mine lives in Frankfurt, in Germany, she's my best friend. She often, often if she goes to a new place or has an exciting trip she will share photos with me because I specifically request them.*

The second way communication was initiated involved unsolicited sharing by the creator. This pre-condition was more commonly reported. For example P36 reported taking photos and sending them:

> *P36: We had an African Sunday at church and we dressed up in African attire. I took lots of pictures and sent them to different ones at our church.*

Also, participants discussed sending links by email and including them in instant messaging status lines to notify interested parties about the availability of a personal experience.

> *P14: Before I used to send out a link to photos when I used Kodak Gallery. Now I don't and just expect if someone wants to see what I'm doing...I just say why don't you just check out my Flickr page.*

Studies of awareness systems [52] and blogs [48] found similar motivations for sharing personal updates with family and friends. Though potential recipients may welcome unsolicited sharing of photos, creator-initiated sharing may at times prove problematic for the recipient. Digital cameras provide vast storage which promotes more comprehensive documentation of personal experiences. People can take photos with less worry about film and development costs. Furthermore, people can take and re-take photos until the desired result is achieved. Unfortunately, the duplicates are not always filtered from the collection. Moreover, not all of the photos are relevant to all audiences necessarily.

Though the recipient may be potentially interested due to the relationship between the creator and the recipient, explicitly shared media may need to be more carefully selected. One participant noted:

> *P14: I do appreciate when someone takes the effort...but I don't have the time. Even sometimes when friends send me links to their photo albums, often I may not actually go and look at that link for a couple of days or weeks sometimes because I just don't have enough time...*

Creator-initiated online photo sharing may create an un-welcomed obligation to view. Time can exacerbate this imbalance in desire to share and desire to view as evidenced by this participant's experience:

> *P37: I have 400 photos [on flickr] and my husband has 1300 photos and that's a lot so I would not sit there and go through all of his pictures at once. It can become overwhelming. They break it down into sets and collections, but just browsing I've spent hours on flickr looking at other people's photos and it can be a lot.*

It seems photo albums can have the potential to inundate recipients with content. Rather than share the complete archive of experiences, it may help recipients deal with photo collections if creators engaged in more selective sharing. Transitioning from sharing with everyone in one collection to sharing specific photos with specific people might also help. Some participants reported engaging in the former behavior (*i.e.,* sharing edited collections). Participants recounted engaging in photowork [33] activities in preparation for sharing. P17 reported editing and extracting photos from his collection before sharing online:

> *P17: I went through all of my photos and triaged them, adjusted the levels and balance. Took the ones I liked and uploaded them to flickr. The*

part that I hate the most is going through and coming up with titles. I hate the generic "IMG147" that the cameras give. Unless there is some sort of story behind the photograph, I don't have a caption.

Though P17 works to avoid overwhelming the viewing audience with photos, he also expressed a tension with providing details about the photos (*i.e.,* titles and captions). Because digital cameras do not use contextually meaningful names, many photos end up on websites with generic titles (*e.g.,* IMG_147). However, the process of adding titles and captions to every photo can also be arduous, especially when many photos are uploaded at once. Furthermore, the titling and captioning process only increases the burden placed on the creator to communicate. However, the title and captions are valued by recipients because they provide information about the experience that cannot always be understood from simply viewing the photo. Unfortunately, participants rarely reported proceeding beyond posting the photo to associating metadata with it.

In summary, I discovered ease of online photo sharing may be adversely impacting online photo viewing. While some may engage in photo management practices, these practices are time-consuming and laborious. However, engaging in those practices (*e.g.,* providing detail through titles and captions) would improve the viewing experience.

While some of the participants had developed strategies for communicating over distance, they also reported facing challenges concerning non-collocated asynchronous photo communication. While motivated to share and view photos, they also reported the authoring and viewing experiences pose many challenges. One practice in particular that participants indicated a desire to engage in more often is storytelling (see Figure 2. In the following section, I discuss the difficulties encountered regarding storytelling.

3.4.2 From Increasing Details to Storytelling

Online photo album services provide an easy means of sharing photos of personal experiences. However, as photo collections continue to expand online, the details about experiences represented by photos remains stagnant. The interviews highlighted recipients' need for more detail about the experiences captured in the photos and a desire of creators to share more detail through stories.

3.4.2.1 Details, Details, Details

Recipients described their frustration with not receiving enough detail about an experience online. They sometimes mentioned having to move from asynchronous to synchronous methods of communication to gather more details. For example:

> P18: I had questions...some things we had to kind of guess on...the best would have been for her to be there in person so she could see what I was looking at and answer questions I had...using voice would have given more detail
>
> P37: There were some captions but not a lot...I think maybe if they had more captions I wouldn't have to ask so many questions...I still couldn't really get her experience from it...we had to talk, I called her and we talked about it and I asked her different questions.

These comments suggest the participants found photo albums can overcome distance to deliver the essence of the personal experiences of others, but at times do not provide all of the information or detail that is desired. As I discussed earlier, captions and titles could provide more context, but the volume of photos being shared, and the efforts required to trim and refine the collection before posting make this activity difficult if not prohibitive. It seems a solution that provides detail to improve the recipient experience, while lessening the burden of the creator needed.

For collocated photo sharing, storytelling is employed to provide details about an experience. Also, in-person interaction affords a recipient-specific sharing experience. The recipient can request more or less detail on particular topics, and the person sharing can adjust the story accordingly. Storytelling is also used in professional asynchronous media to communicate with the general public (*e.g.,* in movies and television). It seems storytelling could be effective in online photo sharing as well. I discussed the use of storytelling in this domain with participants and found it is also fraught with issues.

3.4.2.2   Storytelling

My survey results indicated including additional elements (*e.g.,* plot and vocal narration) could improve the photo viewing experience. Not only would recipients appreciate an enhanced experience, creators would also like to create digital stories to present their media (see Figure 2). To normalize the discussion of *story*, I presented each interviewee with an example to ground the discussion and maintain consistency. The story was a voice-narrated photo slideshow about a personal experience. The participants shared some stories they desired to create:

> *P16: The birthday of my mom, if I were to find pictures from when she was little and to whatever age she is and just show them as a story...*
>
> *P17: Something like a story of his [participant's father] life or how he touched me is about the only thing I would want to create a story around...or something big of that level because it's a lot of work.*

While creating stories are of interest, they are only desired for momentous occasions. However, even for significant events participants expressed challenges to creating digital photo stories. The difficulties expressed by participants concern effort, story development, and production. In each case, the tools available were not

considered sufficient. When I asked P17 if he would create the story he expressed interest in, he articulated this challenge:

> P17: At least not with the current tools, it's more effort than I think it would be worth.

Other participants expressed similar sentiments:

> P15: If we had a tool that would enable us to create a story with greater ease, I think we would use it and they [recipients] would appreciate it.

Both of these participants indicate available tools do not reduce the effort required to create a story using photos. While people are motivated to create stories with photos, the effort required with current technologies is still too high. While required effort squelched participants' desires to create stories to share their personal experiences, the potential consequence of failing to invest the effort could result in a potentially boring experience or one that does not provide enough detail as discussed above.

Effort does not represent the only challenge, however. Creating a narrative to describe a personal experience was also considered difficult:

> P17: Lot of work with current tools. The hardest part is coming up with the narrative, then it's finding the artifacts to support the narrative.

This finding confirms the survey result on composing narratives. Writing narratives requires people to take personal experiences and mold them into an effective asynchronous communication structure (*e.g.,* plot). This can be difficult because people do not usually share life experiences in a structured manner. However, in the survey results, recipients reported the use of plot as a means for improving photo albums. Few researchers have explored the use of plot to tell personal stories to remote asynchronous audiences.

Recipient design is an additional factor that complicates asynchronous storytelling. Recipient design refers to the efforts an author must engage in to tailor a sharing experience to the interests of the audience. Asynchronous communication inherently requires an understanding of the interests and desires of the target audience. When sharing photos in-person, typically the story is produced extemporaneously. Often, it is told multiple times and rarely told in the same way. Because of the effort required to construct a story for online consumption, the user is likely to only do it once. As a result, the user must either tell a story for all audiences, or for one specific audience. To tell a story for multiple audiences, the user would have to create multiple stories. Future research could explore recipient design for multiple audiences while avoiding an increase in the effort required in an already intensive process. In particular, the use of computation to automatically adapt stories for different recipients could be examined. Diakopoulos and Essa explored this idea regarding photo collage authoring [21]. Further research is needed to determine how online photo stories can be adapted to the interests of different recipients without significant effort on the part of the creator.

The production process also hindered participants from creating stories. Participants expressed the need for help with capturing the *right* photos.

> *P18: I know how to use it [camera] to capture what's going on in the environment, but I don't know how to use it to get the right shots and making a story and making something that's entertaining for people to watch. The events that you would record aren't necessarily the things you want to sit back and watch when you could be watching TV or something else.*

Again, recipient design complicates storytelling; this time where gathering visual story content is concerned. Participants highlighted the need to share interesting

content. In addition, they discussed the need to separate photos for archival purposes from photos for sharing purposes. Further exploration into helping people capture or select appropriate photos and manage the boundary between archival and distribution is warranted.

While there are tools available for narrative construction (*e.g.,* Dramatica [14] and media production (*e.g.,* Adobe Premiere [2], these tools are designed with a focus on professionals with skills in these domains. Tools geared towards occassional, semi-skilled media content creators are needed. While tools like iMovie and Windows Moviemaker provide a straightforward user experience, they still focus on easy interaction versus holistic support — from capture to composition. Adams *et al.* have made efforts in this direction by developing a framework to support movie production from pre-production to post-production [6].

3.4.3 On Expectations and Appreciation

By soliciting the perspectives of participants on both creation and viewing, I uncovered an interesting interplay between expectations and appreciation. Based on the skills and time available to the creator, recipients adjust their expectations. For example, someone with professional photo experience is expected to take better pictures than someone with little to no photo experience. In the study, people with little skill were appreciated more than those with more skill regardless of whether both spent the same time and effort to create something to share.

> *P18: From Aunt Patty, I would be touched that they went that far, that they made the leap to doing digital photos. If theirs is good of course I would be like sure to tell them how good it was and to encourage them...*

P18 does not expect her aunt to engage in digital photo sharing because it would require significant effort on her aunt's part. Thus she has low expectations for receiving digital photos from her aunt. However, if her aunt did share digital photos,

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and those photos were "good", P18 would appreciate the effort and encourage her aunt to continue sharing. Again, the creator must engage in an activity that requires substantial effort to satisfy the recipient. However, the recipient's low expectation, garners appreciation of the effort as well as the content of the photos. Low recipient expectations for a creator sets the bar for appreciation lower. The effort to share the content in some cases can overshadow the value of the actual conent. For example:

> *P14: The other day my mom emailed me some pictures of my niece and nephew, and for me I really really appreciated it. Because I was like wow! First of all she got the pictures off of the camera. Second of all she managed to attach them in an email and actually send them.*

In contrast, people with more experience are held to a higher standard. When the recipient has a higher level of expectation, more is required of the creator to be appreciated. P37 describes this phenomena:

> *P37: It's kinda not fair, but yeah. I know a lot of people online, you know in the social media realm, that are really really good with computers and graphics and everything. I know one of my friends does a lot of video editing and stuff, so I expect for her videos to be good, but I mean sometimes she just don't feel like doing a lot of editing...I think you do expect it but it's really not fair for you to.*

People with more skill must continually maintain a certain standard or continually exceed previous efforts to maintain a certain level of appreciation from recipients. As P37 points out, this may not be fair, but it is the state of affairs. This is problematic because more skilled people do not necessarily want to produce with the same level of care and attention to detail each time they share personal photos. For example:

> *P15: We've been regular about sharing all these albums. I know that when we moved from two weeks to a month, and we told them we're not*

going to publish until next month, 5 or 6 people said noooooo. And when we explicitly told them we were moving from one month to two months, they said oooooo noooo. Nowadays I'm not telling them when the next album is going to be.

P15 managed this inequity by becoming more ambiguous about the frequency with which he would share photo albums. Though a higher expectation is placed on the more skilled, the user can usually rely on a quality viewing experience. In contrast, the less skilled are more appreciated for doing less qualitatively; however, the recipient cannot necessarily rely on rich viewing experiences or sometimes any experience at all (*e.g.,* a photo album without titles or captions). Participants mentioned being happy just to receive something from less skilled people. So while skilled creators may be less appreciated, they provide a better experience, whereas for the less skilled, recipients may have to move to synchronous means of communication to learn about the experience documented by the photos.

These results suggest a level of transparency is needed into the process and effort required of a creator to create a photo experience. Whether a less skilled person is sharing a story or a more skilled person is sharing a story, it is important to make the recipient aware of the constraints under which the artifact was produced. Whether time or skill, balancing the desires of recipients with the constraints of creators would help both the creator and recipient understand the perspectives of one another. As a result, recipients could value or appreciate creators based on the effort required, in addition to the final outcome

3.5   Discussion

I have presented the preferences of creators and recipients of digital photo albums and slideshows. The survey results show recipients would value more detailed experiences and creators want to author them via storytelling. However, the interviews highlight

a few barriers to authoring stories. The overriding theme throughout the results is the relationship between the creator and recipient which plays out on several levels. I continue the discussion of the results and their implications for research in the CSCW community.

3.5.1   Improving Visibility into Creator Efforts

Online photo sharing involves, not only the distribution of photos from one party to another, but the management of the relationship between those parties. It is important to consider the social context in which personal media is being exchanged. Social media sites like Flickr, Facebook and YouTube already provide tools for viewers to indicate what they like through rating and commenting. However, I found a imbalance in the creator-recipient relationship. While recipients can critique the work of creators, creators have no means of indicating the effort posting the content actually required.

I discovered more skilled creators are expected to produce more refined artifacts, while the bar for sharing is rather low for people with little experience. A little effort reaps much benefit. P18 referred to encouraging people who are not very skilled with sharing media. However, it may not be the desire of the creator to produce at the same level of quality for each sharing experience. People who regularly produce at a high level of quality have a standard to maintain, though they may not intend to, or want to maintain that standard. Creators do not have a means of indicating the constraints under which a particular set of content was posted. Even for the less skilled, an indicator of the constraints under which a media production was produced would help the recipient value the production according to the work required in addition to the final outcome.

Participants reported already appreciating visible efforts on the part of creators such as attaching photos to an email and sending them. However invisible processes

such as captioning and storytelling involve considerable work, but are less apparent to recipients. To address the imbalance in work required and work apparent to the recipient, I suggest future work explore exposing creator investment to the recipient. For example, the number of hours spent titling and captioning photos could be posted along with an album to provide an indicator of the author's time investment. As another example, the activities involved in creating a story along with time spent in each of those activities could be shared as part of the album . In addition, creators could indicate the amount of time they had available, and other factors that impacted the final outcome.

Not only would providing this information help set expectations of recipients, it could also provide useful feedback to the creator. Participants indicated being overwhelmed by the volume of photos shared by creators in some cases, and in other cases not receiving enough detail. Generating statistics on the creator's effort (*e.g.,* number of captions or estimated viewing time of the album) could reflect back to the creator the amount of energy that will be required of the recipient to review the album. Providing this information to the creator could encourage more thoughtful and detailed sharing while providing an improved recipient experience. At the same time, recipients might be encouraged to provide feedback as a result of seeing the effort of the creator, thereby creating a more reciprocal interaction.

Future work in this area would require researchers to determine what pieces of information are important to share, and what information creators would be willing to share. While some creators may be willing to expose every step of their process, others may want to limit transparency to high level statistics. Next, investigations into mechanisms to automatically and accurately collect this information could be examined. Lastly, further work could explore developing summaries of the collected data in the form of reports or visualizations for both the creator and recipient to view.

3.5.2 Supporting Storytelling

The interview results show time and effort impact not only the artifact that is produced, but also the creator-recipient relationship. Furthermore, creators are interested in authoring stories, but need help with capturing relevant content and constructing an interesting narrative. Participants discussed engaging in these activities as too difficult with current tools. It seems tools to facilitate more than traditional photo sharing either do not exist or are not quite easy enough to use. I found supporting storytelling requires a focus on recipient design and story construction. I now discuss each of these in more detail.

3.5.2.1 Asynchronous Recipient Design

During collocated photo-sharing, people often use viewer feedback to direct storytelling. However, communicating through asynchronous media requires forethought about audience interests. Rather than place the whole burden of recipient design on the creator, I propose leveraging social network sites to support recipient design.

I propose using computation to gather information about potential recipients in the user's social network. Millions of people are generating metadata about themselves on social network sites. People share their interests via profile pages, the groups they join, the pictures they post, etc. Computation could be used to generate interest profiles from the social data available about potential recipients. These profiles could then be used as a guide for recipient story design.

For example, in anticipation of his 40th birthday, a user may want to create a retrospective life story, but he is not sure what to include. Based on the information gathered from his contacts across social media websites, he is able to gather the interests of potential recipients. Based on the interests listed on his recipients' Facebook profiles, he decides they would enjoy hearing about his time playing football as a child, his music career, and his kids. From his Flickr stream, he selects related

photos which received the most discussion and were selected as favorites. He selects a soundtrack for his retrospective based on classic songs his contacts often listen to on last.fm. Through an aggregated view of recipient interests across social media sites, the user is able to design a story of his past with the interests of his recipients in mind.

In summary, taking advantage of information (or metadata) provided in social network profiles can help guide the asynchronous recipient design endeavor. People are providing information about themselves which can be used to help creators anticipate and accommodate the interests of recipients. In addition, people are commenting and discussing content on social media websites which serve as another indicator of interesting content.

3.5.2.2 Story Construction

The survey results show that recipients would appreciate the addition of plot, vocal narration and visual effects. Including these elements in the presentation forms I explored requires editing. The interview results show that time, effort and lack of skill hinder editing efforts. Tools for composition are simply not easy enough to use. I suggest focusing on building supports in composition tools that help creators reflect on their experiences and elicit the story (or plot) that the artifact is intended to communicate.

One approach to supporting storytelling has used templates to help users construct personal stories [32]. Another approach could involve providing archetypes for stories (*e.g.,* the birthday party) in which users could insert their photos. The archetypes would serve as a structure for how the story should be ordered, and what details should be included based on recipient interests. Of course a level of flexibility would be necessary to allow the user to organize the viewing experience in the way that works best.

While templates and archetypes can help users with organizing and articulating their stories, finding the stories in everyday life still remain. The interests of recipients can help; however, the creator must extract the noteworthy experiences from the routine and typical ones. Many researchers have reported on the activities that occur around photos (*e.g.* [51, 7]). I propose using activities such as organization, upolading and even co-located viewing to ameliorate the process of creating stories with digital photos. For example, the process of uploading photos could be framed as a reflective activity, which would encourage remembering the past and tagging the content with those reflections. These reflections could later serve as the building blocks for stories.

In addition to leveraging photowork activities, future research might explore how activities occurring at the point of capture could be exploited. For example, we should investigate ways to encourage users to assign meaning to photographs at the point of capture, so that they would not have to do so later. They could share their photos with the detail recipients desire without significantly more effort. The challenge here is to make the process of assigning meaning relevant at the point of capture and also relevant for sharing across distance and over time.

3.6 Conclusion

I set out to learn if the current methods for asynchronous non-collated photo sharing provide satisfying communication experiences. To investigate this question, I surveyed and interviewed people about their preferences concerning viewing and creating personal experiences with photos. I learned that a considerable number of participants desired to created stories online with their photos, but refrain from doing so. Some reasons included lack of confidence, skill, and required time and effort.

Interviews underscored the importance of providing contextual details about an experience to non-collocated recipients. However, providing detail comes at the expense of time and effort on the part of the creator. Consequently, I suggest improving

the process of communicating details of an experience through storytelling. However, storytelling was reported as challenging in terms of narrative construction and media production. I discussed the use reflection and story archetypes to support eliciting and organizing personal stories.

Lastly, I found the effort to produce more interesting and detailed accounts can go unappreciated depending on the expectations of the recipient. As a result, I recommended increasing transparency in the creator-recipient relationship. By exposing the efforts of both the creator and the viewer, both could better value the other's efforts. In addition, I believe transparency can encourage both the creator and recipient to be diligent in providing rich experiences and feedback respectively.

The results of this study provide answers to RQ1. In particular, people would appreciate more storytelling in the online photo experience; however, storytelling through asynchronous media requires time, effort and skill authors do not necessarily have. My study of people creating stories with media in a digital storytelling workshop, provides a complement to these findings by uncovering the barriers people encounter while in the storytelling process. In the next chapter, I will present this study and the first of two systems I developed to support online storytelling with photos.

CHAPTER IV

USING HUMAN SUPPORT TO INFORM THE DESIGN OF A PERSONAL DIGITAL STORY-AUTHORING TOOL

Few, if any, tools explicitly support storytelling with media. In this chapter I present my study of the Center for Digital Storytelling (CDS), and how the results led to the design of iTell. My work with the CDS uncovered the need to support story development in software. I incorporated many of the storytelling strategies and supports I observed in the design of iTell and Storytellr. Through an evaluation of iTell, I learned that strictly following the professional storytelling approach can be problematic when the software is used outside the constraints of a structured workshop. This chapter will trace the evolution of my ideas concerning supporting the construction of personal narratives, and set the stage for the approach to storytelling embodied by Storytellr – situating storytelling concepts within common photo activities.

4.1 How Do Humans Support Personal Digital Story Authoring?

Storytelling performs a critical function in society serving as a dialog between people, cultures, and times [44]. It began as an oral tradition and has now reached the digital medium as "digital storytelling." In particular personal retrospective storytelling, a type of digital storytelling, involves composing a narrative detailing a personal experience using personal digital media (*e.g.* photos, video, etc.) to illustrate the narrative. Retrospective storytelling presents everyday people with opportunities to engage in dialog with audiences about personal life experiences.

Digital storytelling is a non-trivial task. It entails writing and recording a script, editing digital photos and video, and combining these media to present a coherent

personal story. Combined with these functional tasks, digital storytelling involves critical reflection on personal life events to establish their meaning. My motivation lies in providing support for critical reflection on personal life events thereby enabling people who lack storytelling and technical experience engage in digital storytelling. Recall, I am not focusing the on slideshow story, which can be created with many digital photo management tools. Composing digital narratives requires a more involved creation process and produces an output of greater production value. To develop a greater understanding and appreciation for the process of creating personal digital narratives, I studied the storytelling and technical support mechanisms provided by the Center for Digital Storytelling experts in personal digital narrative authoring to understand how they enable everyday people to succeed at creating digital narratives. The CDS workshop enables people of varying technical and writing abilities to create personal digital stories. I studied two digital storytelling workshops provided by CDS to understand how everyday people create digital stories in this structured workshop environment. In particular, I was interested in learning what issues people encounter while creating digital stories and how they resolve them within the workshop. I chose CDS for the following reasons:

- CDS teaches the skill of producing narratives about personal experiences using digital media,

- each participant is successful in that they leave with a story to share with their intended audience, and

- the CDS workshop has been tried and tested for over 11 years and is modeled by other organizations (*e.g.* [4, 12]) providing digital storytelling services.

