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

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

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CHAPTER I

INTRODUCTION

Storytelling is 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 [27]. Storytelling is also used as a means of archiving personal and family histories.

The proliferation of digital cameras and digital media editing tools has led to an increasing amount of personal experiences being captured in the bits of digital photos and video. While the arrival of "point-and-shoot" camera technology has simplified experience capture, telling stories about those experiences through the captured media remains a difficult problem.

Frohlich *et al.* have 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 [14]. Reminiscent talk tends to occur between people who share the experience documented by photographs. However, telling stories using media to people who do not share the experience is more involved particularly when the person is not co-located. Non-colocated storytelling using digital media requires thoughtful story-writing, media-editing, and composing various media elements into a coherent presentation while managing the whole process to completion. The difficulties introduced by this process hampers attempts to overcome distance and inhibits the formation of networked communities [15] based around online storytelling. Few current technologies attempt to provide holistic support for storytelling in the digital medium.

To determine how non-colocated digital storytelling could be supported, I sought to understand the challenges associated with storytelling using digital media by observing the Center for Digital Storytelling's process. 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 [37]:

> 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: "Its 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 authors 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. As I refer to stories and storytelling throughout my thesis I am referring to this particular form of storytelling which uses only digital photographs, music, voice and sound effects. The process is retrospective and the stories contain a plot that follows a dramatic arc as Aristotle defines it [17].

In the story above, 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 slideshow stories offered by personal media management tools (*e.g.* iPhoto and Adobe Photoshop Album). I do not discount the importance of other forms; I believe telling digital narratives is more engaging and has benefits to author and audience beyond communication (*e.g.* emotionally and psychologically [31]). 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 [27]. While personal digital narrative construction has a number of advantages, it requires more attention to writing and more technical skill to produce than slideshow stories.

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 composing various media to communicate a message and teach everyday people to engage in this process.

My initial approach to creating the authoring tool iTell [23] involved operationalizing the lessons I learned from studying the CDS workshops. While observing this process was informative and useful as a model for developing software support around the digital storytelling process, I found through a study of iTell that novices do not necessarily desire to subscribe to the notion of storytelling put forth by professionals. It seems that a balance between (1) adhering to the advice of successful digital storytellers and (2) leveraging practices that have developed around digital photographs is necessary. This observation led to the development of a new story authoring system.

I propose to support users through the process of creating cohesive stories from their photo collections by situating tenets of storytelling practices within common photo activities. These storytelling activities include: development of a plot, and the effective use of media to present the plot. The common user activities I plan to situate storytelling practices within include: photo annotation, photo exploration, and media composition.

I am developing Storytellr — a story authoring application which integrates aspects of the storytelling process with the photo activities annotation, search and construction. Storytellr is designed to be a Flickr third-party application which leverages the storage and tagging systems of Flickr while providing an alternative interface for uploading images and support for creating retrospective stories. The Storytellr interface takes the user through a series of three phases — annotation, search, and construction. The annotation phase prompts the user with a set of questions intended to generate tags for their images which will be used for making sense of experiences in the search phase. The construction phase engages the user in the construction of their retrospective story. I hypothesize that Storytellr will provide a satisfying experience for the author and also produce an interesting output. I also believe that people will tell stories that resemble professional artifacts and are more interesting to viewers than other forms. My hope is that by leveraging common photo activities people will find storytelling with digital media more accessible and enjoyable.

1.1 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" [20]. 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:

- How do experiences as media consumers and media producers impact the effort and desire of people to create personal stories?
- Can structuring photo activities as storytelling lead to a satisfying experience and output for story authors?
- Can structuring photo activities as storytelling produce a satisfying outcome for viewing audiences?

- Can structuring photo activities as storytelling produce plot-driven stories according to professional practice?
- Can plot-driven stories result from a suite of annotation, search and construction supports?
- Can structuring photo activities as storytelling lead to adoption of digital storytelling as a means of communicating personal experiences?