By observing these workshops and identifying the features that enable storytelling, I have uncovered worthwhile lessons that can inform the development of digital storytelling tools. I present these lessons and consider how the observed human support

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provided in the workshops could translate into digital storytelling software supports when appropriate. When translating human support into software support is not feasible, I consider how software might provide access to human support. The following section presents the research methods I used to learn about challenges participants faced in the CDS workshop. I introduce a set of lessons abstracted from those challenges to inform digital story authoring tool design decisions.

4.2   Center for Digital Storytelling

To set the context for my field study of the CDS process, I will provide more detail about the center and the process used to produce digital stories similar to MOMNOT-MOM. The Center for Digital Storytelling is an organization dedicated to assisting people in using digital media to tell meaningful stories from their lives [3]. The Digital Storytelling Workshop is one vehicle for accomplishing this mission. Over the course of three days, typically between 8 and 15 people engage in roundtable discussions, creative writing, software tutorials, digital image manipulation and movie production with the common goal of telling a personal story. CDS defines digital stories as three to five minute movies consisting of the authors images, video and other media coordinated with a voiceover to tell a personally meaningful story. Story enhancements can include a soundtrack and image panning and zooming effects.

4.2.1   CDS Workshop

The CDS workshop presents a process augmented by human support for telling stories with digital media using commercial tools. Experts in digital storytelling designed and facilitated the workshop and it provides a real world practice useful for informing the design of digital story authoring tools. Understanding this process sets the stage for exploring what human supports can and may be worth integrating into software.

One to two facilitators run the Digital Storytelling Workshop and one to two trained volunteers assist participants during the image editing and movie production

stages of the workshops. The workshop begins with each participant providing a brief personal introduction and preview of the story they hope to tell. A workshop facilitator then lectures on the seven elements [37] defining a digital story using previously created stories as illustrations. 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.

The workshop continues with the "story circle" where participants share their digital story concepts. The story circle focuses on developing story ideas before discussing digital content. Participants are encouraged to write a script prior to the workshop; however, in the workshops I observed participants levels of preparation varied. As each person presents their story idea to the group, the other participants are encouraged to give feedback. The story circle fosters a sense of community, which plays an important role in the cultivation of each story.

With the feedback provided in the story circle, the participants begin writing or revising their scripts, which eventually become the voiceover for their digital stories. CDS sets the ideal script length limit at one page of text and an upper limit at 1.5 pages in an effort to restrict the length of the movie produced to three to five

minutes. Facilitators review each participant's draft and suggest improvements (*e.g.,* by reorganizing the order of events). Once the script is complete, each participant records their own script thus creating a voiceover for their story.

In conjunction with the writing process, facilitators provide tutorials of Adobe Photoshop and Premiere to teach important technical skills for digital narrative creation. These skills included cropping, image touch-up and composition, and non-linear movie assembly. The tutorials provided support for a wide range of experience levels. Following the tutorials, participants begin preparing their content in Adobe Photoshop (*e.g.,* fixing images and creating image compositions) for later assembly in Adobe Premiere.

Once their content is ready, each participant begins creating a rough edit in Adobe Premiere by combining the prepared media with the recorded voiceover. The workshop facilitators review each "rough edit" and suggest further improvements. Finally, participants add effects to enhance their stories. The workshop ends with a final viewing where a facilitator projects each participants story onto a large screen and everyone in the workshop group views each story. Following the workshop, the facilitators engage in a post-production process to refine each story, export the final versions to a portable storage medium, and mail them to every participant.

Given my definition of personal digital storytelling and a description of the workshop I studied, I now describe the research methods I used to learn about digital storytelling in a human supported environment. I then present my findings and abstract a set of lessons to inform digital story-authoring tool design.

4.3   Methods: Studying Human Support

I surveyed and observed two separate workshops held in June and, July of 2004 for a total of 18 workshop participants, 2 facilitators, and 3 trained volunteers. From

this point, I will refer to workshop participants as simply participants. I will refer to volunteers as simply facilitators when I discuss support provided with image manipulation and video production tasks.

I used questionnaires to gather demographic information and assess the technical and digital media composition experience level of the participants. At the beginning of each workshop, I surveyed participants about their computer experiences, access to computers and media capture devices (e.g., video camera), familiarity with popular image and video editing tools, and media sharing habits. I also asked participants about their writing practices, hypothesizing that their practices might affect their ability to navigate the script-writing process.

The CDS workshop represents an opportunity to observe novice digital storytellers create digital stories. This study allowed me to answer the following fundamental questions:

- During what part of the process do participants falter?

- What helps them over these hurdles?

By determining what obstacles exist in the authoring process and developing an understanding of what human supports help people through them, I can begin to think about how to realize human solutions in software. In instances where translating human support into software support is not feasible, I explore providing access to human support via software.

4.3.1 Workshop Demographics

The occupations of workshop participants varied (*e.g.,* sales and product management), but most participants were educators. In total, the majority of participants were female (13 females, 5 males). From the questionnaires I found:

- Twelve of 18 participants reported having access to a digital camera. Five of the 12 having access to a digital camera considered themselves avid photographers.

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Although participants may have been quite familiar with photography, having a distinct interest in photography was not sufficient and they still required help with digital story composition.

- Eight of the participants reported sharing their media by creating a digital artifact. The artifact typically took the form of pictures in an online album or PowerPoint slide show. However, no one reported creating a digital story prior to the workshop confirming that participants were new to digital storytelling.

- Seven of the 18 participants reported having previous experience with Adobe Photoshop and only two with Adobe Premiere. Most Participants were not only new to digital storytelling, but also new to the tools they used to create their digital story.

- Slightly less than 50% of the participants reported engaging in writing (excluding email) more than twice a month. Participants brought more writing experience to the workshop than I expected; however, in some cases writing was a requirement of the participants occupation as opposed to personal fulfillment.

These findings suggest people seem to create simple artifacts using their media, but do not attempt productions resembling a digital narrative. I suspect lack of access and difficulties using currently available tools are major reasons. The results from observing the workshop provide more insight into this issue.

4.4   Results

In addition to surveying participants, I observed participants during the story circle, while they prepared their content with Photoshop and composed their media with Premiere. I interacted with them while they worked as well as on breaks to determine when and how to provide support. I now discuss my observation of four classes

of challenges in the digital storytelling process. Those challenges were with story development, content preparation, movie production and completion.

4.4.1 Challenges in Story Development

The participants attended the CDS workshop to learn how to create digital narratives. A challenge for the participants was to learn and understand the elements of a digital story and how to implement them. The workshop began with a description of the digital storytelling form (*e.g.,* the seven elements) endorsed by CDS. It is important to note that the CDS staff pre-determined the basic elements of the artifact — the participants would not be authoring a video game, for example, to tell their stories. Although CDS defined the form in advance, the participants still had to learn about the form and apply their understanding to create their story. To help participants understand how to create a digital story, facilitators demonstrated how to implement the form by analyzing previously produced stories.

Although pre-defining the form of the story may have provided participants with a starting point, participants still encountered a variety of obstacles. I observed the majority of participants express difficulty with selecting a specific topic as their focus. Feedback from the story circle and individual feedback from workshop facilitators seemed to help participants find this focus. Similarly, I 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. Although, participants did not implement this as a strict guideline, it provided a useful analogy.

4.4.2 Challenges in Content Preparation

As I presented in the "Workshop Demographics" section, participants were largely unfamiliar with Adobe Photoshop and Adobe Premiere. Photoshop and Premiere are

the primary digital media tools used in the workshop, thus presenting a technical challenge to participants. CDS anticipated this challenge and provided Adobe Photoshop and Premiere tutorials early in the workshop to provide participants with example uses of the tools while they were still working on their scripts. Facilitators guided participants through basic image manipulation tasks such as resizing, cropping, and photo touch-up. Workshop facilitators demonstrated eight tools (*e.g.,* lasso and clone stamp) and only those tools for accomplishing these tasks. This minimalist approach to teaching Photoshop allowed participants to focus more on their story and less on learning the tools.

Participants struggled with importing content from their devices and older non-digital storage media (*e.g.,* videocassette). Participants requested assistance with connecting devices and transferring content to their workstation computers. The workshop facilitators often performed these tasks on behalf of participants. One participant described his frustration with importing content in terms of his previous experience with video editing: "I dabbled with videos on my PC but was very frustrated by inability to import video and then once I produced something and created an output file, I couldn't get any other PC to recognize the format."

In addition to performing difficult tasks for participants, the CDS staff used heuristics to answer common questions. For example, I observed participants ask what image format they should use when saving edited images (always using the PSD format was the answer). Facilitators also provided heuristics as "rules of thumb" to help participants avoid pitfalls common to novices. For example, facilitators instructed participants to record their script in segments to reduce the amount of re-recording needed to correct errors.

4.4.3 Challenges in Movie Production

During movie production, I witnessed participants struggle with using Premiere and implementing the visual portion of the story (*e.g.,* economic use of images and pacing). Participants requested help with importing images and adding transitions to movies. By far, participants required the most assistance with adding effects to their movies. By the morning of the final day in both workshops, all major content (*i.e.,* photos, video and voiceover) had been imported and the rest of the day was dedicated to adding effects which consumed more time than any other activity involving Premiere.

Facilitators used heuristics again to aid students, but this time with the visual design of their story. For example, when selecting photos for their story, facilitators advised participants to use a particularly good photo to represent an idea versus a sequence of similar photos.

4.4.4 Challenges to Completion

The challenges to completion involved managing the process, overcoming obstacles with particular tools, and dealing with fear of incompletion. Communal support played a major role in enabling participants to complete their projects. Participants solicited feedback from one another. They also supported one another technically and emotionally. In the first workshop I observed, the group encouraged the first participant to record a voiceover as she left the room.

Workshop facilitators provided more structured support to help participants overcome the challenges to completion. An important part of authoring digital stories is careful time and process management. CDS defined the timeline participants followed and used a whiteboard to track their progress. To help participants take an organized approach to storing their content in the workstation file system, CDS provided a directory structure with descriptive names related to the process of creating a digital narrative (*e.g.,* folders named soundtrack and resized). Participants simply

duplicated and used the provided structure to manage their project content.

Facilitators also ensured participants completed the process by the end of day three by monitoring their progress and in extreme cases finishing the project with the direction of the participant. In addition, facilitators used a manual post-production process to refine the movies following the workshop.

4.5   Lessons Learned

From the challenges and observed support presented in the previous section, I have abstracted a set of lessons to aid digital narrative authoring tool designers in using my findings. The lessons address the obstacles participants encountered with both software and storytelling itself. In this section, I discuss those lessons in the context of strategies used in the CDS workshop. I then explore potential translations of the CDS strategies into software supports when possible. My intent is not to directly apply the techniques from the workshop, but to transfer the spirit of the techniques into software when possible. I continue the discussion in the following section by exploring three particular areas (story development, collaboration and process management) where currently available video editing tools could provide support for digital narrative composition.

4.5.1   Pre-defined story models and examples of effective use support story development

Understanding the process of creating digital narratives is essential to digital storytelling. If workshop participants already understood how to create a digital narrative, the usefulness of attending a workshop would be arguable. Digital storytelling refers to a specific form defined by CDS. Having the form pre-defined removes the need for participants to define the type of artifact they will produce. Workshop facilitators helped participants understand the digital storytelling model through both principles (*e.g.* economizing the use of images) and examples. The model and examples also

served as a point of departure for the storytelling endeavor. They allowed participants to spend less time determining how to approach writing and more time writing. During the instructional portion of the workshop, a facilitator played previously produced digital stories highlighting how each implemented the seven elements. The following strategies eliminated the need for participants to select a form and allowed them to begin the process of implementing the form:

- Define the story form and its components in advance

- Demonstrate the usage of the form with visual and written examples

When people do not have access to the human support a workshop provides (*e.g.* after they leave or if they never attend one), where will storytellers obtain support for the story development process? Software could potentially come to the aid of storytellers by helping them understand the form and guide them in using it. Another question that arises is who defines the form? Because CDS and others provide resources that outline and guide novice digital storytellers in the writing process, the responsibility of the software designer then becomes developing an experience that guides storytellers through the provided resources. Exploring successful examples could be a part of that guidance allowing storytellers to observe the form in use as opposed to proceeding with only a description. CDS not only described principles for story development, but also used example digital stories to highlight each element, and show how and why each of the stories effectively implemented the seven elements. Software could possibly emulate this human support by providing annotated story examples to present the importance of each story form component, and demonstrate why the example is successful.

4.5.2 A pre-defined toolset for media manipulation and examples of effective use ease content preparation

Participants in the workshop used Adobe Photoshop to manipulate the images they included in their stories. Through a survey administered at the workshop, I learned they were largely unfamiliar with Photoshop. Workshop facilitators had already anticipated this and addressed the issue by providing tutorials. The tutorials provided models for effective and appropriate use of various tools (*e.g.* clone stamp, magnetic lasso). It also provided participants with the opportunity to practice before working with their own media. I observed in the workshop that a large toolset is not necessary to produce a quality digital story. CDS included only a select number of tools in the tutorial and advised participants to use only those. However, the tools introduced by facilitators still required technical expertise. CDS used the following strategies in the workshop to facilitate the creation of compelling stories while minimizing difficulty with tools:

- Define a limited toolset for implementing a story form

- Provide tutorials of the toolset in the context of appropriate usage scenarios

I noticed participants only spent time on the content preparation stage using the tools presented in the Adobe Photoshop tutorial. Limiting the toolset in digital story authoring tools could potentially allow novice digital storytellers to devote more time preparing their content rather than expending unnecessary effort on selecting tools. In the workshop, the facilitators could only suggest restrained tool use, but software designers have the opportunity to limit the total number of tools digital storytellers can access.

Along with defining a limited toolset, it is important to help digital storytellers understand when the use of a particular tool is appropriate to obtain a desired outcome. Even within a limited toolset, users may still have options for performing a

particular task. Software should guide storytellers through how each tool works, the result it produces, and how the effect could be used in their story. For example, during the Adobe Photoshop tutorial, a workshop facilitator explored a number of tools for copying a segment of one image to another image showing how each was not best for the task though they did ultimately work. The facilitator cited the last tool demonstrated as the appropriate tool and provided an explanation of its use. Likewise, software should seek to explain what tool makes sense to use for particular effects and rule out those that are sub-optimal.

4.5.3 Feedback increases story quality and eliminates software barriers

This lesson addresses challenges associated with story development, content preparation and movie production. For these challenges, obtaining feedback from peer storytellers and workshop facilitators was a part of the solution. For example, a roundtable discussion (or story circle) was held to allow each of the participants to get feedback on their story ideas from their peers. Feedback is useful for story development and difficulties encountered with technology. The story circle provided peer feedback during the writing process and facilitators provided individual attention during the writing, content preparation, and production processes. Participants also served as resources for one another with technical problems and story design decisions. This type of rich individual and communal interaction is vital to improving story quality. CDS used the following strategies to provide feedback to participants:

- Connect users with a support network of peer digital storytellers.

- Connect users either directly with experts or with expert recommendations.

The implementation of these strategies provided participants with access to two types of support: peer support and expert support. The story circle served as a support network of peer digital storytellers in the CDS workshop. It was particularly effective at providing each participant with targeted feedback and suggestions for

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improving their story. Workshop facilitators encouraged this network and components of the workshop reinforced it. Participants were also encouraged to help one another throughout the three-day process. Workshop facilitators also provided individual direction to each person.

4.5.4 Providing automated solutions is sufficient for addressing tasks not vital to producing a quality digital story

The CDS staff handled some tasks on behalf of participants. These tasks were not essential to improving story quality, but were a necessary part of the process. For example, some participants required help with transferring content from a camera or a non-digital storage medium (*e.g.* VHS) to their workstation computer. In addition to completing tasks for participants, workshop facilitators also provided heuristics for tasks completed by participants as a preventive measure and in answering questions. In the context of digital storytelling, I observed the following strategies used to help participants complete tasks not vital to creating a quality story:

- Provide abstractions for file organization and content management

- Provide heuristics for navigating each stage of the storytelling process

- Aid the transfer of content from the capture device to the computer

- Fine tune the user's final cut of their digital story (post production)

I observed participants experiencing difficulty interacting with the file system of their workstation computer. The difficulty was with maintaining the link between the objects (*e.g.* images, and soundtrack) being manipulated in the applications and their location in the file system. Participants were provided a directory structure tailored to the digital storytelling process to help with content organization and management. CDS used folder names to represent the different media that would need to be stored during the process (*e.g.* resized images, and soundtrack).

In software, it might be helpful to go even further by providing users with abstractions that allow media manipulation to occur without requiring access to the file system. Although the directory structure helped with organization, I still noticed people having trouble determining where they saved their content (*e.g.* when they inadvertently saved resized images in the soundtrack folder).

Participants who brought their content on cameras or other storage media (*e.g.* Beta Max) required assistance in many cases just to connect devices and import the desired content. One participant's storytelling process involved a series of technologies to digitize her video stored in VHS format. The CDS staff provided the equipment and expertise needed to accomplish this task. Software might assist digital storytellers by providing instructional videos demonstrating how to connect devices and import content.

In many fields, experts develop a set of "tricks" they become more efficient practitioners. Novice storytellers lack practical and repeated experience with authoring tools and thus lack a collection of these strategies making the process more difficult. Software might help users avoid the pitfalls of novice behavior (*e.g.* scanning photos one at a time versus scanning multiple photos at once and separating them using Photoshop) by providing a library of tips for users to consult when performing certain tasks.

4.5.5 Clearly defining and managing the user's process in terms of progress, time and emotion facilitates completion

Although completion of the final story was a challenge for participants, they had little involvement in managing the process and time. Despite the participants' awareness of the imposed time constraints of the workshop, the facilitators defined the process, set goals, and monitored the progress of the participants to meet those constraints. The importance of process management is evidenced by one participants comment on his difficulty with software tools: "[the] interface [is] not clearly related to [the]

process." I observed the following human supports being used to help users manage time and process in the workshop:

- Clearly define the different parts of the process

- Help with setting a timeline and goals for each part of the process

- Provide assistance with tracking progress

- Provide encouragement for making progress

In Section 4.5.1, I discussed defining the form for users. While digital story authoring tools should provide sufficient tools for assembling digital content, they should also provide support for managing the process. Outside of the workshop users are not guaranteed a forcing function for completing their stories; therefore, it becomes important to think about how to help storytellers set goals and a timeline. In addition, users must be kept aware of their progress.

In the CDS workshop, facilitators used a progress board and deadlines to keep people on track. It is also important to explore ways in which software can encourage storytellers to continue making progress without causing frustration. We might look to research in affective computing for direction [50]. Another important challenge is helping users resume work on a story following a period away from the authoring process. It is unlikely that users will spend three consecutive eight-hour days authoring a story as participants did in the workshop. As a result, tools should help the user manage interruptions in the authoring process. Work on the Cooks Collage [58] and Where Were We [47] may provide some insight into helping users re-orient themselves to the storytelling process following a break by providing examples of interfaces that help users resume a task after being interrupted.

4.6 Supporting Personal Retrospective Story Authoring in Software

My observation of the CDS workshops was mainly motivated by my desire to learn what difficulties people have with telling stories and how I might help them with software. Observing the workshops also allowed me to understand how professionals engage in digital narrative composition, determine the obstacles novices encounter and the techniques skilled instructors use to help them through those obstacles. Based on the findings I discussed in the previous section, I designed iTell — a digital narrative composition tool — to support retrospective story creation with personal photographs. I also leveraged research in the Learning Sciences and common practices in the film industry to guide the design process of iTell.

Storytelling is an inherently creative process; however, I discovered at the CDS workshops that complete artistic freedom can be counterproductive. Workshop facilitators tracked each participant's progress and helped them move forward. Through the design of iTell, I aimed to guide retrospective storytellers through the process of creating a digital story while not interfering with the creative process. As a result, iTell provides an overriding structure for the story authoring process while allowing users flexibility in specifying the details of their stories. iTell uses a transaction system process model similar to the check out feature provided by online shopping websites. The user must complete a specific set of steps to achieve an end goal — a story. To support users with creating retrospective narratives about their personal experiences, iTell presents users with four steps to complete: Brainstorm, Organize, Writing, and Add Personal Media. Each step specifies the goal of the step and provides a set of directions for completing it. The user must complete each step before moving on to the next step. The user cannot skip a step without completing it at least once. After a step is completed, the user can revisit it at any time. Any changes made in previously visited steps propagate to later steps when appropriate.
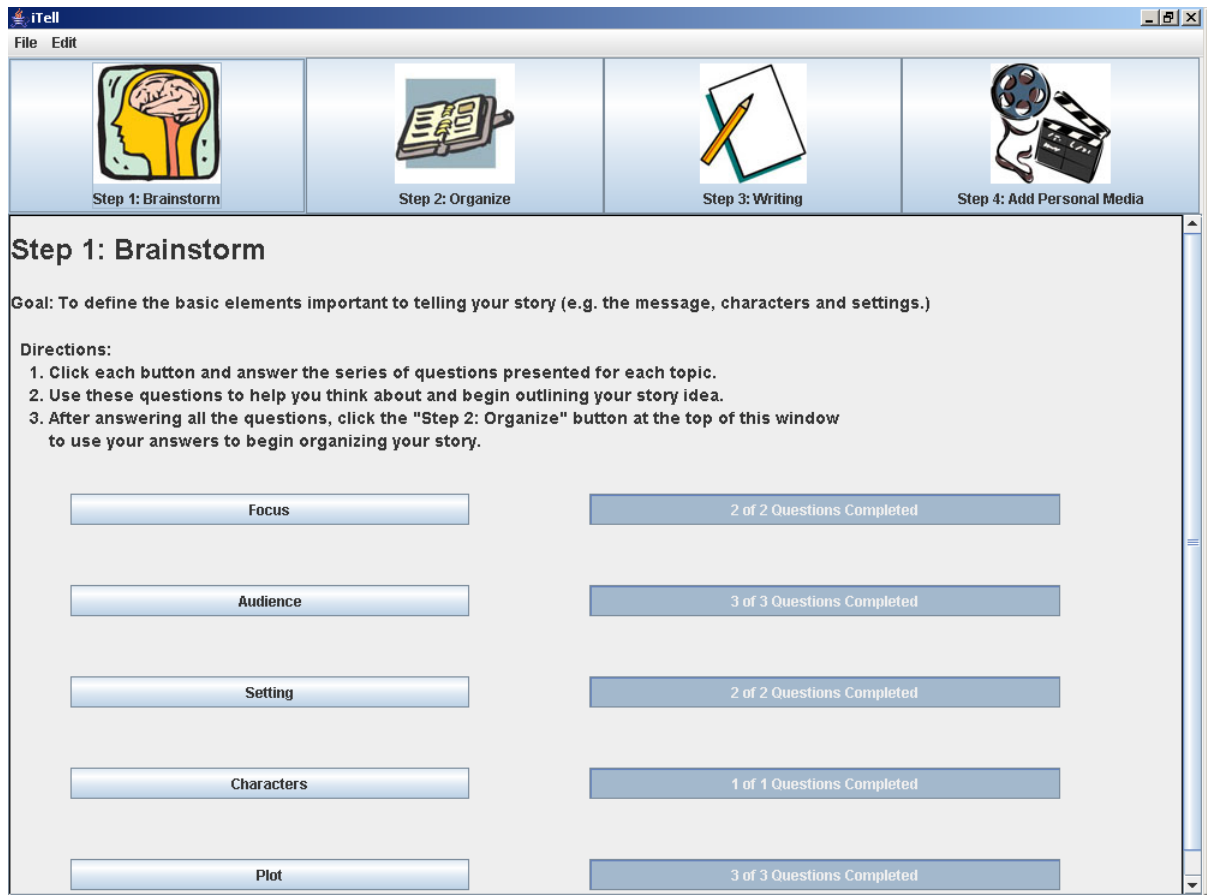
Figure 4: iTell Brainstorm Interface

iTell uses a prominent process bar to define the steps in the process and designate steps that have not been completed. The buttons for unvisited steps are disabled as well as grayed out. I now discuss each of these steps in more detail and present my rationale for the design of each.

4.6.1 Step 1: Brainstorm

The goal of the brainstorm step is to help users define and document the basic elements essential to telling their story. Observing CDS workshop facilitators (expert digital storytellers) initially emphasize story development over movie production led to the design of this step to engage users in story brainstorming.

In addition to the CDS approach I investigated other approaches to supporting

narrative compostion. For example, Hacker suggests engaging in a brainstorming process to set a "tentative focus" for the writing process [28]. Bereiter and Scardamalia underscore the importance of up front planning in the writing process and report novices engaging in this process produced more expert-like writing [13]. To support novice writers, one of their methods included using a series of prompts to help the novices engage in the writing process like experts.

With the Brainstorm step, I drew from all of these methods of supporting the writing process to design an interaction with the goal of helping novice storytellers implement the conventions of a traditional narrative (*e.g.* plot, climax, resolution, etc). In this step, the user answers a series of questions from five categories: focus, audience, setting, characters, and plot (See Appendix A). The interface contains buttons for each category (See Figure 4). Each button opens another window containing questions relevant to that category. The questions serve two purposes:

- Evoke thought about story

- Document elements essential to telling the story

Each question prompts the user to consider a specific aspect of their story. The intent of the focus question set is to help the user determine the story's overall message. The audience question set was designed to encourage the user think about who the story addresses to ensure the story connects with that audience. The setting questions were selected to allow the user to provide detail about the places the story occurred. The character questions were designed to perform a similar function but for providing details about the people involved in the story. Plot questions invite the user to consider the dramatic elements of their story (*e.g.* conflict and resolution).

For each question set, a progress bar displays the number of questions the user has answered for that set. The user must respond to all of the questions in each set before moving to the Organize step. Based on the importance and influence the writing

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process has on the quality of the resulting story, I consciously decided to require an answer for all questions. I balanced the potential barrier of this requirement by limiting the number of questions the user must answer. In addition, this is the only step that requires completion before moving to the next step. The primary purpose of the questions in the Brainstrom step is to help the user define, document, and describe the elements needed to tell their story. The information the user provides in this step provides support later in the process. The focus and audience question responses are presented in the Writing step as reminders to the user to consider their focus and audience as they produce text for their story. The character, setting, and plot responses are used in the Organize step to help the user assemble a storytelling plan.

4.6.2 Step 2: Organize

The goal of the Organize step (See Figure 5) is to help the user organize the events in their story and associate details with each to create a plan for use during the Writing step. Bereiter and Scardamalia found expert writers plan before they begin producing text and compose from scratch using their plan as a support structure versus using their plan as an initial draft [13].

The Organize step focuses on creating a plan for use in the writing process. For each event the user listed in the plot question set in the Brainstorm step, iTell presents the user with a set of controls for associating setting and character details with that event. With each set of controls, the user can select an event and specify the setting and characters relevant to the event. The user can select the order in which the events will occur in their story. Associating a setting and characters with each event helps create a plan for telling the story. Again, I leverage the investment in the Organize step by using the responses provided to automatically create an outline for the user to reference in the Writing step.

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Figure 5: iTell Organization Interface

4.6.3 Step 3: Writing

Again, from observation of the CDS process and exploration of primers for screenwriting and video production, I decided to include an explicit writing step as an integral part of the retrospective story creation process. In this step, the user writes the script that will be illustrated later with photos. The user will also use the script to record the storys narration.

With the Writing step, I aimed to support the user as a story script is produced. The story tree (See Figure 6) serves as one of those supports. The story tree visualizes the responses captured in the Organize step. Each branch is an event containing sub-branches for characters and settings associated with that event. Along with the story

tree, iTell provides the user a text box for typing in the script text.

The majority of this step involves the creative process of writing the story. The story plan and focus and audience reminders are provided as supports as writing occurs. I considered inserting text suggestions or notes in the textbox for the story to avoid the intimidation an empty text box could cause. However, I was concerned I would encourage the phenomenon Bereiter and Scardamalia observed where novice writers would consider their plan a first draft rather than a plan [13]. In addition, I wanted to avoid limiting the creativity of the user by generating text or otherwise influencing the development of text. As I mentioned previously, I hoped to guide users through the process of creating a digital narrative while not interfering with the creative process.

4.6.4 Step 4: Add Personal Media

At this step, media is used to illustrate the story written in the Writing step. At the Center for Digital Storytelling I learned the video production process involves a number of menial tasks software could automate. In addition, I noticed workshop facilitators provided participants with heuristics (*e.g.* recording the story script in parts). In this step, I attempt to make the process of illustrating the story with images as simple as possible by incorporating heuristics in the tool and automating some of the tasks required by non-linear editing tools.

Currently available digital media composition tools typically do not support the screenwriting process. I leverage the content produced in the writing process to create an interaction, which allows the user to transition from writing to illustrating their story. In this step, the user specifies the high-level sequencing of the imagery and voice while leaving finer details (*e.g.* synchronization and content management) to iTell.

iTell departs from the typical timeline metaphor used by current video production
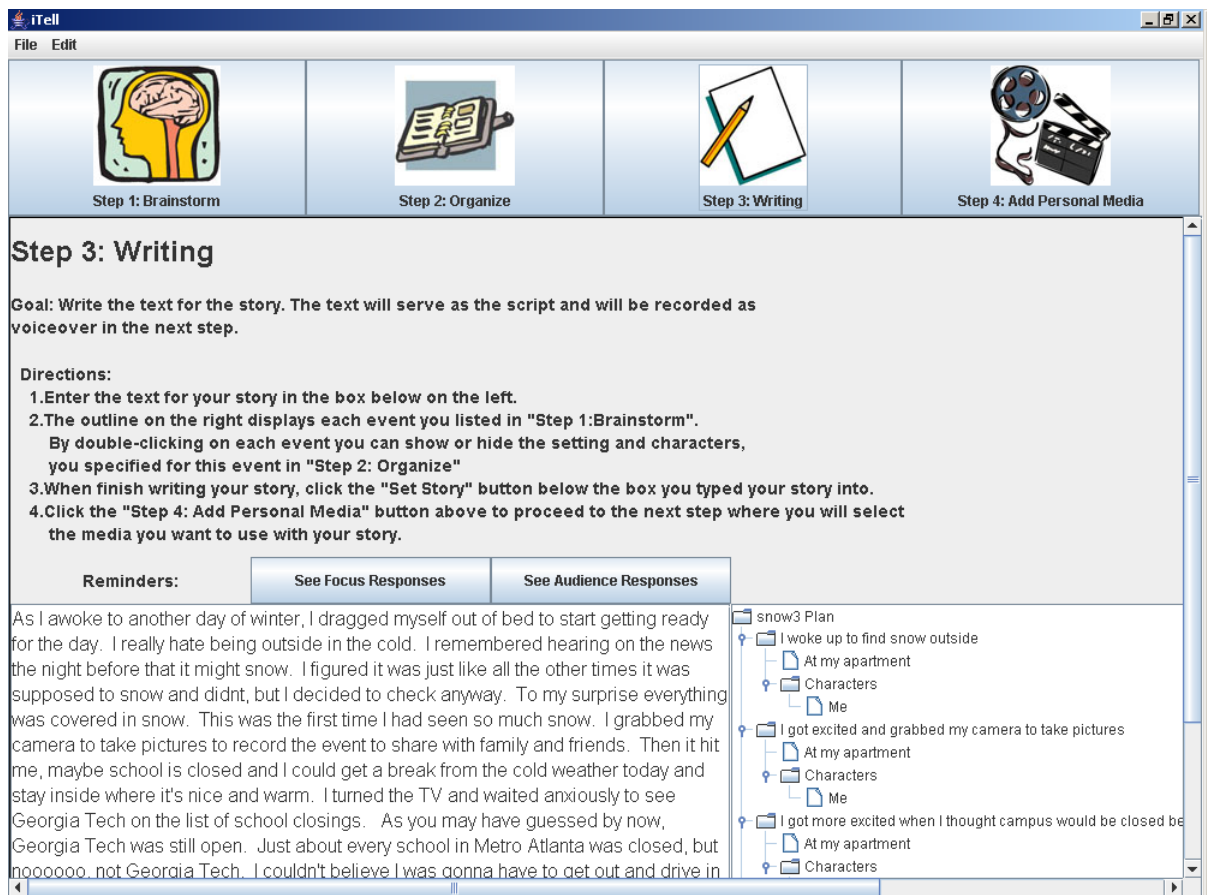
Figure 6: iTell Writing Interface

tools. Current tools require synchronizing the voice with the image using a timeline. Instead, iTell uses the notion of an association to indicate a relationship between the script, voiceover and images. To specify the sequencing of the photos, the user creates a set of rows in a table (See Figure 7). Adding a row to a table creates an association. iTell links the photos and voiceover in each row and presents them together in the generated story. The user can access photos through a file browser, and add them to rows via drag and drop. Clicking the "Record Voiceover" button in a row opens a dialog presenting the text from the row and an interface for recording the text. When the user clicks the "Done" button, iTell creates an audio file and places it in an automatically generated project directory used for storing the content associated with a story. Clicking the "Generate Digital Story" button initiates the packaging
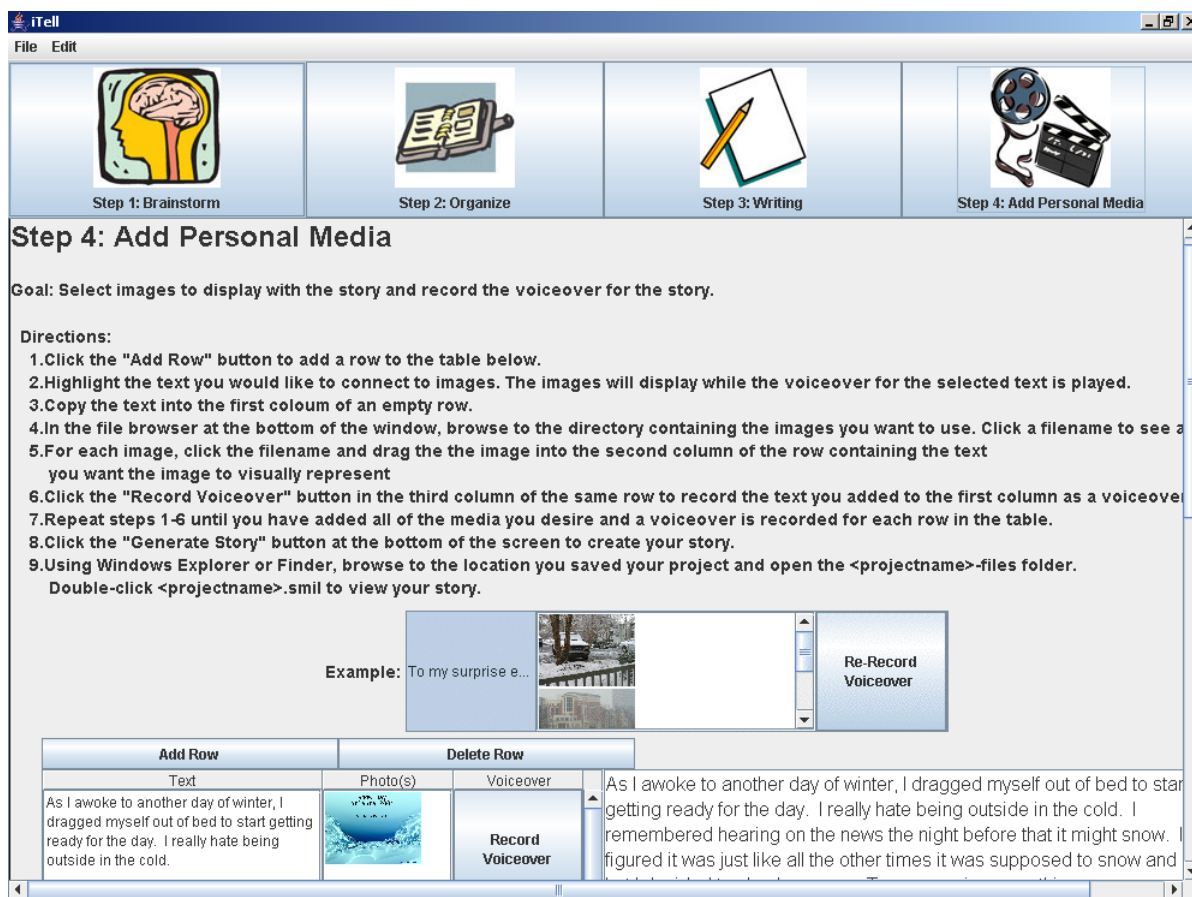
Figure 7: iTell Media Composition Interface

of a directory with the user's content, which the user can copy and distribute to the target audience. iTell translates the associations created using the table structure into a Synchronized Multimedia Integration Language (SMIL) media file, which can be played with a RealPlayer or QuickTime™media player.

CDS workshop facilitators advised workshop participants to record their script in parts to minimize the amount of re-recording needed to correct mistakes. In this step, the user records a voiceover for each table row. This design implicitly divides the script for recording. In addition, it allows the user to associate media with the script/voiceover without dealing with synchronization. iTell handles the synchronization of the media with the voiceover automatically. By handling synchronization, I hoped to reduce the amount of time the user spends on this task. Photos in each

row display for the duration of the voiceover. iTell divides duration of the voiceover evenly between the photos when a row contains multiple photos. This approach does have drawbacks when inequitable time division is preferred. Splitting photos between multiple rows serves as a workaround, although some work is required to finely tune the timing.

4.7 iTell: The Evaluation

Following the design and development of iTell, we conducted a qualitative user study of iTell to gain insight into the following questions:

- What features of iTell enable retrospective storytelling for novices and how do they support the process?

- How do novices approach retrospective storytelling with only software support?

In this section, we will present the methods we used to explore these questions and provide details about three cases we will explore in the Results section.

4.7.1 Methods

We encouraged participants to think of a story topic and bring in digital photos they thought would illustrate the story they wanted to tell. We used surveying, observation, interviewing, and data logging as techniques for collecting data about the retrospective storytelling experiences of our participants. They answered a background survey aimed at characterizing their storytelling and media practices prior to participating in the study. We then provided participants with a workstation for creating their story using iTell. After transferring the photos the participant brought in to the provided workstation, we instructed participants to take an hour and thirty minutes to begin creating their story using iTell. We allotted more time for participants to complete the process when necessary. We wanted to ensure time was not a

barrier to completion so we would have the opportunity to understand each participants experience from start to end. We did not provide an introduction or tutorial to iTell considering it important for users to be able to navigate the storytelling process without needing support. In the event participants needed help, we served as human support to develop an understanding of what help participants needed and how we could provide it.

We observed and videotaped each participants iTell experience. We took field notes during their interaction with the tool and iTell also captured an additional source of data in an XML file, which served the dual purpose of recording the users input for use in the tool but also as a log of the users activity. We asked participants to think aloud during the process and prompted them to tell us more about behaviors we found particularly interesting. Following the creation of their story, each participant completed a post survey which collected their impressions of the tool and their experience. Finally, we conducted interviews to learn more about each participants experience.

4.7.2 Participant Demographics

Three participants used iTell to create retrospective stories. The occupations of the participants were mother, graduate student and engineer. We now provide detail about the background of each of these participants gathered through background surveys.

4.7.2.1 Mother

The mother created a story about her family and how her reflection on a family trip caused her to see her family in a new light. She reported daily computer use and taking digital photos on a monthly basis. She documented having little experience with writing personal narratives while considering herself moderately experienced with digital photography. Though she captures digital media on a regular basis,

she only shares the captured media on special occasions with relatives and friends (e.g. she made an album as a birthday gift). In terms of compositions, she reports combining her media to create a slideshow using Microsoft PowerPoint. She only desires to create compositions on special occasions and cites time, ease of access to tools, and access to media scattered across computers and devices as barriers to this goal.

4.7.2.2 Graduate Student

The graduate student told the story of her involvement in her friend's wedding. The graduate student also reported daily computer use but more frequent digital photography activity. She considered herself moderately experienced with writing about personal experiences and an expert digital photographer. She documented taking digital photos weekly and reported weekly sharing activities with relatives, friends and co-workers via email and online photo albums. Despite the frequency of her sharing activities, the graduate student had never created a composition using her photos though she desired to on a monthly basis. She cited a lack of software for composing and sharing as obstacles.

4.7.2.3 Engineer

The engineer recounted his trip to Las Vegas to commemorate his 30th birthday. The engineer was also a daily computer user and reported taking digital photos only on special occasions and sharing them only on special occasions via email. The engineer noted little experience with both writing personal narratives and digital photography. The engineer had never composed his photos with any other media but desired to create compositions for special occasions. Interestingly, he did not see any obstacles to the creation of a composition; however, when we interviewed the engineer after he used iTell, he considered lack of software as a barrier to composition creation.

4.8 Lessons Learned from iTell Evaluation

Through a user evaluation of iTell, I gained a few insights into my expert-based design approach. These insights have lead to a new design approach for supporting retrospective storytelling with digital photographs — situating storytelling practices within common photo activities. I will now discuss the lessons I learned from user experiences with iTell and how they connect to the rationale for my new design approach. More details on the study results can be found in [38].

4.8.1 Role of Media in Retrospective Storytelling

Developing a strong story is typically a pre-cursor to video production [17, 59]. I designed iTell to align with this professional approach to creating media compositions. However, in my experience with participants, media was a concern throughout the storytelling process. Media served two functions: reminding and guiding. Images were used to answer prompts about characters and settings. Participants also used media to guide the direction of the story. Surprisingly, participants reported excluding portions of their experience when they did not have media to visually represent the experience.

The role media played in the participants' processes highlights an important distinction between video production and retrospective storytelling. In the former, the story concept is developed prior to capturing footage. In retrospective storytelling, image capture ordinarily occurs before the author develops the story concept. There is no opportunity to gather more media from events that have already occurred. Rather than use media representative of ideas presented in their stories, they chose to exclude events based on the photos they had available.

These findings suggest the need to elevate the importance of media in the retrospective storytelling process. Professionals tend to develop a coherent story and

then capture the media needed to tell the story. The process is reversed with retrospective storytelling. People typically do not take pictures with a story in mind. Consequently, my experience with users seems to suggest people will develop their story around available photos, which suggests media should come into play sooner in the story development process than it does in iTell. I hope to address this in the design of Storytellr by situating the story development process within the context of the user's photo collection.

4.8.2 Storytelling Styles: Novice vs. Professional

According to resources on screenwriting and video production, strong stories should have a plot in which a series of events rise to a climax and then resolve [59, 17]. In an attempt to help users engage in a thought process similar to professionals, iTell leverages research on written composition by including questions designed to help novices take the professional approach to developing a story [13]. However, I found participants did not view their story as having the properties of a typical narrative (*i.e.* climax, resolution, etc). Consider for example one participant's response to the first plot question about the initiating event: "Its not a beginning and ending story, but a look at our family from a different perspective." She considered her story to be more a series of events unfolding. Upon inspection of the log file, it became clear that the participants listed a sequence of events that took place in their story as opposed to documenting the dramatic arc.

Our attempt to prompt our participants to engage in behavior similar to professionals only confounded them. Although they answered the questions anyway, they reported uncertainty about the appropriateness of their answers. It is possible the choice of questions may not have been the most effective at encouraging thought in more dramatic terms about their story. However, participants were able to recognize the dramatic concepts, but chose not to answer the questions to address these

concepts, which suggests users are either not interested or do not see value in telling stories in this form. In this thesis I plan to explore this result further by providing example answers to the questions to give users a model to emulate. I hypothesize the example answers will not only provide a model that user can use to relate their personal story to the professional storytelling approach, but also begin to understand how to tell plot-driven stories.

4.8.3 Balancing Writing and Media

I approached the design of iTell with emphasis on writing based on observations of the CDS workshops and literature on screenwriting and video production. My experience with end users illuminated the need to consider media an integral part of the story development process as opposed to considering it once the writing is complete. Story development (especially brainstorming) is still important and was considered useful by participants; therefore, I suggest designing to balance the emphasis on writing and media as the retrospective storytelling process progresses. From my experience, allowing parallel consideration of the storyline and the available media would better support the experiences I have observed. This result provides further support for the situating story construction within photo activities.

4.8.4 Supporting Novices via Human Support Model

Overall, the design of iTell was based on providing observed human supports in software to help novice storytellers engage in storytelling activities in the manner experts do. I studied a storytelling activity facilitated by humans to determine what supports are needed and how I might provide them in software.

From this evaluation, I discovered people might not desire to take the expert approach though they may understand it. Participants displayed understanding of narrative concepts used by experts, but did not see their story as fitting into that

framework. One participant compared the experience she wanted to create to conversation around the dinner table. It seems that using human supports provided by experts provided benefit to study participants, so modeling human supports seems useful. However, attempting to coerce users into engaging in expert behavior may not be as beneficial. It may be the case that participants inexperience with writing and media may have caused reservations about attempting to take the professional approach.

One of the main goals of this thesis is to produce an experience for everyday people that allows them to leverage their collection of photographs to communicate about their personal experiences. I believe the use of plot-driven stories is a useful construct and so the task becomes merging the practices of users around photos with the activities necessary to create plot-driven stories. The next chapter will discuss my design of Storytellr and how it merges user practice with story composition activities to produce a satisfying experience and story that effectively communicates a user's experience.

CHAPTER V

STORYTELLR: SITUATING STORYTELLING WITHIN PHOTO ACTIVITIES

5.1 Introduction

In the field study described in Chapter 4, I observed the need for a great deal of proficiency in multiple areas (*e.g.* photo editing, audio recording, video composition, writing) to produce a well executed story in the digital medium as done by professionals. Further complicating the matter, I found the professional approach to storytelling (*e.g.,* using plot and dramatic arc) does not match the storytelling practices of the users I have studied. Although people may be reluctant to engage in storytelling in the professional sense, it nevertheless has benefits (*e.g.,* psychologically [49]). In addition, results from Chapter 3 show they do have the desire to tell stories with photos. As a result, I aimed to mitigate the resistance to storytelling in this form by leveraging traditional photo activities around media, thereby providing a familiar entry-point to novices [33]. I developed Storytellr as the means to this end. Ultimately, the goal of Storytellr is to allow users to reap the benefits of storytelling while engaging in familiar activities. More broadly, the narratives created with Storytellr will enable more rich (*i.e.,* detailed and introspective), remote, asynchronous communication with photos.