I propose the following thesis statement:

Integrating storytelling activities with common photo activities can lead to (1) the production of plot-driven stories that (2) are satisfying to the author, (3) satisfying to viewing audiences, (4) and increase the use of storytelling with digital media as a means to communicate personal experiences.

1.2 Overview of Proposal

This proposal is organized as follows. Chapter 2 will explore the literature covering the activities people typically engage in with digital images and the work researchers have done to understand and support these activities. Chapter 2 will also provide additional motivation for this thesis in the context of prior research. Chapter 3 will provide an overview of my previous work supporting storytelling with digital photographs by studying a human process and emulating that process in the software prototype iTell. Chapter 3 concludes with observations from an evaluation of iTell which leads into a discussion of the system that is the focus of this thesis in the next chapter. Chapter 4 builds on the evaluation of iTell and describes my approach of embedding storytelling practice within familiar activities and the design of the Storytellr system as an instantiation of this approach. Chapter 5 presents my plan for evaluating my thesis questions and this proposal concludes with my plan for completion.

CHAPTER II

BACKGROUND AND MOTIVATION

The literature on supporting activities around personal digital media covers a range of topics including: editing, annotation, review 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 previous work related to photo activities and motivate applications of this work to storytelling. I will also provide a brief overview of work describing the benefits of storytelling and approaches to teaching people how to tell stories.

Given the primary media addressed in this thesis is the digital image, this chapter will be organized according to the high-level stages of image capture: pre-capture, point of capture and post-capture. At each stage I will comment on prior work and the potential impact further research at each stage could have on supporting the practice of storytelling with digital images. To further orient the reader to the notion of storytelling addressed in this thesis, this chapter will conclude with a summary of practices concerning storytelling from the perspective of writers, moviemakers and educators.

2.1 Pre-Capture

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 [9]). In practice these tools are impractical considering the amount of time required to put them to use (days to 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 (i) the need for certain content, and (ii) the

need to capture that content in the manner required" [4]. 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 construction process. In a sense, the authors recognize the importance of creating a good story, yet forgo designing support for an element they consider necessary to drive the rest of their process. My thesis will address the narrative composition phase of media creation thereby complementing this work.

Tools used by professionals provide a model which can be appropriated to develop less time consuming but effective processes for pre-capture preparation. Brainstorming is one commonly implemented technique to generate ideas. A version of brainstorming that prompts consideration of the event to be captured and the eventual use of the captured media could be used to help users create a plan for capture to ensure all necessary media is captured. An even less burdensome approach would be to create templates for typical events (*e.g.* birthday party, wedding, vacation) that users could simply select to receive a pre-constructed guide to who, what, when, how and why to capture. Either of these simple efforts could help ameliorate the sometimes daunting task of storytelling with digital media. While some of these supports exist in the physical in the form of paper checklists, porting templates to a digital format could lessen the effort required to track a paper list, while obtaining images important moments of an event.

2.2 Point of Capture

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.

2.2.1 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 [21].

Marc Davis *et al.* have explored developing systems that direct humans in the capture of video [12]. 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 [4].

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 [23].

2.2.2 Annotation

Annotation of digital photographs after the fact is burdensome and difficult to motivate users to do. Automating annotation, particularly at the point of capture potentially solves this problem. Patel and Abowd developed a video camera capable of determining the presence of people and information associated with the activity being captured and annotating the footage with that information [30]. Gemmel *et al.* developed a sensor-rich camera capable of taking photos at "interesting" moments and tagging those images with date/time as well as location data. This work provides a record of experiences without requiring the user to explicitly engage in capture.

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.

2.3 Post Capture

2.3.1 Annotation

Annotation, associating a document with succinct descriptive labels, provides a means by which to retrieve that media at a later time. Text documents are typically indexed based on their contents so that they can be searched for using words related to or contained in the document. Unfortunately, photos carry very little text that can be indexed. Typically, images are indexed based on the text from the context in which the image appears which is not very optimal but can be effective. Normally very little metadata is available in the case of personal photographs.

Many researchers are investigating the creation of keywords for indexing visual media based on the visual properties of the image [13, 25, 26, 36]. 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 [40]. The FotoFile [22] system combines automated and manual annotation by supporting feature extraction (*e.g.* faces) and bulk annotation respectively.