Storytellr represents a major iteration on the iTell prototype. Its design remains rooted in the findings of the digital storytelling workshop studies. Additionally, it is complemented by the findings from the evaluation of iTell and surveys and interviews of user preference detailed in Chapter 3. In particular, recall the findings from sections 4.8.1 – 4.8.4. In Section 4.8.1, I report my observations of users employing photos as

memory aids and selection criteria for what would be included in their stories. Overall, this suggests a much more media-centric process than iTell provided. Storytellr attempts to address this by focusing each phase of the process on interaction with media.

Although participants in the iTell study had some reservations about telling their stories in a plot-driven manner, I consider it important to continue to use this general model of storytelling because it is taught as a part of formal education, used professionally, and is an effective and engaging form of communication. Furthermore, plot-driven stories facilitate communication asynchronously allowing the author to communicate thoughts and feelings about an experience through the story itself. Rather than change the form, I believe coupling the form with common photo activities around media will appeal to users and also enhance their abilities to communicate in this form.

To do this, I leveraged the photo tagging process people engage in when uploading photos to media hosting websites such as Flickr$^{\text{TM}}$. As a part of the tagging process, the production of annotations useful for engaging in the story creation process is encouraged. I also transformed the traditional notion of free-text search into one that encourages reflection and photo-collection sense making; thereby allowing the user to explore a collection for photos, while determining what photos are relevant to the storytelling process. In Storytellr, searching for photos to share in a story is a process of identifying the elements of the emergent story via search prompts. This guided search also addresses the need to balance writing and media interaction (See Section 4.8.3) by combining the exploration of media and pre-writing activities into one process, thus allowing users to develop their ideas in the presence of their media.

Section 4.8.2 reports the divergent styles of storytelling that professionals and novices practice. iTell was designed to support the professional approach for novices.

Storytellr attempts to converge on a solution that still engages users in professional-like storytelling while situating the process within activities familiar to them. For example, it uses the notion of prompting to help users derive benefit from professional techniques while engaging in familiar activities.

Although Storyteller is designed to be a much more media-centric process than iTell, I have been careful not to remove the essence of what defines a story (*i.e.* a dramatic arc). This is evident in the inclusion of prompts that specifically ask the user to think conceptually about story. Section 4.8.3 calls for a balance in the emphasis on writing and writing-related activities, and exploration and engagement with media. Storytellr attempts to provide this balance.

Storytellr has been developed as a third-party Flickr application using the Flickr API. Flickr is used to host users' photos and Storytellr is designed in part, as an alternative upload interface. My intention was not to duplicate the Flickr service, but provide support aimed at telling stories with personal photos hosted by the Flickr service. Using Storytellr involves navigating three phases: photo tagging, search and composition (See Figure 8). The following scenario provides a example of the intended use of Storytellr. Following the scenarios, I will discuss the design of Storytellr in more detail.

> Ricky has just returned from his Caribbean vacation. Before he left, his
> friends asked him to take lots of pictures. During is time in the Caribbean,
> he took over 500 photos. Once he transferred his photos from his camera
> to his computer, he begins selecting the photos he would like to share with
> his friends online. He remembers hearing about the Storytellr system and
> decides to give it a try. He places the photos he wants to share online into
> a separate directory and logs into Storytellr using his Flickr account. He
> clicks the "Upload Photos" link to begin uploading photos. He selects all
> of the photos from the special directory he created and clicks the upload

arrow to continue.

Ricky is then taken to the Tagging Phase where he is presented with one of his photos and a set of questions (*e.g.,* What emotions (positive or negative) do looking at this image evoke?). For each question he can create tags as responses, which can then be used to tag his photos. He can also provide a title and caption to upload along with the tags. He finds coming up with emotions and themes challenging, but he finds the tags pre-defined by Storytellr (*e.g.,* happy and family values) and repeated tagging helps him think introspectively about his vacation. As a result, he considers telling a story that includes both what actually happened, and what it meant in the broader context of his life.

After tagging his photos, he moves on to the Search Phase to select photos to include in his story. He is presented with another set of questions, but he notices they seem to be more about telling a story. He also notices the tags he created in the Tagging Phase are listed with the questions. He answers each question by placing a check in the box next to each appropriate tag. As he answers the questions, he notices the photos in his Flickr collection are being filtered based on the tags he checks. After answering all of the questions, he drags the photos he would like to include in his story to the clipboard and moves to the Composition Phase.

In the Composition Phase he notices three timelines (one each for setup, climax and resolution) are provided to organize the photos for his story. With the reflections elicited in the Tagging and Search phases, he begins setting up his photos to cover the events that transpired and what the experience meant to him. As he drags photos to the timeline, he realizes he is unsure about the best way to tell his story. He reads the hints provided by Storytellr and decides to follow the suggestions of

the timelines and provide a setup, climax and resolution. Once he sets up the photos in each timeline, he writes what he would like to say for each photo in the provided textbox and records the corresponding audio for each photo. Finally he clicks the "Generate Movie" button and a narrated photo slideshow is generated for him to share with his friends on his various social network sites.

Figure 8: Storytellr Process Diagram

5.2   Photo Tagging Phase

Many methods exist for annotating photographs with metadata. Digital cameras automatically stamp digital photographs with time and date information. Some research has advanced beyond date and time to technologies that tag photographs with information based on GPS coordinates [53], concepts (*e.g.* indoor or outdoor) [24, 41, 42, 55] and face detection [36]. Current photo management tools allow users to tag their photos manually with text. Researchers have also explored the domain of manual annotation by providing interfaces for annotation using drag & drop [54] and through an online game [60]. While these are all useful annotation criteria for media, they are not particularly helpful in the process of constructing stories from digital photographs. Current annotations describe explicit information about the captured event (*i.e.,* the who, what, when and where), but I argue that the *how* and *why* of the event, or more implicit information, is more important in the context of storytelling with digital photographs. The goal here is to help users expound on the experience

Table 2: Photo Activity & Story Activity Pairings

Photo Activity	Storytelling Activity
Tagging	Brainstorming
Search	Brainstorming
	Story Development
Composition	Story Development
	Media Composition

taking place between the snaps of the camera. The process of story construction itself can also provide metadata for images through the associations formed by inherently combining a particular set of photographs and other supporting media into a story. The benefit of this kind of tagging is that it provides a more abstract level of information about the photos. These additional annotations could potentially provide for better search and browsing in addition to support for the overall story construction process.

5.2.1 Situated Photo Tagging Challenges

To determine how to elicit the how and why of people's experience, I started from the story constructs necessary to tell a plot-driven story. I then created a mapping between the type of information needed during the storytelling process and the type of information that is relevant to the tagging process when the photo is being uploaded. Table 2 presents this mapping. Beginning with story constructs and working backwards, a typical story includes characters and settings. Characters and settings may seem irrelevant during the upload process; however, the people and places pictured in photos are quite common as tags. By prompting users about the people and places pictured, iTell concurrently gathers metadata that describes the characters and settings for a potential story.

While developing a mapping from characters and settings to people and place was somewhat straightforward, creating a mapping between plot elements (*i.e.,* setup,

Table 3: Metadata-Story Construct Mapping

Story Element	Annotation Type
Setup/Resolution	Positive Emotion
Setup/Resolution	Neutral Emotion
Climax	Negative Emotion
Characters	People Present
Setting	Place

climax, resolution) and personal experiences was much more difficult. Personal experiences do not occur in neatly packaged plots. Furthermore, people do not think of their lives as plot-based. While life experiences may not necessarily follow a dramatic arc, the undulating pattern of life certainly creates moments of triumph, tragedy, and triumph over tragedy. It's these pivotal points in life that not only give us stories worth telling, but they are amenable to being told in a plot-driven manner.

Again, I used photo tagging as an opportunity to associate metadata with photos that are useful in the storytelling endeavor. To engage users in reflection on their digital images and generate tags that are both useful during uploading and storytelling, I used emotion as the link (See Table 3). By characterizing emotions evoked when viewing and reflecting on a particular image as positive, neutral or negative, I believe emotion can be used to map experiences onto the basic plot elements (*i.e.,* setup, climax, and resolution).

The metadata I lay out here more deeply describe experience. In addition to helping facilitate the storytelling endeavor, it also opens up the space of queries people can construct to search their own media collections. For example, searching for images that display a "happy" scene requires that images in a personal collection have been annotated to that effect. Tagging images with more abstract concepts will enable searches for more abstract ideas across media collections.

5.2.2 Photo Tagging Interface Design

The photo tagging phase of Storytellr is designed to be a guided manual tagging interface. Rather than provide an interface through which users independently generate ideas for tags to annotate their photos, this interface focuses on generating tags useful for search during the storytelling endeavor. The Storytellr tagging process occurs in conjunction with uploading photos to the Flickr photo service. The tagging process can occur as part of the overall storytelling process, but could also occur apart from the search and composition phases. For the purposes of this thesis, users will engage in the complete process during Storytellr's evaluation.

In the tagging phase, the user is prompted by a set of questions to generate tags that can be leveraged during the storytelling process (See Figure 9). As the user uploads photos, each photo is displayed alongside the questions allowing the user to answer the questions in the context of the image. Allowing the user to view the image not only makes the process more media-centric, but it provides the user the opportunity to use the photo as an aid for reflection [16]. Because the guided tagging may increase the length and effort required by the upload process, the prompts have been designed to support quick, lightweight responses. For each question, the user is presented a set of choices from which to select, allowing quick and minimal interactions to help save time. I anticipated users might find the questions related to emotions difficult to answer, so I included tags to help users get started. Users can also create custom tags. The custom tags are saved in a database for the user, and appear as options during subsequent photo uploads. The option to add custom annotations is also provided to allow for flexibility in how tags are added. The tagging interface also provides the opportunity to enter other general annotations that may not be targeted at storytelling, but are useful for search.

Asking users to answer questions can provoke thoughts about their experiences and capture those experiences more descriptively in the tags they create, particularly

for telling stories later. However, prompting thought does lengthen the photo uploading process. I hypothesize that the additional time spent interacting with supports (*e.g.*, prompts) will improve the outcomes of users. In addition those improvements will be achieved in less time and with less effort than would be required to become a professional media author. The benefits of the professional process (*i.e.* a better output and the inherent benefits of storytelling) would serve as reward for the investment of additional time and effort.
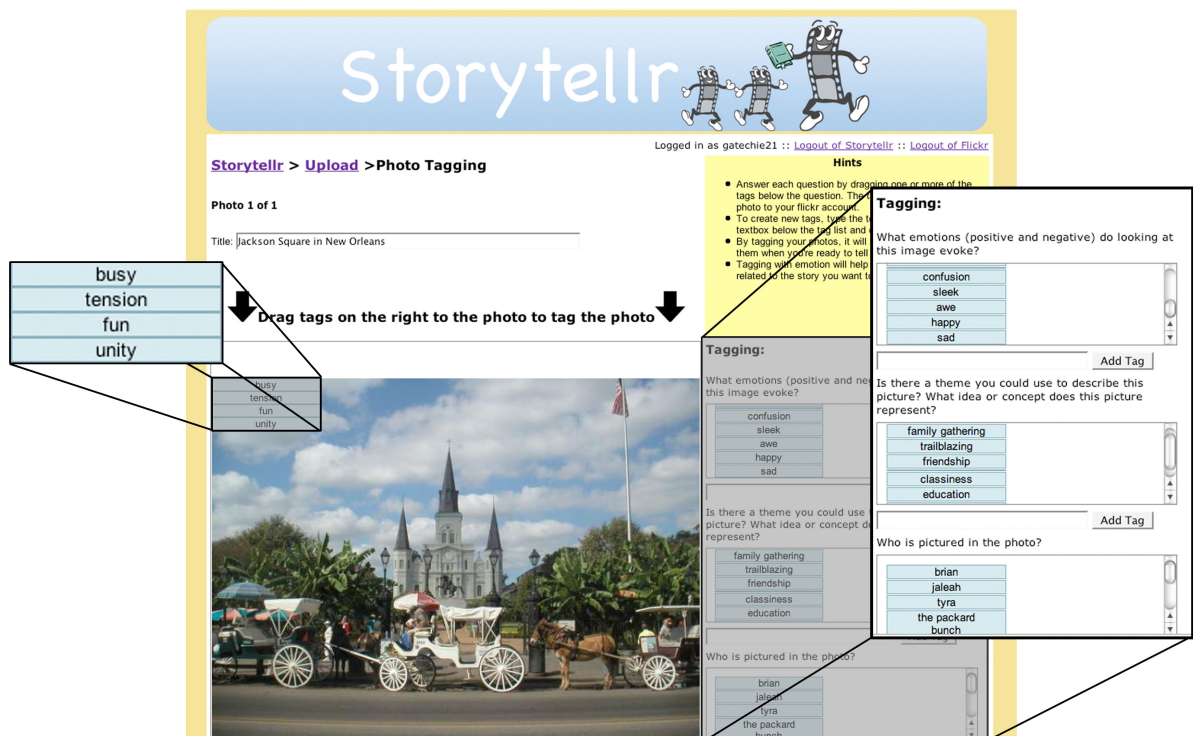
Figure 9: Storytellr Tagging Screenshot

5.3 Search Phase

Metadata is often used to describe digital documents to make them easier to find. For example, documents in a digital library are tagged with keywords that users are likely to use in a query to find those documents. Similarly, tags are assigned to photos to help search engines locate photos. The search phase of Storytellr leverages the annotations provided in the tagging phase to help users select photos for their stories.

Selecting images to include in a story can be a challenging proposition. A balance between quantity and relevance must be achieved. As opposed to photo albums where as many photos as desired can be included, a story requires selection of photos that help tell the story. To address the challenge of image selection, I combined procedural facilitation with search to help the user filter the collection based on the elements of their story (*e.g.,* emotions, setting, characters). This serves two purposes: prompting thought about the story and selecting images to include in the story. This phase differs from traditional search in that it encourages users to think about their experience and conduct their search based on experience versus browsing or keyword search.

5.3.1 Search Phase Interface Design

The search phase presents the user with a set of questions; however, the questions take on a different role from the question in the photo tagging phase. In the photo tagging phase, the questions were meant to generate metadata to make search for images for storytelling easier. The questions in the search phase shift focus to developing the story. As a result, the questions are meant to prompt users to reflect on their experience and consider the story they desire to tell. In the process of answering these questions, media is retrieved based on the answers to these questions.

Each question in the search phase corresponds to a question in the photo tagging phase. The tags created for each question are presented as a series of checkboxes. The

Figure 10: Storytellr Search Screenshot

user answers each question by checking the appropriate boxes (see Figure 10). As the user checks or un-checks boxes, a Flickr search query is generated and submitted to the search engine. The results of these queries are continually updated in the Results pane as the user continues to make tag selections. The user can select the images to use in their story by dragging images from the search pane to the clipboard. By placing the images on the clipboard, they will be transferred to the Composition phase of the Storytellr system. The user moves on to the Composition phase but clicking the Continue button at the bottom of the page.

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5.4 Composition Phase

The composition phase is designed to support the combination of photos and a voiceover to tell a story. The goal here is to help users develop a story around the photos they selected in the Search phase. The Search phase is intended to initiate the story development thought process and the Composition phase is intended to support the completion of the story. Recall that the type of stories I intend to support contain a dramatic arc. As a result, the Composition phase supports molding the user's experience into a coherent story.

5.4.1 Composition Phase Design

The composition phase consists of two primary panes: one on the left, which contains three timelines, and a tabbed panel on the right. The tabbed panel provides access to photos placed on the clipboard in the search phase and the ability to perform a keyword search to find additional photos. Rather than provide a single timeline for the user to organize their photos into a story, Storytellr includes three. A timeline is provided for the beginning, middle and end of the story. This is done to help the user think in terms storytelling as they produce their story. Each timeline is labeled with the portion of the story it relates to. No constraints are imposed on where the photos can be placed. The timelines are meant to provide a guide for how to organize the story. To help users understand how their life experiences might fit into this structure, text is included on each timeline that briefly relates how they could make their experience work in this form. It is specifically written such that they might relate to it more than the labels of the timeline. For example, the "Climax" timeline suggests the author create some suspense and make the viewer wonder what happens next (see Figure 11). As described in Chapter 4, people do not necessarily find communicating personal experiences using plot logical. As a result, we designed Storytellr such that the interface elements related both to personal experience and

storytelling.

Each timeline contains a space to place photos and also a textbox. Clicking the textbox opens a modal dialog which contains a larger textbox and an audio recorder. The textbox can be used for writing notes or text that will be recorded and played with each photo. When ready, the user can use the recorder to flip between photos and record audio. When done, clicking the Save button dismisses the dialog box. The text that was entered in the large box is saved and displayed in the box on the timeline. Also, associations are generated to link the audio recorded to each photo. Once audio is recorded for each photo, the user can click the "Create Movie" button to generate a Flash video of their story. Traditional media production tools require the user to synchronize the audio with the visual. Storytellr uses the length of the audio to automatically synchronize the photo slideshow to the audio.

5.5 System Architecture

In an effort to integrate with current user practices, we developed Storytellr as a Flickr third-party web application available on our webserver [1]. We used PHP to access the Flickr API, which allows Storytellr to authenticate users, search and retrieve photos from a collection, and upload photos. We used JavaScript and the Yahoo API to create the interactive tagging, search and composition experiences. JavaScript also served as a bridge between the application and the Flash audio recorder. Due to the sandbox model the World Wide Web (WWW) employs to protect end-user devices from the Internet, I was not able to record audio for stories directly to the user's machine. I used Red5[2], an open source version of the Flash Streaming Server, to record the audio of users to our server. We also used the Ming[3] PHP library to automatically generate a Flash movie of the audio-narrated slideshow. During the

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[1] Available at http://otter.cc.gt.atl.ga.us/storytellr/storytellr.php
[2] http://osflash.org/red5
[3] http://www.libming.org/

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playback of the movie, the audio recorded on the server is streamed back to the user's desktop. We also used MySQL to record the tags each person created in the database so they could be reused during the tagging phase and leveraged during the search phase.

5.6 Additional Support

Throughout the Storytellr system a series of yellow boxes appeared in each phase of the interface. I learned from my work with iTell that providing goals and directions are useful when users are attempting to orient themselves in the process. In Storytellr, I included a yellow box in each phase to provide users with support related to using the interface as well as getting the intended benefit from the interface. See Figures 9, 10, and 11 for examples. The yellow boxes were intended to be helpful hints along the way and prompts to encourage users to think about how to tell their story.

Storytellr was carefully designed to merge typical photo practices with typical storytelling practices to provide an experience that provides enough support and structure to the user while still allowing the process to be fluid and steered by creativity. In the following chapter, I discuss the evaluation of Storytellr with end-users. In particular, I discuss how the system supported knowledge transformation and plot-based storytelling while providing the authors with a satisfying experience.
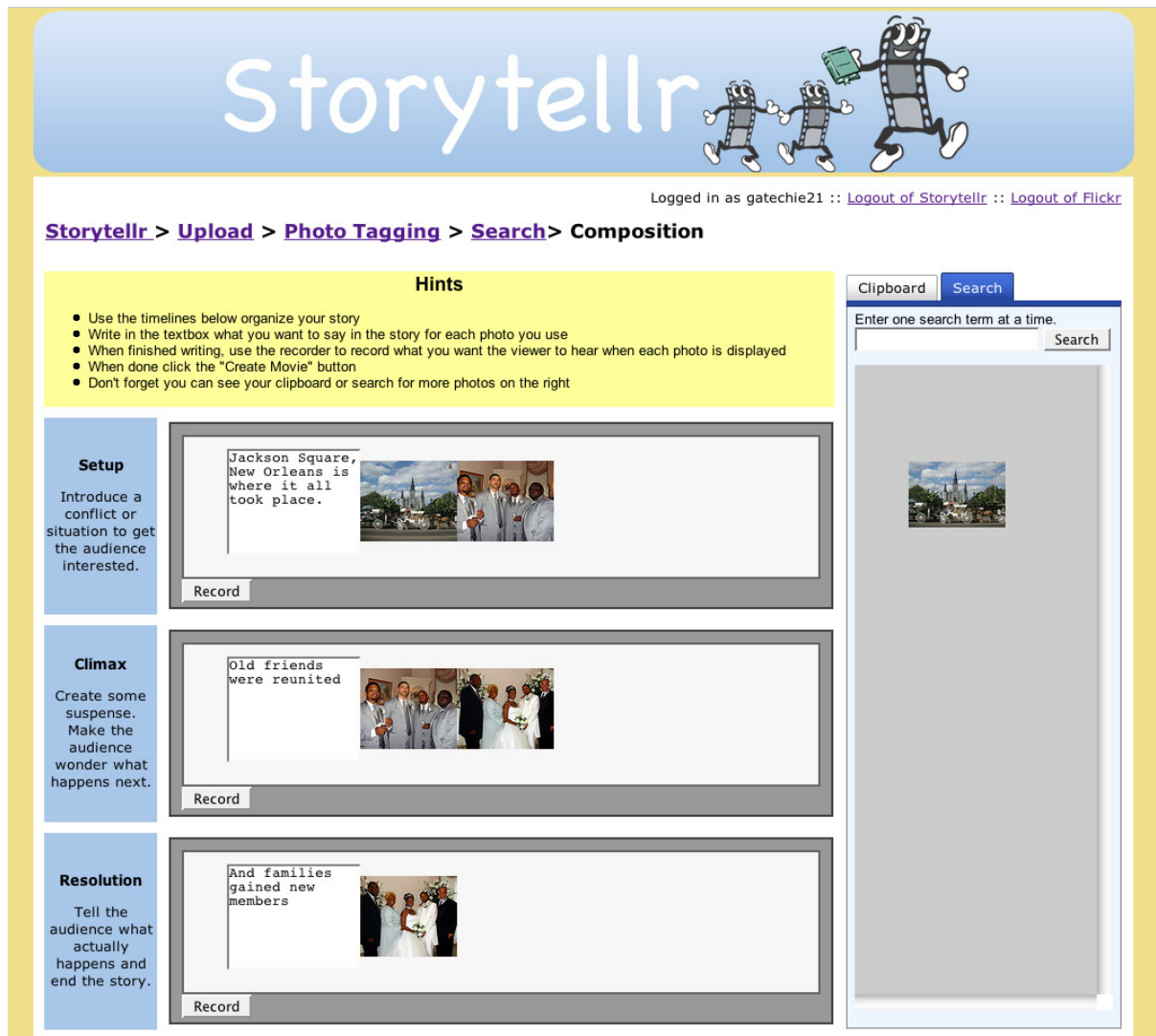
Figure 11: Storytellr Composition Screenshot

CHAPTER VI

EVALUATING STORYTELLR

Storytellr was designed to fit within current photo practices while introducing storytelling activities to support communication about personal experiences through digital photographs. Following the design and development of Storytellr, I wanted to gain insight into how successful the design of Storytellr would be at supporting knowledge transformation (or deeper thought) about experiences, which would in turn be communicated to the viewer. I was also interested in whether the experience and resulting story would be satisfying to the user. Finally I was interested in how viewers would respond to the stories produced with Storytellr. As a result, I conducted a qualitative laboratory study of Storytellr to take an in-depth look at the authoring and viewing experiences.

I chose to conduct a lab study so that I could get an up close look at how people would engage with the Storytellr process, and react to the stories they produced. Storytellr fills a space between tools that are designed to support movie construction (*e.g.,* iMovie and Windows Movie Maker) and story development (*e.g.,* Dramatica). The goal of this evaluation was to determine if the Storytellr approach to supporting personal storytelling is a successful one. Future work would determine how the Storytellr approach compares to other types of approaches or tools.

6.1 Methods

6.1.1 Authors

I recruited 10 participants from the Atlanta, GA area to participate in the Storytellr evaluation as story authors. I recruited people though digital photography forums, posts on Craigslist and word of mouth. I screened participants to ensure they met

the following conditions:

- 18 years of age or older

- owns or uses a digital camera, and

- interested in telling stories with photographs

I encouraged participants to think of 2 stories and bring in digital photos they thought would illustrate the stories they wanted to tell. Participants were allowed to bring as many photos as they wanted, but were limited to using 7-10 in their story. A photo limit was imposed to help bound the length of the storytelling activity. I asked each participant to tell one story of their choosing, and one of a time where they felt like they grew as a person. I did this to demonstrate the potential of the Storytellr system when users are oriented towards sharing stories that span several events (*e.g.,* life or anniversary story). I compensated each participant with a $30 gift card for participating in the study. I also offered an additional $5 gift card to encourage authors to help with recruiting a relevant viewer to watch and provide feedback on the viewing experience. I used surveying, observation, and interviewing techniques for collecting data about the storytelling experiences of our authoring participants. All participants completed the survey I discussed in Chapter 3 to help characterize their storytelling and media practices prior to participating in the study. We then provided participants with a workstation for creating their story using Storytellr. After transferring the photos the participant brought in to the provided workstation, I provided a brief overview of the system. Following the brief tutorial, participants were asked to create their two stories. We asked that they create a story of their own choosing and then one that tells of a time they felt they grew as a person. We alloted an hour and thirty minutes for the storytelling activity; however, we did not impose a time constraint on the participants. We wanted to ensure time was not a barrier

to completion so we would have the opportunity to understand each participants experience from start to end.

I observed and video recorded each participants experience. I also recorded the screens of participants so we could review their actions during data analysis. I asked participants to think-aloud, and prompted them to share their thoughts when interesting behaviors were observed (*e.g.,* expressions of frustrations or problem-solving). I took field notes during their interaction with the tool. Following the creation of their stories, I interviewed each participant about their impressions of the tool and their experience. I returned to each phase of the Storytellr system (*i.e.,* tagging, search and composition) and asked each participant to share their impressions. For the Tagging phase I asked participants the following:

- what the purpose of the step was and whether it achieved that purpose,

- whether there were prompts that did not make sense,

- if would they have thought about emotions if they had not been prompted to,

- what impact creating emotion tags had on their stories.

For the Search phase I asked participants:

- perceived purpose of the step and whether it achieved that purpose,

- whether the questions caused thought about how they would tell their stories,

- what impact answering the questions had on telling the story,

- whether any of the questions were difficult to answer,

- did tag-based search interfere or constrain their search for photos for their stories.

For the Composition phase we asked participants:

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- perceived purpose of the step and whether it achieved that purpose,

- why they thought there were three timelines,

- the impact they believe the three timelines had on their stories,

- whether they were able to organize their story in a way that made sense to them,

- how they made decisions about dividing the photos across the timelines,

- how they felt about recording their voice.

The interviews were audio recorded and transcribed for analysis. The authoring participants ranged in age from 19 to 29. Occupations included chemist, educator, interaction designer and student.

6.1.2 Viewers

I also recruited participants to view the stories of the authoring participants to gauge how relevant audiences react to the stories created with Storytellr. I asked each author to think of someone to view the stories they created, and help to me recruit those people as viewers. Authors were compensated with an additional $5.00 gift card and viewers were compensated with a $20 gift card for participating.

I used observation and interviewing as methods for collecting data about the viewing experiences. I recorded each participant's face as they watched the stories. Following the viewing of the stories, I interviewed each viewer about their experience. I asked each viewer to discuss the following regarding the stories:

- possible tools used

- perceived ability of the author

- appreciation of the artifact

- expectations

- emotions evoked

- detail provided

A total of four people participated in the viewer portion of the evaluation. It was important for us to gather perspectives from relevant viewers so that we could effectively assess the the author-viewer-artifact relationship. However, recruitment was much more difficult due to the limited pool of people from which to recruit. As a result, what I can claim about the viewer experience will be limited, but will provide avenues for further exploration in the future.

6.2 Analysis Procedure

I approached the study of Storytellr with a set of research questions and hypotheses concerning the impact of the system's design on storytelling with photos. Broadly, I was interested in whether Storytellr would encourage plot-based storytelling photos. Despite my top-down approach to analyzing the data, I also remained open to emergent findings. Through an initial inspection of the data and stories, I found the stories aligned with Bereiter and Scardamalia's [13] classification of writing styles. I grouped the stories and accordingly, the participants into the following groups: knowledge telling stories (KT), knowledge transforming stories (KX) and knowledge transforming stories that employ plot as an organizational structure (KXP). While KXP stories were the ultimate goal, not everyone told one. As a result, I explored the other types of stories (*i.e.,* KT, KX) users created to understand the impact of the system in those instances.

I used the case-study method [62] to analyze the data collected in both the author and viewer portions of the Storytellr evaluation. I took this approach to take a deep look at how the approach embodied by Storytellr supports storytelling. I used an

Participant Number	Any Topic	Grew as a Person
21	New Year's Eve	College Story
23	Bird Collection	Spring Break Trip
41	Child Birth	1st DSLR
17	Peruvian People	Hot Air Balloon Trip
18	Family Reunion	Conference Trip
42	Birthday Story	Overcoming Challenges in Life
26	Weekend with Friends	Home for Summer Vacation
28	Vacation	Journey to Austria
30	Parking Ticket	Trip to Portland
20	Trip Around Europe	University Years

Knowledge Telling	Knowledge Transforming	Knowledge Transforming Plot

Figure 12: Listing of Participants and Story Types

embedded multiple-case design to answer my research questions. I chose a multiple case design because theory [13] and a review of the data collected suggested that there were three types of artifacts being produced by study participants. In addition, there are multiple units of analysis within each potential case — the participants and the stories they created — which suggests the use of an embedded design. Figure 12 lists the stories of each participant and classifies each story into one of the three case types. I thoroughly examined two cases within each of the artifact categories — one as the representative of the category and a second as a replication test to ensure the findings generalized for that category (see Figure 13). The KT category was the only category that did not include more than one participant who told two KT stories.

Any Topic	Grew as a Person	Case Role
Child Birth	1st DSLR	Representative
New Year's Eve	College Story	Replication
Birthday Story	Overcoming Challenges in Life	Representative
Family Reunion	Conference Trip	Replication
Trip Around Europe	University Years	Representative
Parking Ticket		Replication

Knowledge Telling	Knowledge Transforming	Knowledge Transforming Plot

Figure 13: Cases Examined in Detail

I developed a set of theoretical propositions based on my research questions. I searched the data for evidence that supported and rivaled those propositions. I analyzed the data with a focus on the following theoretical propositions which represent my research questions. Below I list each research question and the associated proposition(s).

- RQ2: Can integrating storytelling with common photo activities (*i.e.,* Storytellr) promote knowledge transforming?

  - P2: Prompted tagging will help users engage in knowledge-transforming behaviors to extract and document meanings embedded in photos of their experiences.

  - P3: Prompted search will help users select photos from their collection relevant to the experience they desire to share.

  - P4: Story-based timelines will encourage knowledge-transforming and lead users to consider creating plot-based accounts of their experiences.

- RQ3: Can integrating storytelling with common photo activities lead to a satisfying authoring experience?

  - P5: Integrating storying into current practice will lead to satisfying author experiences as observed and reported by users

- RQ4: Can integrating storytelling with common photo activities lead to outcomes satisfying to the author?

  - P6: The Storytellr process will lead to a satisfying outcome for the author as observed and reported by users

- RQ5: Can integrating storytelling with common photo activities lead to outcomes satisfying to the viewer?

  - P7: The Storytellr process will lead to satisfying outcome for the viewer as observed and reported by viewers of author stories

For each case within each category (*i.e.,* KT, KX and KXP), I used pattern matching and explanation building as analytic techniques to draw causal links between the design features of Storytellr, the experience of users and thus the resulting stories. I also looked for evidence of rival explanations in this process. The patterns I used are based on theory about the difference in novice and expert writing behaviors. Bereiter and Scardamalia suggest observable behaviors that differentiate novice writers from expert writers [13]. The behaviors I used in my analysis are as follows:

- Revising

- Problem Solving

- Reflection

- Planning

I examined the observations (noted from watching the video collected), field notes and interview transcripts for evidence of these behaviors in each case to converge on explanations that confirm or reject the propositions. I also explored the following quantitative measures to provide additional support or denial of my propositions:

- number of emotion and theme tags created

- the number of words typed in the composition phase

- the amount of time spent composing.

By showing the stories created in each category resulted from the level of use of Storytellr supports, I can confirm the validity of the approach to supporting storytelling. In essence, this analysis can confirm that Storytellr effectively employed procedural facilitation when people engage with the supports provided to produce knowledge transformative stories. Furthermore, people who do not engage with the supports remain in the knowledge telling state which has implications for the viewing experience. To explore this I also looked at the reaction of viewers to the stories in each category to learn how the difference in the story types is perceived by viewers.

6.2.1 Representative Cases

Bereiter and Scardamalia discuss two approaches to writing that are typical of novices and professionals [13]. In this section, I briefly discuss the cases I chose for knowledge-telling, -transforming and -transforming with plot. For each I present the participant's background and then provide a transcript of the story the user told[1].

6.2.1.1 Knowledge Telling

Knowledge tellers use cues such as intended genre or topic matter to retrieve information from memory and then include the retrieved information as part of the final work.

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[1]All names and locations that could link participants to this study have been anonymized to maintain confidentiality

The knowledge teller's first draft is typically the final draft. The knowledge-teller in this work reported being an English teacher and nanny who takes photos on weekly basis, but has never created a story with pictures, though she reported a desire to do so. She also reported intermediate skill with oral or conversational storytelling and advanced skill with writing stories about personal experiences. She told two stories: one about her years in college and another about a trip around Europe. For both of her stories she engaged in knowledge telling. See the text for her college story below. Each sentence represents the audio recorded for each photo.

> That was the first stop. We're at Belguim. And I got lost in Amsterdam. And that was one of my favorites, Copenhagen. And that was Berlin's Holocaust Memorial, a very jolly place. I hate Norway. Sweden is cold. Then I went to the Old Jewish Ghetto. Hungary, one of my favorite places Budapest. And end in Venice which stinks

6.2.1.2 Knowledge Transforming

Knowledge transformers go beyond using memory cues as strategies for producing text. While the knowledge-telling process is certainly a part of knowledge transforming, it is situated within a larger context of problem solving. Knowledge transformers engage in iterative resolution of their belief and understanding of a topic as they write. They also iteratively work to resolve rhetorical issues to reach the goal of the composition.

The participant representing this category reported being a chemist and college instructor who takes photos occasionally, but has never created a story with pictures, though he reported a desire to do so. He also reported expert skill with oral or conversational storytelling and advanced skill with writing stories about personal experiences. He told two stories: one about attending the birthday party of a family member and another where he reflects on his life achievements. See the text below

for the story of his life achievements.

Baseball was my first and favorite sport. My family and friends always wondered why I wanted to play the game. Because I wasn't the most athletic, between my asthma and glasses and other health issues I was always sorta sick, but I played anyway. I got good at most parts of the game, but I was scared every single one, but not enough to quit or walk away.

Was I crazy? I know I was gettin a little older, but a kid with asthma and glasses trying play football, on like a team. ehhh why not? Once again I'm venturing out. I'm still scared, but even more determined to succeed, it's a new challenge, one more thing to prove I could meet a challenge and get a good thing out of it.

Piano recitals, booooo. No matter how many times I performed at one, no matter how many times I practiced my songs, still nightmare. The feeling while I was playing though, and when I finished especially, was truly priceless. I just learned my most difficult piece in this photo, played it for my great-grandmother and everybody else there at the nursing home that day. I got though it, but it challenged me.

Mr. John McAfee, the only school principal I ever met that took his job seriously. I mean he really wanted to see his students excel, I won a lot of awards that night. This is when he asked me to try the international baccalaureate program at the high school. He promised that it would challenge me and take my education to the highest level possible in high school. But I would have to leave most of my friends in my other classes. I had to sorta step out on faith, just take his word on it and hope I did well.

This night was special, not because it was another awards ceremony,

the lady on the far left taught my mother in high school. My high school named the National Honor Society chapter after her. This night I was inducted into the society by her and her daughter. My mom's greatest teacher offered me a hand and some words of advice: "don't stop pushing ahead."

That's my cousin Jasmine handing me an award, one I was not expecting. She had just told me and the entire high school that I'm the saluatorian for my class. She is one of my smartest cousins. It was a great moment, not just because of the award, but really because she was actually giving it to me. To me this is more like a passing of the torch, my turn to take on the task.

Dr. Palmer, the head of the school board, shaking my hand? The principal shakes everybody's hand at graduation, but not Dr. Palmer. I thought I would never work hard enough to gain his attention, let alone his respect. He had spoken to me a few times but never said too much. But on this night of graduation he told me to keep my faith strong, for my path would surely challenge me. This moment plays in my mind almost every single day, keep the faith.

6.2.1.3 Knowledge Transforming & Plot

Due to my interest in plot as a possible structure for supporting storytelling with personal photos, I also looked for instances of stories where plot was used. The composition phase of Storytellr was designed to encourage users to engage in plot-based storytelling. Three timelines were used to separate the photos by the elements of a plot: setup/conflict, climax, resolution. As expected, none of the knowledge tellers created plot-based stories, which is why this category of story is named for knowledge-transformers. This category represents knowledge-transformers who also

created a plot-based story. The participant I selected for this category reported being an Interaction Designer who takes photos on a daily basis, but has never created story with pictures though she reported a desire to do so. She also reported advanced skill with oral or conversational storytelling and intermediate skill with writing stories about personal experiences. She told two stories: one on the experience of becoming a mother and another on the experience of becoming an amateur photographer. See below for her motherhood story:

The anticipation of birth is both exciting and scary, one minute you learn that you are pregnant and before you know it you see the image of the little person you have created. The curve of their head, the bend of their spine, and the length of their arms, the little button nose, it becomes real, you're about to become a parent, you will be responsible for a life in this world.

Less than 20 weeks after the previous photo was taken, I became a parent. These beautiful feet are my newborn days after she was born. Words cannot express how stressed, fearful, and happy I was all at the same time. My new role as a mother had begun, and I had a beautiful baby girl to raise.

When she was 3 months old, my husband and I took our daughter on our first family vacation. I was scared to death to take her out of the home for the first time. It was at this trip to Savannah that she found her thumb for the first time.

Those first few weeks most of our days were spent playing in the nursery playing with toys and getting to know one another. I was still apprehensive as my role as her mother, I started questioning if I was really cut out to do this job.

Everything came to a head on our first plane ride as a family. We flew

to Maryland and this picture shows exactly how the trip went. It went from bad to worse where my daughter cried the entire way, and I became that mother who couldn't control her child. I always wondered if I was actually fit to do this job and raise this little girl.

As my daughter grew up, I grew as well. I settled into my role as a mother. Finally I was happy and content in my new role. Life was finally getting back to "normal." My daughter picked up on this and she became the happy baby I had always pictured.

Finally the baby is happy and I am happy. She trusts me and I trust myself, and we are finally free to have some fun and not have to be super baby and super mom. We can just be ourselves and that's what family is all about.

6.3   Results

I suspected there might be differences in how participants responded to their Storytellr experiences in the interviews based on the types stories our participants created (*i.e.,* KT, KX, or KXP). Thus I looked at how each case type responded to questions about the system in the interviews. Surprisingly, the results were relatively homogenous across the groups. As a result, I will discuss the response of participants to each phase of Storytellr in aggregate. In the following section, I will discuss differences I observed in the actual use of Storytellr, which I believe contributed to the difference in the types of stories produced.

6.3.1   Testing The Design

6.3.1.1   Tagging as Story Planning

The Photo Tagging Phase was designed to facilitate Brainstorming. Through observation of and interviews with my participants I found prompted tagging, particularly about emotions and themes helped people document meaning of an experience that

transcends what the photo displays (Proposition 2). In this phase, participants exhibited the *reflection* and *problem-solving* behaviors mentioned in the analysis section. Using prompted tagging they were able to elicit what the story behind the photos might be. For example one participant mentioned:

> P42: I was thinking more of the experience than actually just that snapshot, than actually that photo. And thats with like all of them, I was thinking more of that whole like moment during that picture, like right before and after, moreso than that exact moment.

Here P42 discusses *reflecting* on the experience around the moment rather than just the moment captured by the photo. Because the prompts included emotion and themes, participants also created tags that transcended what was depicted to describe how they felt about the experience (*e.g.,* anger and serenity). For example,

> P18: Happiness but also sadness because we were leaving. Hardwork. All these feelings from one picture.

Furthermore, participants expressed the benefit of the prompted tagging in terms of helping with the organization of their stories. When asked about her understanding of the purpose of the Tagging phase, P41 discussed tagging helping to "form" the story. P18 expressed a similar sentiment.

> P41: Tagging? I guess to draw emotions out, and then the emotions help to form a story. I definitely felt it was helpful to go through each picture and sort of talk about what emotions it evoked or what themes I could draw from it.

> P18: To begin reflecting on what the picture was showing and how things were coming together in the story. So I guess when I said the

whole thing about, serenity or something like that, doing that helped me to, like, put in one word the different pictures, or even the themes and all that helped me to think about how I was gonna organize my story, like, what would make sense to organize it with.

Participants expressed the importance of coming up with emotions and themes in the process of telling their stories. Although prompted tagging did help users engage in reflective exploration of their experiences, the process was not met without challenges. Again, prompted reflection encouraged users to articulate the human experience represented in the photo. While participants expressed the benefits of prompted tagging, they exhibited uncertainty about tagging with emotions and themes. Nevertheless, they were able to overcome that uncertainty with some effort.

Participants usually responded to the emotion and theme prompts with reservations; however, they would eventually come up with tags.

P21: I don't know what emotions, yea I guess I can associate emotions with it. Yea, I decided to use anticipation for an emotion because it was on our way to Time Square and we're still like 10 blocks away here. We're hoping we're gonna get there.

Even once they thought of a tag, they would question whether the tag was an appropriate answer. For example:

P21: Is sleepy an emotion? [laughs]

When participants could not come up with satisfactory tags for a photo, they would simply move to the next photo. However, I observed more tagging would help participants arrive at tag possibilities for earlier photos:

P18: And of course we have Cousin James' new ride. So this...what emotions [laughs] definitely for him, happiness but then there's also like

proud, uh pride, nah nah not pride, uhhh, we'll say happy...there is something but I think it might be better for the story...it is more like Uncle James likes to come with a new car and like but it's always like his son Danny's car and so, but he loves to like show them off and all that stuff, but I don't know how to put that in a word.

Here P18 is engaging in *problem-solving*. She is attempting to determine how she can succinctly codify her cousin's love of showing off cars. She wants to be sure she does not describe this behavior in a negative manner. She believes there is a better, more positive word, but she cannot come up with one at the time. However, as she continues tagging she discovers a better tag:

P18: And is there a theme? ummm, maybe there's also a theme showcase and maybe that's what Cousin James was doing as well. Like it's kinda showcasing something like the layout and the beauty of something, something like that, which also Cousin James likes to showcase like the cars and layout and the beauty of the food, which is what I like to showcase.

As she continued to tag, not only did she find a term to describe her cousin's actions, she was able to make a connection between her own interests and the interests of her cousin. While thinking more deeply about their experiences were challenging, prompted tagging was not a barrier to storytelling. It served to aid storytelling while helping users make sense of their life experiences.

While it seems the prompted tagging helped participants determine what their stories might revolve around, it could be the case that they were already attuned to thinking reflectively about an experience when they tag and post photos online. To explore this more, I asked them about whether they would have normally thought

about creating tags that represented emotions and themes. Participants indicated they would not have. For example,

> P42: No, I probably wouldnt have thought about the emotions, not tagging it that way. Like I said, in that part actually made me start thinking about how I felt in that moment, so actually, it was kind of neat and weird at the same time. Just 'cause you dont expect a program to sort of, you know what I mean, to do that to you.

Though they found prompted tagging challenging, participants identified the value in the process (*i.e.*, organization and story ideas generation) and derived benefit from it. Lastly, this is a process that participants agreed would not typically happen without the prompt. Thus, I claim the prompted tagging indeed facilitated Brainstorming (See Table 2) by prompting knowledge transforming behaviors (*e.g.*, reflection and problem-solving), thereby confirming Proposition 2.

6.3.1.2   Search

The prompted Search phase was designed to support further Brainstorming and Story Development (see Table 2). To manage the challenges of situation storytelling activities within common photo practices (see Section 5.2.1), I used prompting again as a means to search the photo collection for photo to include in a story. In this phase, the prompts are more oriented toward storytelling than general tagging. The observation of this phase's use along with participant's impressions yielded surprising results. Though some of the results were induced by a software bug found during the experiment, the findings provide insight into the broader process.

Participants indicated understanding the goal of this phase; however, suggested it would only provide value in the case where they had more photos on Flickr. For example:

> P20: easier to use these tags for searching when you got loads of photos

Because users were limited to 7-10 photos per story, the filtering was not necessary. I observed participants immediately place the photos they wanted on the clipboard without looking at the questions. One participant suggested for future stories a tag-based search interface would be useful, but also mentioned potential drawbacks:

> P21: Like if I wanted to go, especially if I wanted to go back and use images that I used in my first two stories in a future story, then having the search page connected to tags would be really good, although I could imagine that, based on the way it looks now, with another load of pictures in there the tags could get kind of unwieldy. Like I already have like 18 people tags on there.

While the tags could be useful for filtering the collection, the tags may need better presentation as the number of tags grows. P21 points to another benefit of searching based on photo tags: drawing connections. While the photos may have been taken at different events, tagging and searching based on those tags allows users to see photos across the collection that relate to an emotion, theme, person, etc. P18 discussed this further:

> P18: So it helped me to think about new alternatives, it helped me to think of the different options and the way that some of my different stories connected to each other.

Finally, I learned the questions were redundant. Under the assumption users would not use the system all at once, Storytellr's original design was targeted toward use in three ways: 1) tagging only, 2) storytelling only and 3) tagging and storytelling. In the evaluation participants used it in the last way. This resulted in participants using the tagging interface to think about their story as opposed to the search interface. In summary, the search interface did not evoke brainstorming

and story development (see Table 2). However, it does show potential for filtering large photo collections. Furthermore, the questions may become more relevant in the storytelling-only use case. I conclude Proposition 3 would require a different kind of evaluation to confirmed.