2.3.2 Sharing

Photographs are often used as conversational storytelling aids [14, 6]. Many commercial photo management tools (*e.g.* iPhoto, Adobe Photoshop Album [1]) are available for 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.

Media artifacts (*e.g.* video) that effectively communicate an experience often follow some structure as suggested by the artifact's form. For example, motion pictures tend to use a plot as a structure for presenting a story. This thesis aims to support people with communicating their personal experiences through digital images via plot-driven stories.

2.3.3 Storytelling for Photos

Much of the research involving storytelling via digital media has focused on supporting activities involving little or no composition [3, 22, 28, 33]. For example, Balabanovic *et al.* extended the common practice of storytelling around print photos to digital photos [6]. 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 [14]. Our work on supporting retrospective stories of personal experiences through digital media attempts to provide families with the option to share their experiences with non-collocated audiences.

Commercially available video production tools (*e.g.* Final Cut Pro) traditionally support the combination of various artifacts (video, photos, audio), but assume prior engagement in the screenwriting process. This assumption may be appropriate for professionals, but unreliable for novice and casual storytellers. We seek to provide holistic support for the process of digital narrative authoring as opposed to only the media production portion.

2.4 Storytelling

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 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 [5]. 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)[9]. 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 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 that the key to good storytelling is "telling exciting stories about exciting people in an exciting form" [18]. To do this, they suggest common techniques such as defining a protagonist, introducing the protagonist into some conflict and explicating 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" [11]. Similarly, Hacker suggests engaging in a brainstorming process to set a "tentative focus" for the writing process [16]. 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 [8]. 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. We have used this approach and plan to continue to use it in the design of Storytellr.

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 impact and informs my work in storytelling from the perspective of professionals and researchers along the spectrum of pre-capture to post-capture and storytelling in general. I will now discuss my previous work and how that work has lead to this thesis concerning situating storytelling concepts within familiar activities to support storytelling.

CHAPTER III

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

I will use this chapter to summarize my previous work and draw connections to the approach I am proposing. My initial work with the Center of Digital Storytelling uncovered the need to support story development in software. Much of the story concepts I plan to embed in common photo activities are drawn from this work. The development of iTell was informed by these findings. Upon evaluation of iTell, I learned that strictly following the professional approach in the design of software 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 lead into my proposal to situate storytelling concepts within the user's context.

3.1 How Do Humans Support Personal Digital Story Authoring?

Storytelling performs a critical function in society serving as a dialog between people, cultures, and times [27]. 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 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.* [2, 7]) providing digital storytelling services.

In the following sections I summarize the lessons I learned from observing the CDS workshops. For more detail, refer to [24].

3.1.1 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.

3.1.2 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, we 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. We 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

We 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.

3.1.3 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 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.

3.1.4 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, we 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)

We 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, we 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.

3.1.5 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." We 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 3.1.1, we 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 [32]. 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 [38] and Where Were We [29] 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.

3.2 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.