6.3.1.3 Composition

The Composition phase was designed to support further story development and media composition. Three timelines were provided to help with both story organization and photo organization. A writing and recording interface was also provided to allow users to document ideas, write a script and record a narration for each photo. We observed participants engaging with the story-based timelines and exhibiting the following knowledge-transforming behaviors: revising, problem-solving, reflection and planning. These transforming activities occurred under the guise of story organization. We observed participants revising the placement of photos on the timeline and then reflecting on the placement to determine if that placement makes sense. For example P42 engaged in reorganizing photos after he had placed them on the timelines. When prompted about his thought process, he responded:

> Just thinking about like uhhhh....I'm looking at the tips which definitely help, just what would be the best order of the pictures even within setup, climax, resolution. What would flow better you know, if uh, whoever looks at it.

The tips and the descriptions on the timelines caused him to think about how he would organize his story. During interviews, participants underscored the impact of the timelines on their process. Again, the notion of organization was prominent. P21 commented on the simplicity of the story model, and the importance of three timelines versus one:

Its a very basic arrangement that everyone understands. Having the three – having the timeline for each one allows for more organization. I think one timeline would just be unwieldy or just like too much to handle

They also discussed the timelines helping support the structuring of their stories:

P42: Shoot, this was to make sure that my story didnt suck. [Laughter] Really make sure I kept in mind that it wasnt just a random assortment of photos or just a random slideshow. Really try to set it up, give it some structure, and it helped. Like I said, you got the pictures there, and you can sort of get in your mind, okay, which should I show first. I dont wanna give away the whole story in the first picture? Then its like what's the point of watching the rest? So it definitely helped set everything up.

One participant even suggested the story-based timelines as an improvement over photo-sharing on Facebook[2]:

P30: Yes, it made me think about like how to construct a story like I think I think of everything. This made me think the most about how to construct the story versus just having like a slideshow with like random descriptions like you would have on Facebook.

Based on our observations and participants' reports, it seems the Composition phase succeeded in supporting story development and media composition (Proposition 4). Users were able to leverage plot-based timelines to organize the flow of their stories. In addition, they were oriented toward using a plot-based structure, though not all participants produced plot-based stories. I will discuss why in Section 6.4. First, I will discuss general author impressions of the Storytellr system as a whole.

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[2]http://www.facebook.com

6.3.2 The Author Experience

My general approach to designing Storytellr was to integrate common photo practices with storytelling activities. We discussed the overall experience with participants in terms of: time and enjoyment. We also discussed their impressions of the stories they produced. In general, participants were satisfied with the time and effort required but expressed discomfort about recording the narrations.

As I mentioned above, it was not my goal to quantitatively compare the Storytellr experience to other tools currently available. However, I did want to understand how well the process works in terms of the time and effort users would have to devote. It might be the case that the Storytellr process takes more time and effort to reach an outcome, but if the users do not perceive the process as time-consuming and tedious, I believe the approach is a successful one. Participants did not report the process as lengthy and actually perceived it as reducing time:

> P20: I'd use that definitely for something like that 'cause it would drastically reduce the time.
>
> P21: I'm guessing that one story probably took 40 minutes or so. I'm guessing. I think thats a reasonable amount of time. I didn't feel like, I never felt as I was doing it that this was taking too long, but I was also fairly oblivious to the time it took, but it felt, I felt comfortable in the amount of time it took to do the two stories.

Participants also considered the process enjoyable and one they would engage in again:

> P21: I was pretty satisfied with it...I'm pretty happy with the experience and what I got out of it. So I think this is comparable to what I was trying to do on Facebook, but I think this is better. This is better at it than Facebook is, just because of the sound, I think, in some ways.

Regarding the outcomes (or resulting stories), again participants expressed satisfactions and also shared some concerns and potential improvements. Overall, participants appreciated their stories. P42 discussed the stories as valuable to himself as the author and the recipient:

> P42:You get a bunch of pictures in your e-mail, but you never get a story with them. So I mean, actually, this is just something pretty neat that even the storymaker themselves are more likely to view those photos over and over again than if they didn't have anything, if it was just a mere folder, a mere collection.

> I'm really thinking about like even instead of buying just a card for somebody, let's say if their sick, or a birthday or anniversary, merely getting a card, or coming back from a trip or something, putting together a story. Actually, to me it's a more personal touch. It's more than written words on a page. It's the actual voice of someone that you know or love or both.

Though participants expressed satisfaction, they also raised concerns regarding control and voice narration. Storytellr automates the final construction of the story, including timing and effects. In some instances, participants wanted more control over the visual aesthetic of the final artifact. For example:

> P21: I've created PowerPoint^{TM}, which is like sort of telling a story, like a version of PowerPoint. It took significantly longer, but I felt like the final product was significantly higher quality because I had more control over the individual components. Like I could control what transitions I used. I could control like the way things would move and stuff, though I dont think the transitions are always the answer...however, I would like the opportunity to control the time it takes to fade in and fade out.

Participants expressed concern with using their own voice to narrate their stories. While they felt uncomfortable hearing their own voices, they also recognized the value for the recipient. This conflicting stance is embodied in P18's comment:

> P18: Oh, I don't like my voice on recording, but I liked the outcome of it. Like, I don't like necessarily hearing my voice on a recorder, but to me it made me wanna send it to my brother even more because, like I said, he was taking his exam in the story. To me something like adding my voice to the pictures might add something to his being able to vicariously experience what was going on.

In summary, users were satisfied with the process and the outcomes, which confirms Propositions 5 and 6.

6.3.3   The Viewer Experience

I recruited people to view the stories of our authors and asked them to share their impressions of those stories. Each author suggested a potential viewer. With their help, I recruited that viewer. Recruiting viewers turned out to be very difficult. In the end, I was able to recruit a total of 4 viewers. At least one viewer per story type participated so I can discuss reactions based on story type. However, because of the small number, I was unable to replicate these findings. Also, the viewers do not correspond to the representative cases for KX and KXP; however, they do correspond to the cases that were used as replication tests. Consequently, I cannot make strong claims based on this data. Nevertheless, the discussions of the stories with viewers do suggest further avenues of exploration.

6.3.3.1   Knowledge Teller

The viewer in this case was the husband of the author. Overall the viewer of the knowledge telling story was pleased with the story he saw. He suggested improvements

to the story might include more detail about the experience in the audio. He also mentioned using the audio as a way to connect the pieces of the story as another means of improvement.

The viewer reported the selection of the photos for the story was good.

> P20V: I think she did a good job of using only a few amount of photos to cover a pretty large period of time. And it seemed like it was a few years...the beginning and the end photo encompassed at least [a] three or four year period.

However, he felt he could use more detail about the experience:

> Yeah. I don't know if she only had a set amount of pictures she could use, but a few more pictures would have been helpful so that I would have had a more specific understanding of what she was getting out. The general conclusion that I could make was sort of a broad, it was rather broad, but it seemed to be about her university days.

He desired to know more about her relationship to the people in the photos and commented the story seemed vague:

> It seemed kind of vague...I felt like even though I could see a beginning and an end, there wasnt a lot of filler with the audio. Visually, I think it was a good thing, but audially, I think she could have filled in more with what was happening here, what was happening there.

The viewer describes the difference in what he saw and what he would have liked to see. The difference he describes is a typical difference found between knowledge telling and knowledge transforming stories. He says:

> I think although the opportunity was there with the audio to tell the story, I think she kind of fell into that, I don't know. She just sort of

described each picture as opposed to linking them together with her words. She didnt really do that in my opinion. There wasnt a beginning, middle and an end. There was just sort of, "This is what this picture is. This is what this is, and this is us doing that." I wish there might have been more words. I mean even though I like things to be succinct, do like sort of an elaborate description of whats going on. And I like for things to tie in together.

The viewer identified the lack of depth to the explanation of the experience. He found the photos she chose interesting, but the story she told too short and high-level. He also desired a more coherent story rather than a photo-by-photo presentation of the experience. Below I explore the knowledge teller's Storytellr experience more closely to determine how her interaction (or lack thereof) with the system may have led to this outcome.

6.3.3.2   Knowledge Transforming

The viewer in this case was the best friend of the author. Also, she participated in the trip the author discussed in her story. Overall, the viewer was pleased with the story. In contrast to the knowledge telling story, the viewer found the story provided the appropriate level of detail. Furthermore, she appreciated the level of focus the story maintained and how connections were made between topics in the story.

The viewer in this case also discussed the selection of the photos as a major difficulty that she thought the author did well.

First she had to select the pictures because we took over 700 pictures, so she had to select. I don't even know if that was 10 pictures or how many pictures that was, but select down to that many pictures to capture her message, which, I think, probably was the hardest part of all.

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Again, the viewer picked up on a key factor that distinguishes knowledge telling stories from transforming stories. She commented:

It was just kind of like, she picked iconic pictures. Then I also noticed that the story she, the pictures she picked didn't always talk about the exact experience that was captured there, but it was part of the story. I thought she was really descriptive about just everything that you were seeing in the pictures, from who was in the picture to the place, and what to focus your attention on in the pictures. I thought it was very, very descriptive, yeah.

In addition, she appreciated the way in which the author told the story regarding the types of details and the overall flow of the story.

And also since it was conversational, like she was actually talking, it was as if I could have took myself out of it for a little bit and it was just like, wow, this is how she felt about the trip. We never talked about that aspect of the trip. It was kind of like a step inside of [the author's] brain for a little bit.

There was a chronological flow to the story, so when you got to the new place, she transitions you into, now you're in Munich, or, I'm sorry, Berlin, and the significance of this place, and, OK now were back in Munich or wherever we were. So she had the sequence and flow of what place you were in, and who you were with, so even though they werent pictures of other people, and it was a lot of scenes, it talked about the people we went with, and because she introduced the characters earlier.

Lastly, she discussed her appreciation of the focus the story maintained and how the presentation of the story superseded traditional slideshow.

And it was kind of like a focused look of their trip, not "Here's all the pictures of my trip," but "Here are seven or eight pictures that I thought were significant." Let me tell my story of my trip through that. So I like that. I like that I didnt have to sit for a long, long time and watch it, but I did get, quickly, what happened and major sites in her trip. I guess I like the focus-ness of it, yeah, and the personalization.

Overall, the knowledge transforming story seemed to exhibit the issues of vagueness, lacking detail and discontinuity the knowledge telling story. Below I explore the knowledge transformer's Storytellr experience more closely to determine how her interaction (or lack thereof) with the system may have led to this outcome.

6.3.3.3 Knowledge Transforming & Plot

The viewer in this case was a friend of the author. Overall, the viewer was satisfied with the story. She discussed the way the story provided more insight into the experiences of the author and how it presented a short focused story. The experience of this viewer was quite similar to that of the knowledge transforming viewer.

While she did think of details she would have asked more questions about, the viewer found the photos selected for the story appropriate:

I wanted to know what happened to his friend that he ended up on crutches. But no. I think the pictures in general illustrated pretty well the story he was telling.

She discussed getting the story behind the photos and how she could make connections to her own experiences. In addition, she found the audio helped tie the photos together into a story:

Well, since it was more of a story, I got more of a feel his undergrad life and I got to see the similarities to mine instead of just the static pictures of seeing them around, I got to the story behind them.

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She compared the story she saw to a version without audio and suggests the audio adds a layer of valuable information:

> Without the audio. I think the audio really helps centers it. Otherwise, itd just be a collection of pictures and so you're left more to your imagination to figure out what hes trying to convey.

While I suspected a plot-based story might garner more praise or more satisfaction than just a knowledge-transforming story, this may not be the case. Further exploration of the experiences of viewers is necessary to develop a conclusion. Overall, the viewers of the stories were satisfied with the outcomes, particularly in knowledge transforming and knowledge transforming with plot cases. As a result, Proposition 7 is validated.

6.4   Why the stories were different

Regardless of the type of story (*i.e.,* KT, KX, KXP) produced by participants, I found participants were satisfied with the Storytellr approach and resulting story. I expected participant feedback to align with the type of story produced. For example, knowledge tellers may find the experience confusing and the supports unhelpful, which could lead to an unsatisfactory result. However, for each story type, participants appreciated the process and the stories they created. This begs the question: what caused the stories to differ regarding knowledge telling, transforming, and plot? I will discuss possible causes and my conclusions based on evidence from the data.

Individual aptitude for telling and/or writing stories could serve as one explanation for the differences in the stories. In other words, some participants may have been good at writing stories, and the supports did not actually help. As I discuss above, during interviews participants recognized the supports as helpful to them concerning creating their story. In addition, we surveyed each participant using the survey presented in Chapter 3. I examined each participants experience with telling oral or

conversational stories, experience with writing personal narratives, and the frequency with which they combine media (*i.e.,* photos, audio, etc.) to tell a story about personal experience. There were no connections between reported experience and the story outcomes. For example, the knowledge teller described in the Analysis section above reported Advanced experience with written storytelling while the knowledge transformer (with plot) reported Intermediate experience. It seems the explanation for the story differences is more complex.

I decided to more deeply explore the experiences of each storyteller by watching the recordings of their experiences. In particular, I looked for their interactions with Storytellr that indicate knowledge telling and knowledge transforming behaviors. I queried the Storytellr database to retrieve the number of tags each case type created. I used the video to determine the amount of time each representative case spent in each phase of the system (*i.e.,* tagging, search and composition). Lastly, I counted the number words in each story as a means of exploring interaction with the system. In the following sections, I present the results for each case type to show how the amount of interaction or advice taken from the system impacted the resulting story.

6.4.1 Knowledge Telling Stories

The Knowledge Teller (from here I will refer to the case representatives by the following abbreviations – KT, KX, KXP) displayed the least amount of engagement with the Storytellr system. Her experience began with uploading the photos she brought in to tell her story. Upon arriving at the Tagging interface, she reads the yellow hint box. Armed with hints for using the interface to her advantage, she began reading questions and tagging photos. Upon closer inspection, I discovered she did not create any titles or captions for her photos. In addition, KT created far fewer tags than KX and KXP (See Figure 14). KT also completed the Tagging phase quickly relative to the other case types (See Figure 16). Regarding tagging, it seems she does not engage

in much reflection on her experience. She does not seem to engage in problem-solving and reflection as we observed with KT and KXP.

In the Composition phase, KT does seem to give some consideration to her story as she hesitantly selects and places each photo on one of the three timelines. However, once all of the photos are placed, she chooses not to write any text for her story. Instead, she records audio based on memory cues, in the way collocated photo sharing often occurs [26]. The photo is used to cue memories and those memories are shared. This behavior is the hallmark of a knowledge teller and explains why KT's story indicated a knowledge telling strategy on her part. Despite her approval (as indicated by her interview responses) of the Storytellr process and outcome, by not engaging in writing as suggested by the hints in the Composition phase, her story did not achieve its full potential. This is further confirmed by KT's viewer's desire for more thoughtful detail.

6.4.2 Knowledge Transforming Stories

KX exhibited much more effort regarding story production. KX read the hints throughout the process and made use of them. During the tagging phase, KX noticeably reflected on the images as he created and assigned tags to his photos. As Figure 14 shows KX generated considerably more tags than KT. Furthermore, he wrote titles and captions for each photos, which I believe required further reflection and problem-solving. Overall, KX spent more time in the tagging process (See Figure 16). That additional time was spent contemplating titles, captions and tags for photos.

In the composition phase, KX thoughtfully chose the placement of the photos on the three timelines. He discussed trying to determine the best ordering of the photos for his potential audience. Once he's satisfied with the ordering of the photos, he proceeds to write text for his story. Here is the paramount difference between the

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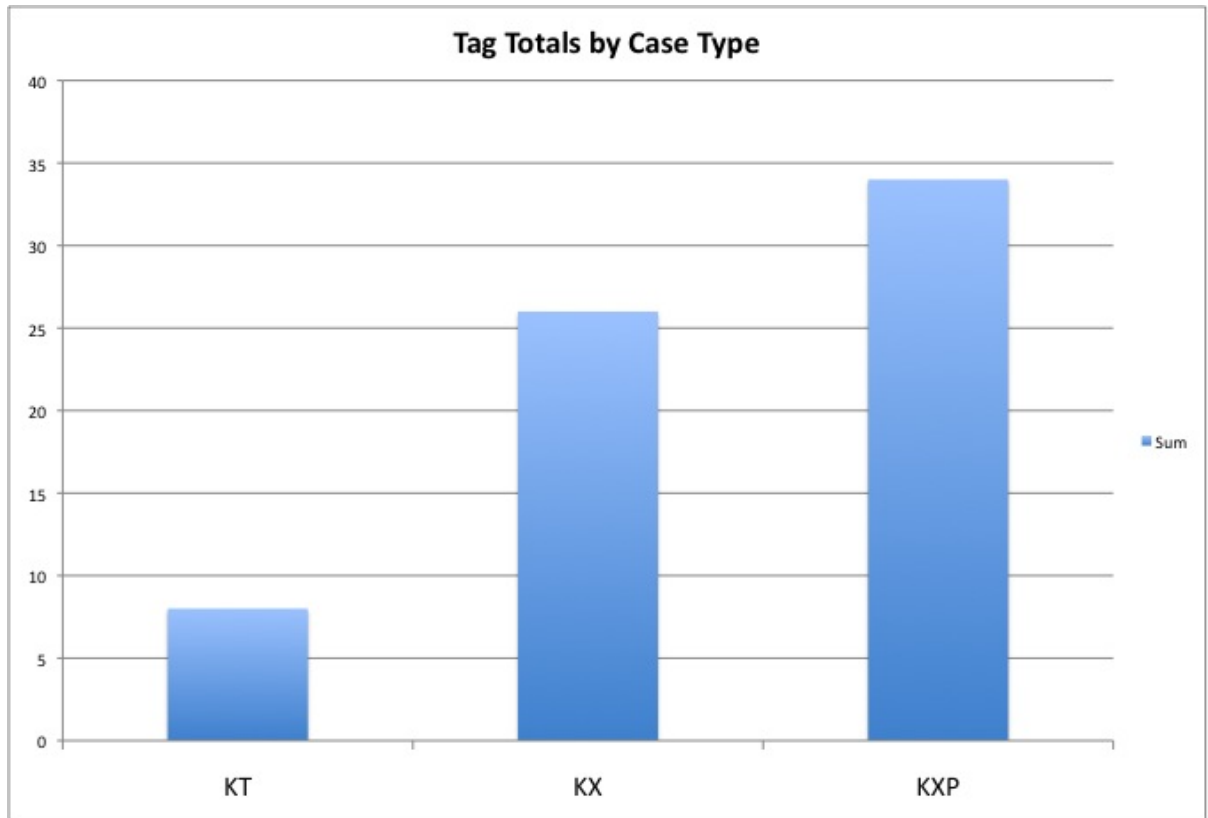
Figure 14: Number of tags produced by case type

processes of KT and KX. KX writes a considerable amount a text to record as audio (See Figure 15). For each photo, he writes a paragraph of text to record. As he writes, he revises, reflects and engages in problem-solving until he is satisfied with the text. Overall, he spends much more time in the composition process. I believe the additional time reflecting in the tagging phase and writing text in the composition phase account for the difference in the stories of KT and KX.

6.4.3 Knowledge Transformer with Plot

KXP exhibited the same behaviors KX did, but her story also followed the plot structure Storytellr was designed to support. While I observed marked differences in the processes of KT and KX, the difference in the process of KX and KXP are less pronounced. I did observe KXP take more care when examining the hints in the
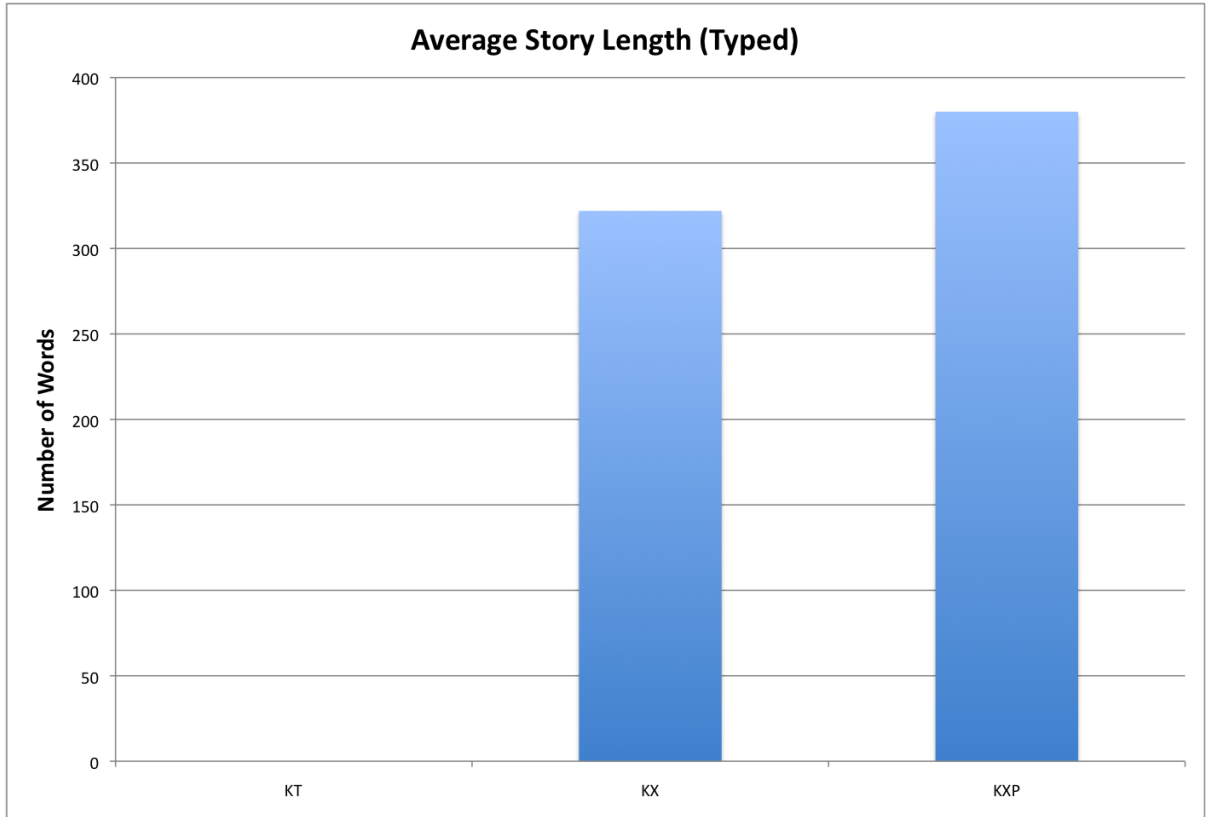
Figure 15: Average Story Length (Typed) by Case Type

composition phase. In addition, she carefully read the text describing each timeline before placing photos on the timeline. She also wrote a longer story, reflecting and revising text as she wrote. These observations however do not serve as strong evidence for the difference in the outcome. As a result, I believe further exploration is warranted to learn what factors contribute to the creation of plot-based stories versus stories that exhibit knowledge transforming, but do not follow a dramatic arc.

6.5   Thesis Contributions

My evaluation of Storytellr has made several contributions to my overall thesis. First, it has validated my design approach to supporting asynchronous storytelling with digital photos. This study has shown combining common photo activities with supports for storytelling can prompt engagement in knowledge transforming behaviors (RQ2).
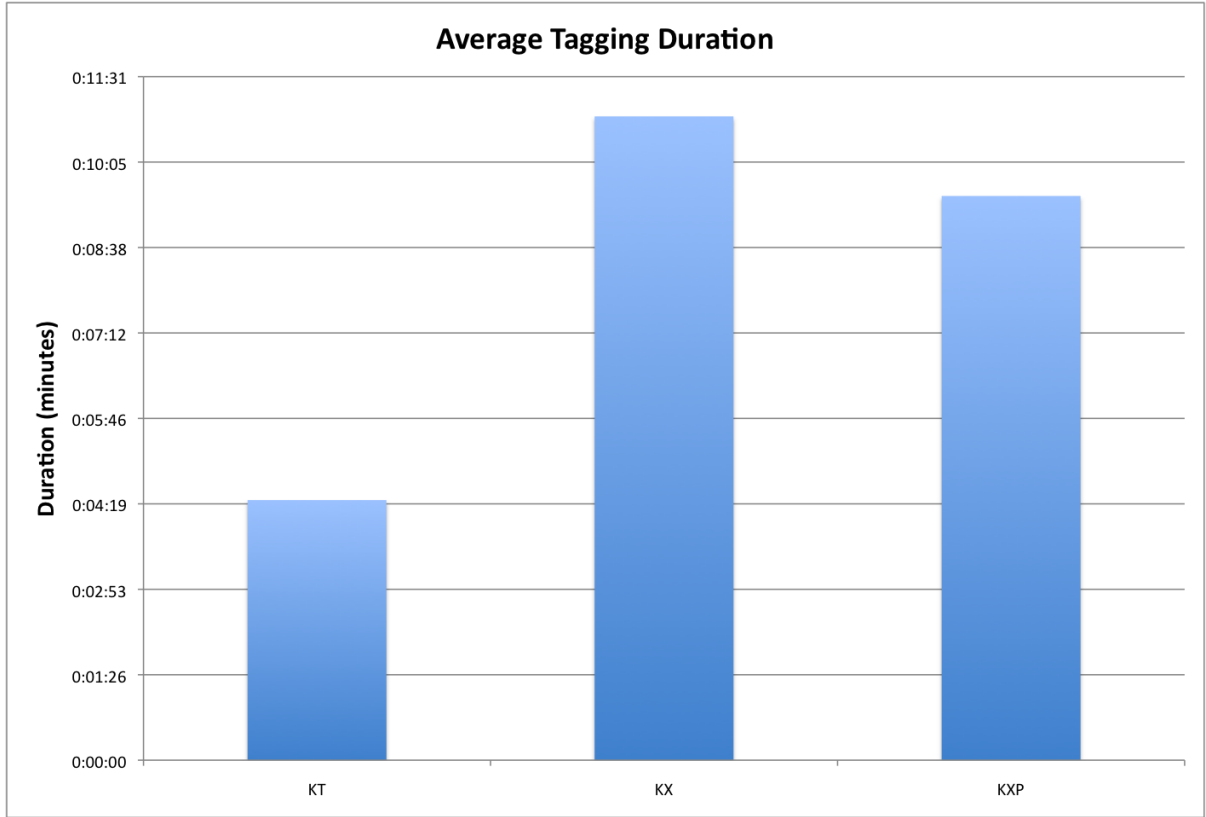
Figure 16: Average Time Spent Tagging by Case Type

As a result, people created introspective accounts of their personal experiences.

In particular, this study has shown prompting reflection within the photo tagging process can promote knowledge transforming behaviors, which extract and document meaning associated with photos, in addition to what is visible in the photo. Furthermore, I have shown encouraging plot-based storytelling through story-based timelines at the least leads people to create introspective stories. In some cases, the timelines can also lead to plot-based stories.

Second, this evaluation has shown the process by which users created their stories was not only satisfying to users (RQ3), but the stories created were satisfying to author (RQ4) and viewer (RQ5) alike. Authors found the process challenging at times, but reasonable in terms of time and effort. In the next chapter, I discuss implications for designing photo-based media communication technologies based on

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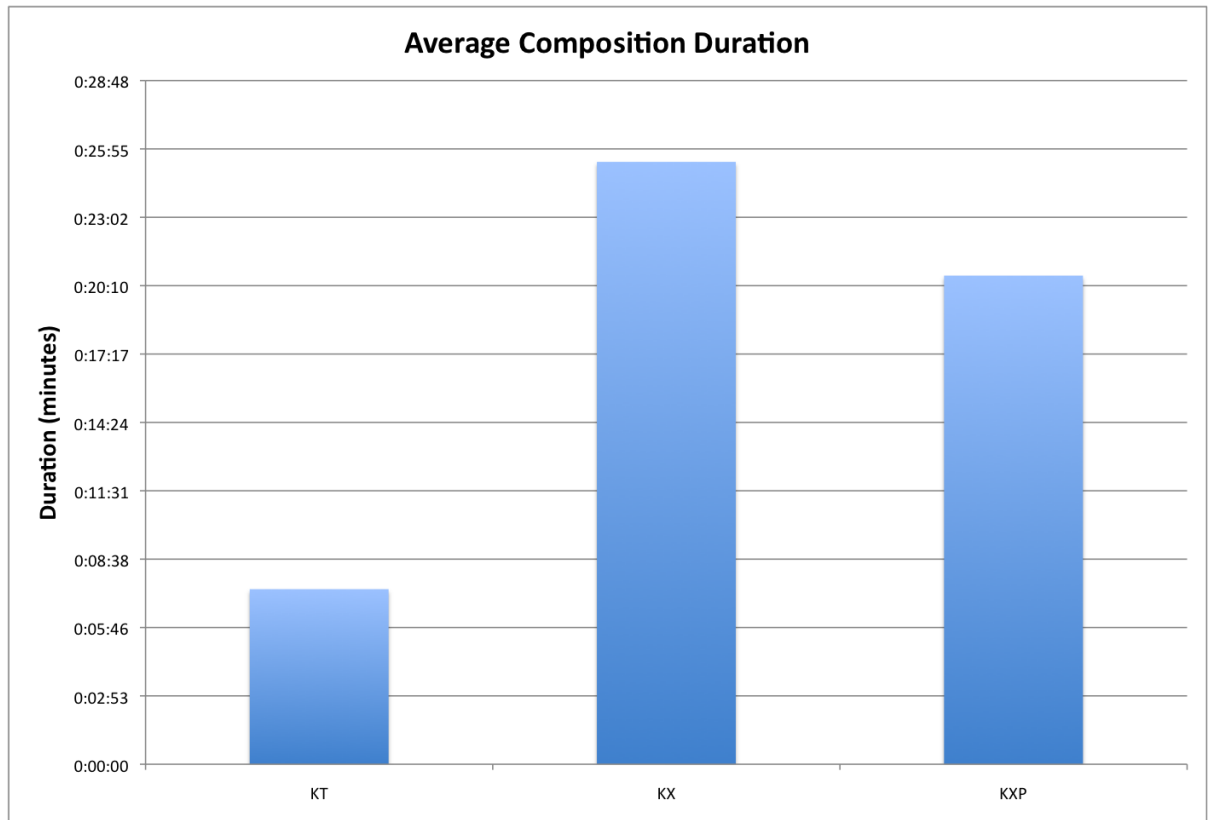
Figure 17: Average Time Spent Composing by Case Type

my experiences with iTell and Storytellr.

CHAPTER VII

DISCUSSION: GUIDELINES FOR PHOTO-BASED COMMUNICATION TOOL DESIGN

In this thesis, I have discussed two different approaches to supporting asynchronous storytelling with digital photos. The first approach employed a story-centered approach. iTell was designed to emulate some aspects of the supports I observed at the Center for Digital Storytelling workshops. Primarily, it focused on story development and less on media production. The second approach integrated more common photo activities with story development activities. From both of these experiences I have abstracted a set of guidelines from which designers of asynchronous photo communication tools can benefit. I conclude this chapter with a discussion of the population of people my participants represent – perpetual amateurs – and how my future work will center around supporting asynchronous photo communication within this group.

7.1 Use every effort in the process to the author's benefit and make that benefit apparent

The people in my studies typically had little experience with creating stories with digital photos. In addition, they engaged activities with their media more on an occasional basis than a frequent one. Though people are motivated to create stories with their photos, they do not necessarily have the time or skill. As a result, designers must consider what users are asked to invest time in, and how that investment will turn into benefit.

One of my goals with combining photo activities with storytelling activities was to provide users with storytelling support through a little additional effort in the activities they already engage in. The benefit of answering a few questions and

writing would come in two ways: richly tagged photos and an interesting story about a personal experience. The benefit of answering questions about storytelling can be unclear within the process. It is not necessarily clear to the user how reflecting about emotions will help with storytelling while using the tool. As a result, it is important to leverage early efforts of users in later stages of storytelling.

With iTell, answers to questions about the story were used to create an outline for use in the Writing phase. In Storytellr, created tags were used to help users filter their photo collections in the search phase. Storytellr could have gone even further to present the tags, titles and captions of the photos with the photos to help users develop their story.

When using the user's effort to their benefit is not possible, conveying the value of that effort is still important. Both iTell and Storytellr provided intangible benefits to users. Prompting users to reflect on their experiences initiated a thought process from which users derived themes for their stories. In the case of Storytellr, users reported the usefulness of the Tagging phase in relation to helping them to form their stories. Though there was no tangible benefit to the user, there was an impact on the experience. By helping users see how activities like tagging might benefit them, we might encourage users to engage in activities that may otherwise seem pointless.

7.2 Balance photo activities with writing activities

I approached the design of iTell with emphasis on writing based on our observations of the CDS workshops and literature on screenwriting and video production. My experience with end users uncovered the need to consider media as an integral part of the story development process as opposed to considering it once the writing is complete. To address this inequity, I was careful to design Storytellr, such that interacting with media and writing were central to the process.

Through my evaluation of Storytellr, I found users no longer complained about not

being able to access to their photos when they were writing. In the iTell evaluation, photos served two functions: reminding and guiding. Through tagging participants were able to reflect on their experience, and participants reported this interaction helped them develop a plan for their story.

Overall, I recommend designers seriously consider the co-dependent nature of photos and writing. Photos act as cues about the experience, bringing back the memories of the experience. Writing acts as a mechanism for helping making sense of the experience captured in the photos. Writing often leads to reconsideration of the photos ,and viewing photos leads to revisions of the text. Both are necessary and should be supported equally to create a process, in which the user can move fluidly between reflecting and revising.

7.3 Limit the number of photos that can be used to illustrate the story

I gave users a rough limit of 7-10 photos for telling their stories in both the iTell and Storytellr evaluations. I obtained this limit from the storytelling workshops I observed. It served to bound the length of the story and thus the storytelling endeavor. Making the decision of what photos to include in a story can be a difficult one. By selecting a set of photos for use, the storytelling effort becomes considerably more tractable. Limiting the number of photos that can be included in a story helps users begin to focus on what is important in the experience and select images to represent that. Other forms of photo sharing (*e.g.,* photo albums) can be used to share the more comprehensive set of photos. Viewers of stories created with Storytellr discussed their appreciation for the focused nature of the stories. I believe part of this can be attributed to the soft limit I imposed.

While nothing in either system enforced the limit, participants stayed within the limit. In a more natural setting it may be necessary to impose a hard limit above 10 (*e.g.,* 15) photos to keep users from engaging in creating a story they fail to complete

because they cannot manage to weave the number of photos into a coherent story. In addition, users might also begin to include photos that do not necessarily contribute anything new to the experience. Either way, the potential impact is creating a confusing or boring experience for the viewer. Thus, I recommend designers impose a limit appropriate for the artifact being created. In my experience, a limit of 7-10 photos provides enough content to illustrate the experience while maintaining focus.

7.4   Balance automation with user control

Based on findings from studying the storytelling workshops, I designed iTell and Storytellr to automate aspects of the media production process, particularly synchronizing the photos with the audio and generating the final artifact. This removed many of the challenges of creating the end product. However, with that benefit comes limits on control over how the final artifact will look. Storytellr in particular calculated the timing of photos with audio and used a cross-dissolve effect for transitions between photos. While this produced a polished outcome, some participants wanted more control. As discussed earlier, users desired to tweak timing and aesthetic aspects of the resulting story.

Finding the balance between automation and user control can be difficult. While some people may be comfortable with having more control over the outcome, others may find control overwhelming. I chose to maintain flexibility throughout Storytellr based on my experience with iTell. In each phase of Storytellr, users were encouraged to engage in particular activities, however, there was always an option to circumvent any particular support. For example, users could have chosen not to tag any photos and click the upload button as each photo appeared. However, the benefit of engaging in the activity is lost. Generating the final story was the only process the user could not circumvent. While I believe this approach is reasonable for a diverse set of users, for more advanced media storytellers, more control over the final outcome might be

warranted. It is important for designers to consider the experience level of their users and provide opportunities to make individual adjustments to their stories should they desire to deviate from the prescribed process.

7.5   Future Work: Designing for the Perpetual Amateur

The shift from analog to digital technologies has initiated a multimedia production revolution. Activities (*e.g.,* movie production, animation and high-quality photography) once limited to professionals with specialized training and access to expensive tools are now accessible to the average person. As a result, end-users are creating content for mass consumption. In particular, a group of skilled content producers often referred to as amateurs has emerged. This group has been the focus of my study of asynchronous photo storytelling. Typically amateurs use semi-professional tools and produce content which can rival professional content. In this thesis, I have studied a group of people who are neither novices nor amateurs in the traditional sense. While they also have a desire to create complex artifacts, the challenges often outweigh the benefit. I refer to this group as perpetual amateurs. Perpetual amateurs are those people who are (1) not new to a particular technology, (2) desire to produce more engaging artifacts, but (3) do not possess the skills to do so. I will discuss key differences between traditional amateurs and perpetual amateurs in the context of digital photography. I continue by highlighting the implications of these differences for the design of tools for supporting perpetual amateur photo communication and suggest using current practices to extend the abilities of the perpetual amateur.

7.5.1   Traditional Amateur vs. Perpetual Amateur

In the context of digital photography practices, Miller and Edwards found differences between the Kodak Culture as defined by Chalfen [15] and traditional amateurs (or Snaprs) [46]. The perpetual amateur fits within the Kodak Culture and typically does not engage in digital photography as a hobbyist or enthusiast. In this section, I expand

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on this work by codifying the differences between traditional and perpetual amateurs in a list of characteristics. The characteristics are: occupation, time, motivation and community. We use photography as a persistent example to convey the differences between traditional and perpetual amateurs.

7.5.1.1 Occupation

A common way to distinguish amateurs from professionals is based on whether they engage in a practice as an occupation or solely for leisure. For example, a professional photographer uses tools of the trade (*e.g.,* professional cameras and lenses), and would expect to be paid for any services rendered. The amateur photographer also uses professional tools and attempts to produce professional outcomes; however, amateur photographers do not possess the level of skill that would merit compensation similar to a professional. The perpetual amateur neither uses professional tools nor attempts to produce a professional outcome. The perpetual amateur is the consumer of digital photo point-and-shoot cameras. This class of user takes photos for personal use, and certainly does not expect to be compensated. The reward for the perpetual amateur photographer is the generated photo archive and the photo sharing experience.

7.5.1.2 Time

Another means of distinguishing professionals from amateurs is by the amount of time each devotes to a particular activity. The perpetual amateur devotes the least amount of time because the activity serves a utilitarian purpose versus acting as a personal hobby. To continue with the photography example, the professional photographer would dedicate a significant portion of the day to performing services for people. Also, the professional produces photographs on a frequent (likely daily) basis. In contrast, an amateur photographer has a profession other than photography to which they must attend. As such, amateur photographers spend personal time taking photographs, again for little or no compensation. Though they produce less

frequently than professionals, they produce content (*i.e.,* digital photos) on a regular basis. Perpetual amateurs neither have the time to commit due to their profession, nor the desire to engage in photography for fun. The perpetual amateur photographer takes photos for a purpose. Typically, family events and other milestone occasions prompt the perpetual amateur to take photos.

7.5.1.3 Motivation

Professional photographers are intrinsically motivated by their passion for photography as well as extrinsically motivated by the income their skills can produce. Amateur photographers tend to be motivated by their intrinsic passions for photography and as a result will devote spare time to learning about the craft and improving their skills. The perpetual amateur photographer is intrinsically motivated by the desire to share experiences. A particular event provides the trigger to engage in photography; however they do not devote energy beyond the event to improve their abilities and the types of artifacts they share.

7.5.1.4 Community

Professionals as well as traditional amateurs participate in communities centered around a topic of interest. In the case of photography, many communities exist socially and virtually that act as support for the traditional amateur. Grinter discusses the practices of such communities [27]. Members of amateur photo communities often participate in competitions to showcase their work and solicit critiques. For the perpetual amateur, such a cohesive group does not exist. Perpetual amateurs do showcase their work, but they usually present their work to the people who are in the photos or have a genuine interest in the photo content. While the perpetual amateur's audience may provide critiques, the critiques are likely not to impact the perpetual amateur's behavior drastically.

In summary, perpetual photo amateurs do not engage in photography as an occupation or hobby, but to document life. They are motivated by the moments of life they wish to capture for posterity. As a result, they dedicate time to photography when a particular event is significant to warrant documentation. They are also willing to expend effort in the pursuit of sharing experiences with others. They are not interested in improving their abilities; therefore a culture of critique is not necessary. The perpetual amateur showcases his or her content for the purpose of sharing, not self-improvement. Though perpetual photo amateurs exhibit vastly different behaviors from traditional amateurs, still perpetual amateurs have adopted digital photography. Furthermore, I have shown in this thesis they do desire to create artifacts similar to those produced by professionals and traditional amateurs. However, they engage in digital photography from a different perspective, and thus we must take a different design approach to address this arguably larger group of amateurs.

7.6 Future Work: Leveraging the Common to Support the Challenging

Given the perspective of the perpetual amateur, simply designing systems that assumes the target users are domain experts is insufficient. Furthermore, designing more usable systems for this group is also insufficient. There is a fundamental difference between the domain expert and the perpetual amateur. Essentially, design for perpetual amateurs must extend their capabilities without the commensurate effort that is typically required to develop those capabilities. Miller and Edwards propose a form of email as an idea for the "killer app" for the Kodak Culture [46] due to it's flexibility. I believe the "killer app" will certainly involve supporting storytelling explicitly. Furthermore, I believe for the Kodak Culture and perpetual amateurs alike, the technological solution to communicating with photos must leverage their current practices to enable them to accomplish more.

For example, in my work I have found that perpetual amateurs desire to create

digital stories with their photos. However, I discovered engaging in digital story production requires a great deal of proficiency in multiple areas (*e.g.* photo editing, audio recording, video composition, writing). The perspective of perpetual amateurs directed us to consider designs which would allow them to achieve their goals without requiring a significant amount of additional time, effort and skill.

We decided to enhance the digital storytelling capabilities of perpetual amateurs by coupling their current photo practices with storytelling practices. The result was the Storytellr system. Storytellr integrates the key aspects of the storytelling process with common photo activities.

Perpetual photo amateurs approach photography from a different perspective, thus we must approach design for this group differently as well. It is important to note the differences I have outlined do not suggest that behavior falls into two mutually exclusive categories. Certainly, there are people who take photos on a regular basis, but do not wish to participate in amateur photo communities. Conversely, there are people who begin as point-and-shoot photographers and gradually adopt the practices of amateur photographers. My purpose has been to explore the differences, such that we can begin to think about designing for other types of amateurs, whether perpetual, or somewhere inbetween perpetual and traditional. In the future I plan to explore how common behaviors prior to photo events and at the time of capture can be further leveraged to help people communicate over distance using photos.

7.6.0.5 Reorienting Capture around Storytelling

We suggest thinking of ways to help users reach their goal of creating stories, or at the least, help them provide more detail. This must occur without users having to acquire skills and dedicate an exorbitant amount of time or effort. Rather than designing such that we help users create comprehensive records of experiences, we should design such that any activity related to photos focuses on supporting sharing.

While sharing may not always be the goal, it certainly does occur frequently enough to warrant exploration of new methods for supporting sharing, especially over distance and time.

I conjecture leveraging the motivation and effort that go into photowork activities can alleviate the challenges to photo sharing posed by distance. Kirk *et al.* provide us with a context to frame such an effort. In particular we suggest exploring ways in which we can leverage photowork activities users already engage in to reduce the time and effort it takes to produce richer photo albums to communicate with others.

Many researchers have reported on the activities that occur around photos (*e.g.* [51, 7]). I propose using activities such as organization, annotation and even co-located viewing to ameliorate the process of creating enhanced presentations of digital photos. For example, the act of annotating photos could indicate the photo's importance and signal its inclusion in albums available to public viewers. As a result, a distinction between the photo archive and photo album is made. Not all photos captured are meant to be shared. However, current tools make no distinction and thus viewers are overwhelmed. Leveraging an already occurring activity eases the author's burden while improving the viewer's experience.

In addition to leveraging post-capture activities, future work should also explore how activities occurring at the point of capture could be exploited. For example, we should investigate ways to encourage users to assign meaning to photographs while in the moment so that they would not have to do so later. They could share their photos with the detail viewers desire without significantly more effort. The challenge here is to make the process of assigning meaning relevant at the point of capture and also relevant for sharing across distance and over time.

It may also be prudent to consider how to spread the task of editing throughout the production cycle. If the author will be confined to documenting the event in the first place, we suggest exploring ways in which the author can perform some

of the editing tasks in the recording context. On-camera tools that provide easy and effective interactions for making judgement calls could help reduce the editing effort required to share an artifact of appropriate length. Jokela *et al.* have made progress in direction by providing editing capabilities on the capture device itself [31]. A modified form of selective archiving [29] might also prove fruitful here. Rather than store every snap of the camera for later review, only save those snaps the user confirms as worthy of saving. Following a certain time period, all other photo or video segments would disappear. While it may seem an extra burden, consider the practice many photographers engage in where the photographer and even the photographed immediately review photos taken for quality, smiles, etc. A minimal effort early on could significantly reduce later challenges.

Pre-capture activities concern the preparations taken to ensure the appropriate people, scenes, etc. are captured for some later purpose. Everyday people do not typically perform pre-capture activities beyond ensuring the camera is functional (*e.g.* has batteries and film or storage card). For example, I suspect it is uncommon for the average person to think about what events they should capture at a birthday party prior to the party. Instead they determine during the experience what may be of interest to capture and potentially miss captivating moments. Furthermore, I contend that people think even less about stories they might tell using their images. I argue that some simple pre-capture activities should initiate the storytelling endeavor to create a more satisfying experience. Resources on photography typically center around technique (*e.g.* lighting, framing, viewpoint). To provide better support, help resources must go beyond technique to use. In terms of use, particularly storytelling, moviemaking professionals employ a number of tools for directing capture so that a good story can be constructed using the captured media. Some of these tools include storyboarding and storywriting software (*e.g.* Dramatica [14]). In practice these tools are impractical considering the amount of time required to put them to use (days to

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months) and the amount of time people currently spend preparing to capture an event (minutes to hours).