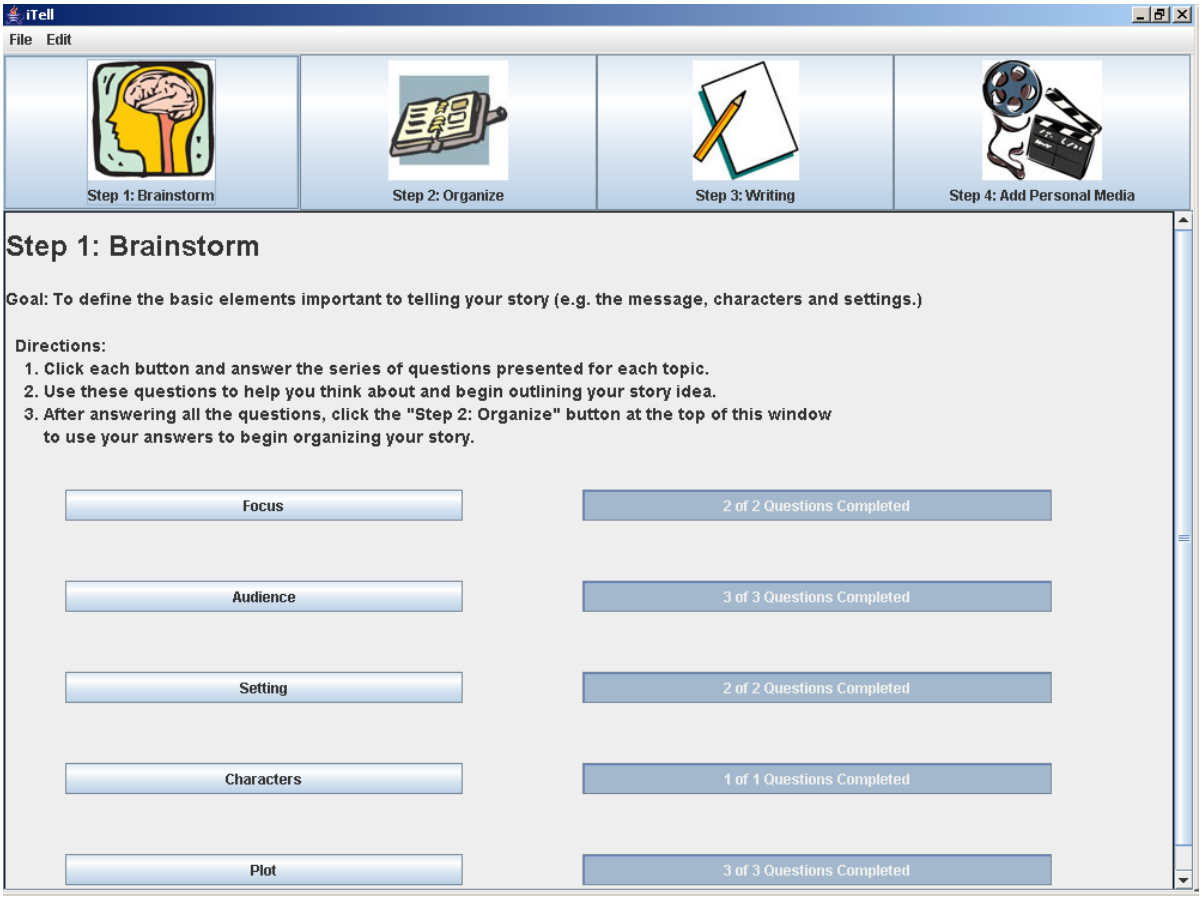

Figure 1: iTell Brainstorm Interface

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.

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.

3.2.1 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 [16]. 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 [8]. 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 1). 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 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.

3.2.2 Step 2: Organize

The goal of the Organize step (See Figure 2) 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 [8].

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

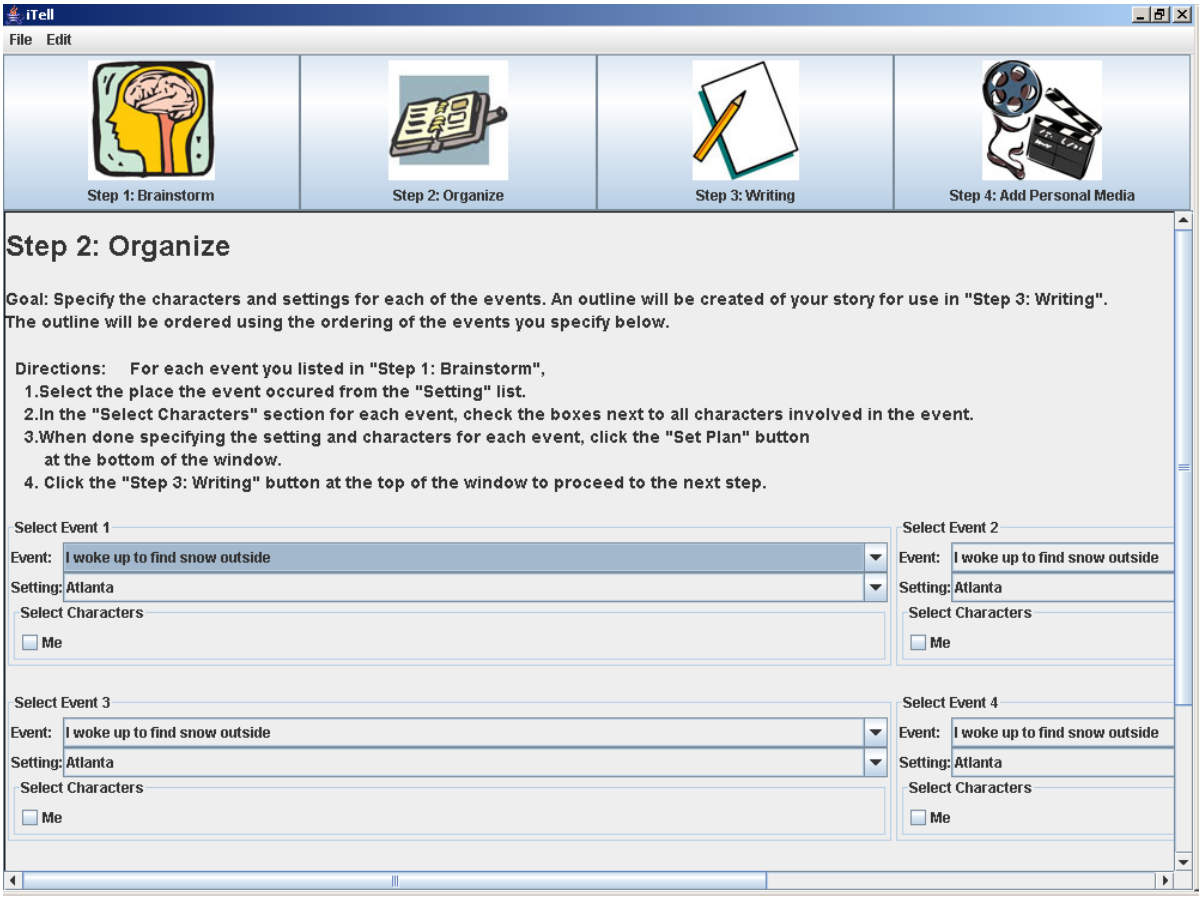

Figure 2: iTell Organization Interface

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.

3.2.3 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 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 3) serves as one of those supports. The story tree visualizes