Adams *et al.* argue that "any final solution must enter the media creation process before capture for the twofold reason of (1) the need for certain content, and (2) the need to capture that content in the manner required" [6]. The media creation process refers to the steps required to produce an artifact that communicates an experience. They present a computational model for supporting videographers which explicitly includes as an initial step the creation of an "abstract media-non-specific story" by the author either from scratch or through a wizard or generative interfaces. The authors provide no specific support or suggestions outside of suggesting the user engage in the story composition process. In a sense, the authors recognize the importance of creating a good story, yet forego designing support for an element they consider necessary to drive the rest of their process. I plan to explore solutions that take advantage of pre-capture activities and at-capture activities to support storytelling with photos.

The point at which media is captured represents another opportunity for researchers to support storytelling with personal media. At capture, a number of approaches could be used to aid the user in capturing purposeful, better-quality media. These include direction, reminding, and annotation. I will discuss how each of these categories have the potential to improve the quality of story.

7.6.1 Direction

Adams *et al.* list the following as common novice capture issues:

- placing every subject in the center of the frame,

- overuse of zooming,

- being stationary versus finding interesting angles,

- overuse of panning,

- shooting everything from eye-level,

- low capture quantity and

- inappropriate lighting.

Given their findings, we can assume novice photographers tend not to take photographs that possess artistic quality though they may have sentimental value nonetheless. To help users create quality, reusable media assets, consumer-oriented imaging companies as well as multimedia researchers have developed interventions which provide direction to the user about taking photos and video. Typically resources on photography provide advice on how best to take photos. For example, the Kodak Tips & Project Center webpage suggests getting down on their level, using a plain background, knowing your flash's range and watching the light to name a few [35].

Marc Davis *et al.* have explored developing systems that direct humans in the capture of video [20]. A feedback loop is used to provide the user advice at capture which is then evaluated by a system and corrected when necessary. Adams *et al.* also have developed interfaces which direct but also negotiate with the user during a video shoot [6].

Although these resources potentially increase capture proficiency, they do not address how photos might be used nor the impact the capture process may have on that use. Capture uninformed by use can lead to situations in which the media captured may not be sufficient to communicate an experience. The problem of particular concern is the lack of an opportunity to re-capture past events which can be detrimental to personal story authoring. The result is a re-construction of past experiences that are limited to the captured media. Alternately, stock footage can be used to symbolically bridge the gap. However, evidence from previous work suggests that storytellers would actually exclude particular parts of experiences due to lack of captured media
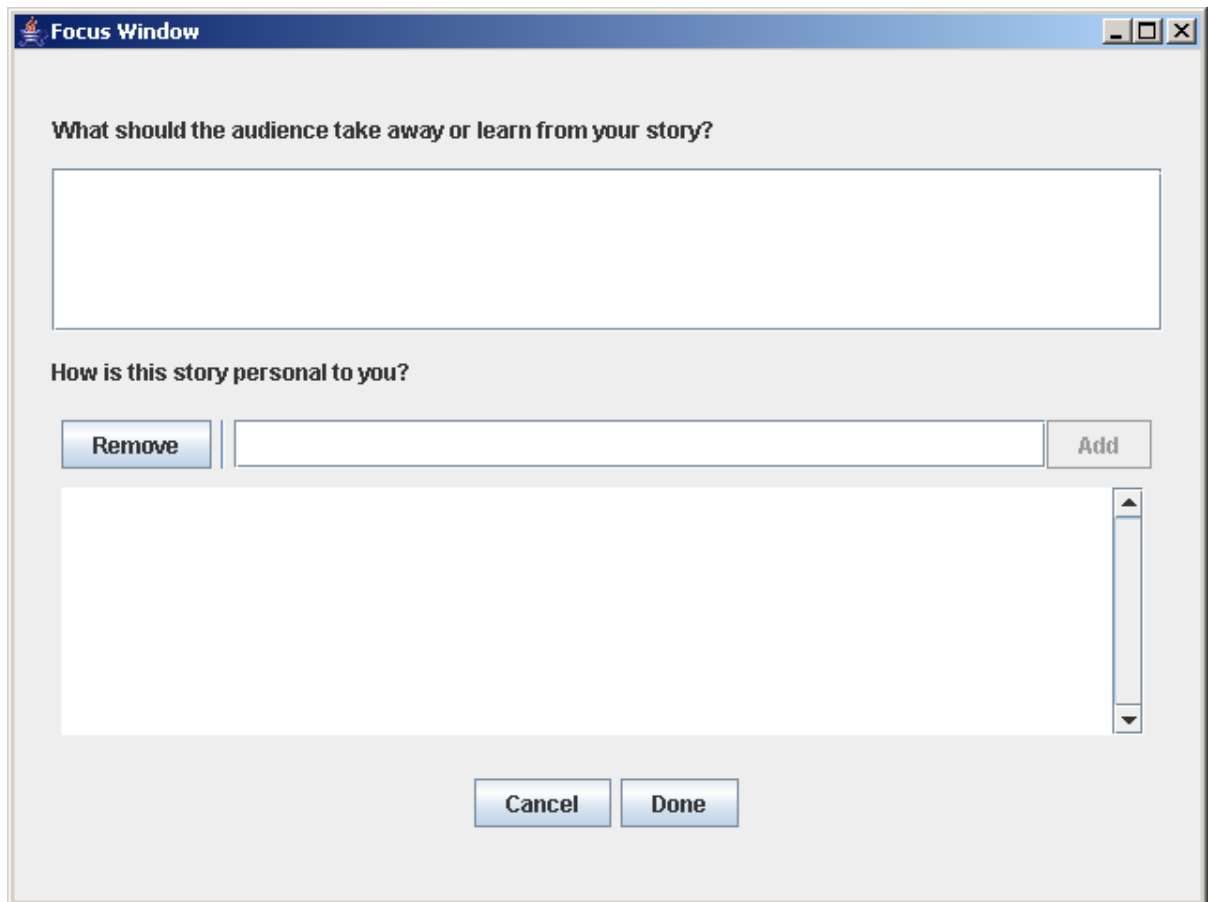
even if the stock footage could actually or symbolically substitute for the missing media [38].

Annotation at the point of capture can be advantageous to storytellers. Supporting the ability to record emotions and thoughts experienced during an event can serve as memory cues or actual content later when creating a story. A potential interface to help storytellers would elicit and record the user's thoughts during an experience. The recordings could then be used to index images according to experience. Indexing images according to experience could be leveraged to search according to experience to revisit moments of an event and integrate those moments into a story.

Storytelling is on the path to becoming a widely used form of expression. Communities of digital storytellers already exist (*e.g.,* Capture Wales [12] and Creative Narrations [4]), and are continually growing. Filling the gap in support to allow users to move from creating simple artifacts to producing stories that are more advanced is necessary to enable more widespread access to this desired form of expression. The work I have presented in this thesis provides guidance for how these types of tools might be developed. I have also made suggestions for how leveraging common activities pre-capture and at-capture might provide even more suupport. I hope by addressing the issues exposed by this work, we can bring personal expression in this form to everyday people, everywhere.

APPENDIX A

ITELL PROMPT INTERFACES

Figure 18: iTell Focus Question Interface
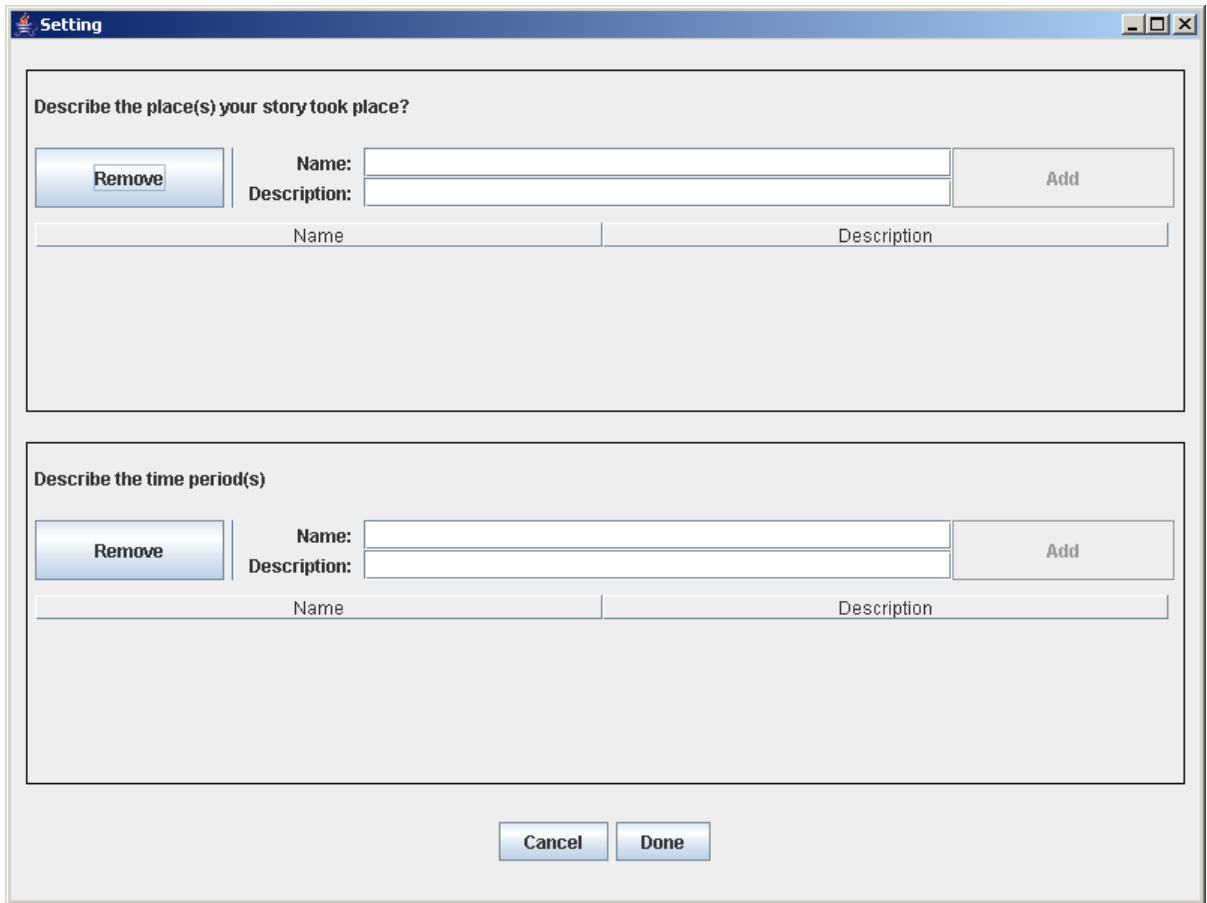
Figure 19: iTell Audience Question Interface

Figure 20: iTell Setting Question Interface

Figure 21: iTell Plot Question Interface

APPENDIX B

PERSPECTIVE STUDY QUESTIONNAIRE

Instructions: This survey will ask you questions about your digital media viewing and creation preferences. Please answer all questions to the best of your knowledge and as completely as possible. Fill in the ovals as completely as possible. For questions with multiple choices, select only one answer unless the question specifies otherwise. If you have any questions, do not hesitate to ask.

Background Information

1. Age? _____

2. Gender?

        ○   ○

       Male   Female

3. What is your occupation?

	Daily	Weekly	Monthly	On Occasion	Never
4. How often do you use a computer?	○	○	○	○	○
5. How often do you take digital pictures?	○	○	○	○	○
6. How often do you record video?	○	○	○	○	○

VIEWING PRACTICES

Home Video

This set of questions will ask you about your experiences with *home video*. Select the answer that applies most. For the purposes of this survey, *home video* is roughly defined as video that was recorded using a personal video recorder (*e.g.* a camcorder) for the purpose of documenting a personal experience (*e.g.* birthday, vacation, graduation, etc.)

	Daily	Weekly	Monthly	On Occasion	Never
7. How often do you view *home video* (yours or someone else's)?	O	O	O	O	O

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
8. I am satisfied with the ability of *home video* to describe personal experiences.	O	O	O	O	O
9. I am satisfied with the typical length of *home video*.	O	O	O	O	O
10. I find *home video* entertaining.	O	O	O	O	O
11. I would find *home video* more satisfying if it included a *storyline.* (A storyline is set of causal events that introduces a conflict, rises to a climax and resolves the conflict.)	O	O	O	O	O
12. I would find *home video* more satisfying if it included a *soundtrack (i.e. background music)*.	O	O	O	O	O
13. I would find *home video* more satisfying if it included *sound effects*.	O	O	O	O	O
14. I would find *home video* more satisfying if it included *vocal narration* (*i.e.* a person using his/her voice to describe what is happening in the video).	O	O	O	O	O

15. I would find *home video* more satisfying if it included *special visual effects* (*e.g.* fading in and out).

16. I would find *home video* more satisfying if it included an *introductory sequence* (*e.g.* a theme song or title sequence).

O	O	O	O	O
O	O	O	O	O

Online Video

This set of questions will ask you about your experiences with *online video*. Select the answer that applies most. For the purposes of this survey, *online video* is roughly defined as video that was created for the purpose of distributing to a public audience via the Internet. Online video sources could include YouTube, MySpace, Facebook, news organization websites, etc.

	Daily	Weekly	Monthly	On Occasion	Never
17. How often do you view *online video*?	O	O	O	O	O

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
18. I am satisfied with the ability of *online video* to describe personal experiences.	O	O	O	O	O
19. I am satisfied with the typical length of *online video*.	O	O	O	O	O
20. I find *online video* entertaining.	O	O	O	O	O
21. I would find *online video* more satisfying if it included a *storyline*.	O	O	O	O	O
22. I would find *online video* more satisfying if it included a *soundtrack (i.e. background music)*.	O	O	O	O	O
23. I would find *online video* more satisfying if it included *sound effects*.	O	O	O	O	O

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24. I would find *online video* more satisfying if it included *vocal narration.*

○	○	○	○	○

25. I would find *online video* more satisfying if it included *special effects (e.g. fading, transitions, etc.).*

○	○	○	○	○

26. I would find *online video* more satisfying if it included an *introductory sequence (e.g. a theme song?).*

○	○	○	○	○

Digital Photo Slideshows

	Daily	Weekly	Monthly	On Occasion	Never
27. How often do you view *digital photo slideshows*?	○	○	○	○	○

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
28. I am satisfied with the ability of *digital photo slideshows* to describe personal experiences.	○	○	○	○	○
29. I am satisfied with the typical length of *digital photo slideshows*.	○	○	○	○	○
30. I find *digital photo slideshows* entertaining.	○	○	○	○	○
31. I would find *digital photo slideshows* more satisfying if it included a *storyline*.	○	○	○	○	○
32. I would find *digital photo slideshows* more satisfying if it included a *soundtrack (i.e. background music)*.	○	○	○	○	○
33. I would find *digital photo slideshows* more satisfying if it included *sound effects*.	○	○	○	○	○
34. I would find *digital photo slideshows* more satisfying if it included *vocal narration.*	○	○	○	○	○

35. I would find *digital photo slideshows* more satisfying if it included *special effects (e.g. fading, transitions, etc.)*.

○	○	○	○	○

36. I would find *digital photo slideshows* more satisfying if it included an *introductory sequence (e.g. a theme song?)*.

○	○	○	○	○

Digital Photo Albums

	Daily	Weekly	Monthly	On Occasion	Never
37. How often do you view *digital photo albums*?	○	○	○	○	○

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
38. I am satisfied with the ability of *digital photo albums* to describe personal experiences.	○	○	○	○	○
39. I am satisfied with the typical length of *digital photo albums*.	○	○	○	○	○
40. I find *digital photo albums* entertaining.	○	○	○	○	○
41. I would find *digital photo albums* more satisfying if it included a *storyline*.	○	○	○	○	○
42. I would find *digital photo albums* more satisfying if it included a *soundtrack (i.e. background music)*.	○	○	○	○	○
43. I would find *digital photo albums* more satisfying if it included *sound effects*.	○	○	○	○	○
44. I would find *digital photo albums* more satisfying if it included *vocal narration*.	○	○	○	○	○
45. I would find *digital photo albums* more satisfying if it included *special effects (e.g. fading, transitions, etc.)*.	○	○	○	○	○

46. I would find *digital photo albums* more satisfying if it included an *introductory sequence (e.g. a theme song?)*.

○   ○   ○   ○   ○

CREATION PRACTICES

47. What types of multimedia projects do you create now or have you created in the past with your digital photos (**select all that apply**)?

○ Television Program   ○ Digital Photo Slideshow

○ Movie   ○ Digital Photo Album

○ Home Video   ○ Story with Digital Photos

○ Online Video   ○ None

○ Other_____

48. What types of multimedia projects are you interested in creating with your digital photos (**select all that apply**)?

○ Television Program   ○ Digital Photo Slideshow

○ Movie   ○ Digital Photo Album

○ Home Video   ○ Story with Digital Photos

○ Online Video   ○ None

○ Other_____

49. How often do you combine any of your photos, video and other media (*e.g.* music or voice) to tell a story?

○   ○   ○   ○   ○
Daily   Weekly   Monthly   Occasionally   Never

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50. How often do you create *digital photo albums*?

○	○	○	○	○
Daily	Weekly	Monthly	Occasionally	Never

Creation Skills

	Expert	Advanced	Intermediate	Novice	None
51. Rate your experience with telling oral or conversational stories.	○	○	○	○	○
52. Rate your experience with writing personal narratives (*i.e.* stories about personal experiences).	○	○	○	○	○
53. Rate your experience with digital photography.	○	○	○	○	○
54. Rate your experience with taking video.	○	○	○	○	○
55. Rate your experience level with *digital* photo editing.	○	○	○	○	○
56. Rate your experience level with *digital* video editing.	○	○	○	○	○

Creation Beliefs

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
57. I am confident that I could create a *home movie*.	○	○	○	○	○
58. I am confident that I could create an *online video*.	○	○	○	○	○
59. I am confident that I could create a *digital photo slideshow*.	○	○	○	○	○

60. I am confident that I could create a *digital photo album*.

    ○   ○   ○   ○   ○

61. I am confident that I could create a *movie* that tells a *story* about my personal experiences

    ○   ○   ○   ○   ○

APPENDIX C

PERSPECTIVE STUDY INTERVIEW GUIDE

Interview Guide

This interview focuses on eliciting the experiences of people when they have had digital photos shared with them from people who are geographically separated and when they share their photos with people who are geographically separated. It also touches on what they expect and what they think people expect of them.

Viewing Rationale

1. Tell me about a time someone who wasn't in the same place shared *digital photos* with you? (in some form e.g. album, slideshow, video)
   - Who shared their photos with you?
   - What did they share? (what was the topic of the content)
   - When did they share the photos with you?
   - How did they share the photos with you? (website, email, etc.)
   - Why do you think they shared the album with you?
2. Do you think this was the most effective way to share their experience with you?
3. What do you think would have been a better way for them to share their experience with you using *digital photos*?
4. Does your expectation of what is shared with you change based on the creator's ability?
5. Does your appreciation for what is shared with you change based on the creator's ability?
6. Would it have been more interesting if they told a story?
7. How could the experience of *digital photo* sharing be improved?

Creation Rationale

8. Tell me about a time when you shared *digital photos* with someone who was geographically separated from you.
   - Who did you share with?
   - What did you share with them? (what was the topic of the content)
   - When did you share the photos?
   - How did you share the photos? (website, email, etc.)
   - Why did you decide to share with the person/people you shared with?
9. Is there any other type of project you would like to be able to create with your digital photos?
10. Do you think you could create a *digital story* using your digital photos?
11. Would you attempt to produce a *digital story* using your digital photos?
12. In general, where do you get your ideas for what to create with your digital photos? (photo websites? TV? the movies? friends? family? etc.)
13. What do you think is expected of you by relatives? friends? co-workers?

APPENDIX D

STORYTELLR AUTHOR INTERVIEW GUIDE

Author Interview Guide

Questions about Design

<u>Photo Tagging</u>

1. How would you describe the purpose of this step? Did it achieve that purpose?
2. Were there questions you felt did not make sense?
3. Were any of the questions difficult to answer?
4. Would you have thought about emotions or themes if you hadn't been prompted by a question? What impact do you think it had on your story?
5. Did you find creating emotion and theme tags valuable? Why or why not?

<u>Search</u>

1. How would you describe the purpose of this step? Did it achieve that purpose?
2. Did the questions cause you to think about how you would tell your story?
3. What impact do you think answering the questions had on your story?
4. Were there questions you felt did not make sense?
5. Were any questions difficult to answer?
6. Was the tag-based search constraining at all?

<u>Composition</u>

1. How would you describe the purpose of this step? Did it achieve that purpose?
2. Why do you think there were three timelines?
3. What impact do you think the three timelines had on your story?
4. Did the timelines help you organize your story? Were you able to organize and describe your events in a way that made sense to you?
5. How did you divide your photos across timelines?
6. Did you have any difficulty with finding your photos and adding them to your story? If so, please explain.
7. Did you search for more photos? Why?
8. How did you feel about recording your voice?

Questions about Experience

1. Is this a reasonable amount of time for you to devote to this activity?
2. Was the story that you were able to create worth the time it took to create?
3. Was the story that you were able to create worth the effort it took to create?
4. Who do you plan to share this story with? How do you think they will feel about it?
5. What was the message of your story? What do you hope they take away from it?
6. Do you think you could create another story with Storytellr?
7. Would you create another story? What do you think it would be about?
8. Tell me about your experience with Storytellr.
    a. What emotions come to mind? What about your experience with Storytellr caused those emotions?
    b. Were there any difficulties? What was difficult?
    c. Did you discover anything new about yourself or the subjects of the story?
    d. How do you feel about the outcome? Are you satisfied, dissatisfied?
    e. How do you feel about the experience? Are you satisfied, dissatisfied?
    f. How does the outcome compare to other digital projects you've created?
9. I feel confident I could use Storytellr again to create a digital story.
10. What tools do you know of that you could have used to create a similar story? Have you tried? If no, why not? If yes, tell me about that experience.
11. What (if anything) would hinder you from creating another story like this in the future?

We'd like you to help us recruit the person you to tell this story to. Remember we will compensate you an additional $5. The person you help us recruit will receive a $20 gift card for participating and it will only take 30 minutes of their time.

APPENDIX E

STORYTELLR VIEWER INTERVIEW GUIDE

Viewer Interview Guide

1. What is your relationship to the author of these stories?
2. Are you in any of these stories?
3. What would you say the message of this story is?
4. Describe the effort you think it took?
5. How long do you think it took to create?
6. What tools do you suppose the author used to create the video?
7. Did the video evoke any emotions? If so, what emotions?
8. Did you think the person who shared this story with you could've created something like this?
9. Was the story descriptive enough about the experience? Did you have questions that were not answered? Or desired to know more detail than what the story presented?
10. Do you think it was organized well? Did it flow?
11. What other digital projects has this person shared with you in the past?
12. How does this story compare to other representations of experiences this person has shared with you?
    a. Photo album?
    b. Photo slideshow?
    c. Home movie?
13. Compare your appreciation of the story to other artifacts this person has shared with you?
    a. Photo album?
    b. Photo slideshow?
    c. Home movie?
14. Did it exceed your expectations?
15. Do you feel the need to reciprocate? How would you?

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