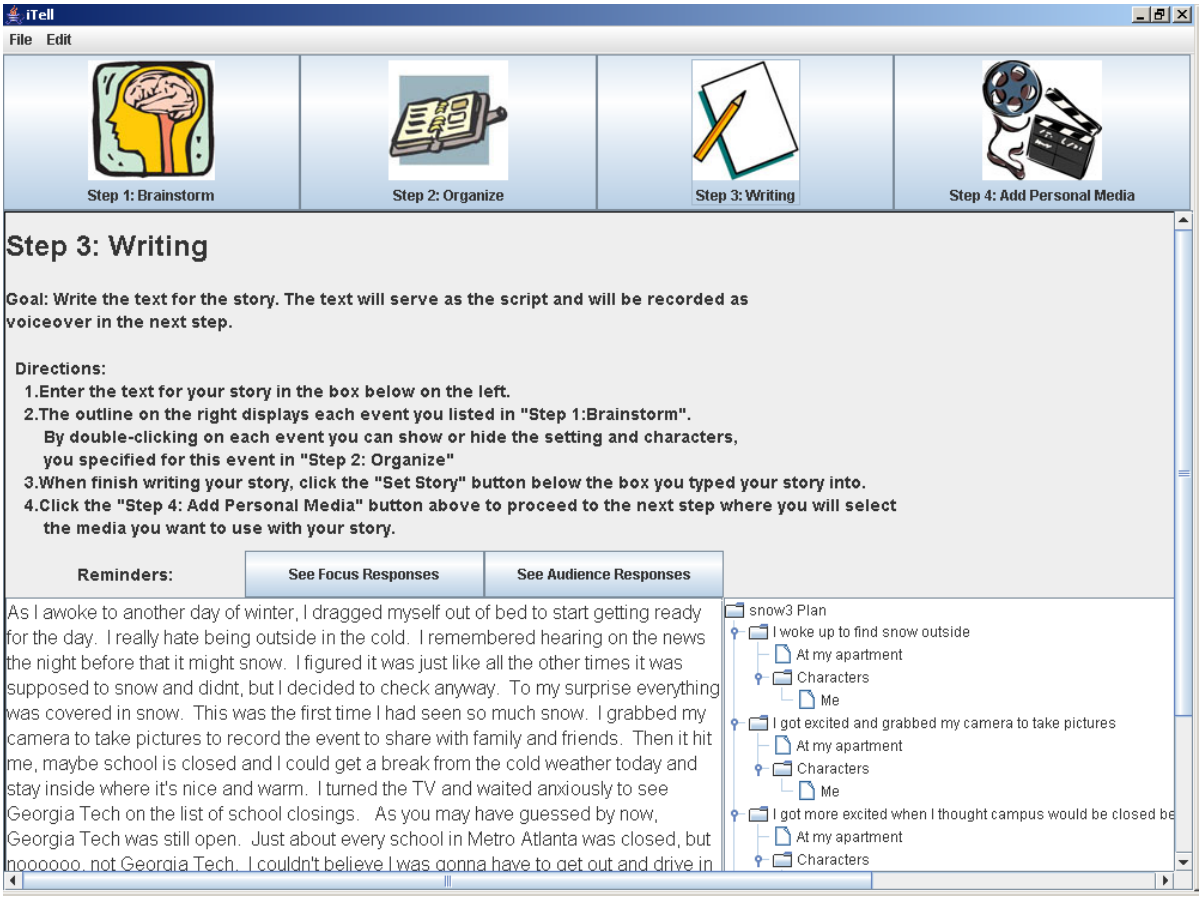

Figure 3: iTell Writing Interface

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 [8]. 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.

3.2.4 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 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 4). 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 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.

3.3 Lessons Learned from iTell and Issues this Thesis will Address

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

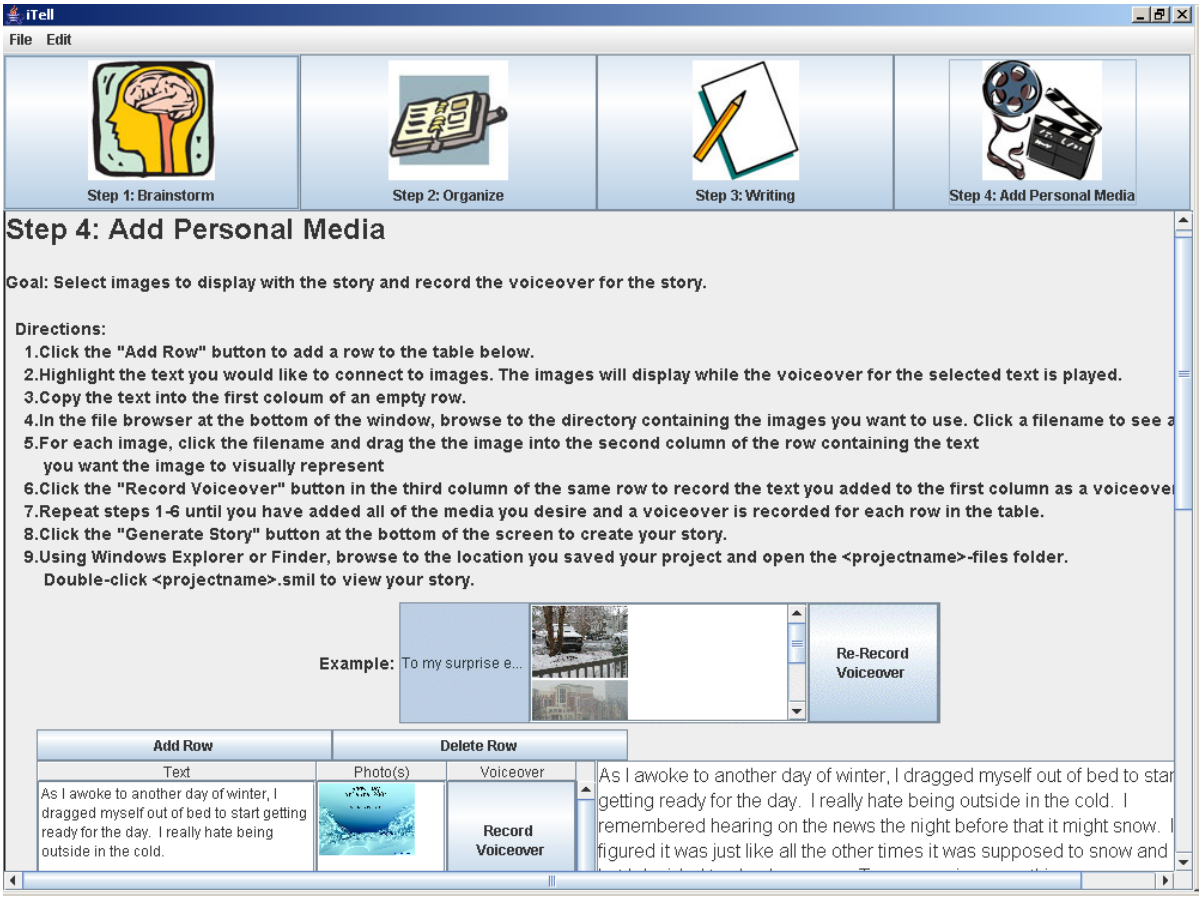

Figure 4: iTell Media Composition Interface

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 [23].

3.3.1 Role of Media in Retrospective Storytelling

Developing a strong story is typically a pre-cursor to video production [11, 39]. I designed iTell to align with this professional approach to creating media compositions. However, in our 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 our 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.

3.3.2 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 [39, 11]. 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 [8]. 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 our 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 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.

3.3.3 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 found to be useful by our participants; therefore, I suggest designing to balance the emphasis on writing and media as the retrospective storytelling process progresses. From our 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.

3.3.4 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 our evaluation, I discovered people might not desire to take the expert approach though they may understand it. Our 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 the participants of our study 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 our 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 IV

STORYTELLR: SITUATING STORYTELLING WITHIN PHOTO ACTIVITIES

In the field study described in Chapter 3, 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. Adding further complication is the finding from evaluating iTell that novices do not necessarily desire to subscribe to the notion of storytelling put forth by professionals. Although novices may be reluctant to engage in storytelling in the professional sense, it nevertheless has benefits (e.g. psychologically [31]). As a result I propose to mitigate the resistance to storytelling in this form by leveraging traditional novice activities [19] around media thereby providing a familiar entry-point to novices while taking advantages of the benefits of storytelling in this form.

The media activities that novices engage in can be very disparate in comparison to those professionals employ though they are beginning to converge when you consider online Flickr^{TM}groups like "Tell a story in 5 frames." This particular group uses only photographs to visually tell a story. The story must meet the following criteria to be included:

- 1st photo: establish characters and location.
- 2nd photo: create a situation with possibilities of what might happen.
- 3rd photo: involve the characters in the situation.
- 4th photo: build to probable outcomes
- 5th photo: have a logical, but surprising, end.

Clearly, plot-driven storytelling with photographs is valued in this group and provides evidence that novice and professional practices are converging. To catalyze this convergence I propose situating the tasks necessary to create digital stories within the context of activities more familiar to novices through the development of the Storytellr system.

Although participants in the iTell study had some reservations about telling their stories in the form iTell was designed to support, 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. Rather than change the form, I believe coupling the form with common activities around media will appeal to users and also enhance their abilities to communicate in this form. To do this, I propose leveraging the annotation process people engage in when uploading photos to media hosting websites such as Flickr to encourage the

production of annotations useful for engaging in the story creation process. I also propose modifying the traditional notion of search to become a guided process of making sense of what media a collection contains and its relevance to the storytelling process. Searching for photos to share in a story then becomes 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 3.3.3) by combining the exploration of media and pre-writing activities into one process and thus allowing users to write in the presence of their media.

Storytellr represents a major iteration on the iTell prototype. It's remains rooted in the findings of the field study of the digital storytelling workshops and is complemented by our findings from the evaluation of iTell. In particular, recall the findings from sections 3.3.1 – 3.3.4. Section 3.3.1 reports my experience with users employing photos as memory aids and determining factors of what should be included in their story. 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.

Section 3.3.2 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 bridge novice activities with professional 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 3.3.3 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.

I will now present my design ideas for the Storytellr system. **The system has been developed in part but I have not settled on a concrete design. The following sections on design should be considered a discussion of design considerations for the Storytellr system as opposed to a presentation of the final design for inspection.**

4.1 Storytellr: The Design

Storytellr has been developed as a third-party flickr application using the flickr API. The site is used to host users' photos and Storytellr is designed in part as an alternative upload interface. Storytellr is not intended 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: annotation, search and construction (See Figure 5). I will now discuss each of these in more detail.

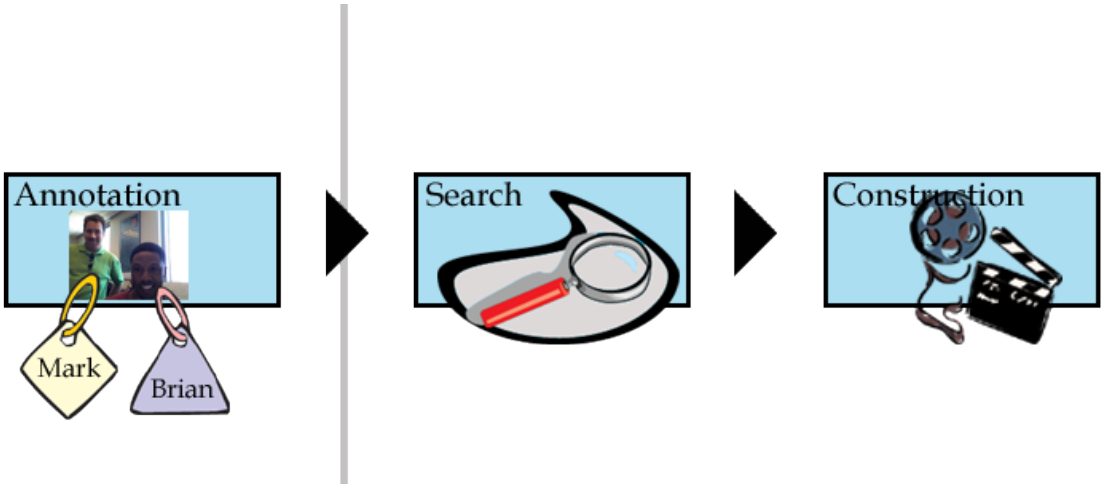

Figure 5: Storytellr Process Diagram

4.1.1 Annotation Phase

Many methods exist for annotating photographs with metadata. Digital cameras automatically stamp digital photographs with time and date information. Researchers have advanced beyond date and time to technologies that annotate photographs based on GPS coordinates [34], concepts [13, 25, 26, 36] (*e.g.* indoor or outdoor) and face detection [22]. Current photo management tools allow users to annotate their photos manually with pieces of text. Researchers have also explored the domain of manual annotation by providing interfaces for annotation using drag & drop [35] and through an online game [40]. 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 is more important in the context of storytelling with digital photographs. How do we help people tell the story 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 for a specific purpose. These additional annotations could potentially provide for better search and support for the overall story construction process.

To elicit the how and why of people's experiences, what metadata should be collected to help people tell stories? Table 1 presents a mapping between storytelling constructs and the metadata I plan to collect in the Annotation phase of Storytellr. Starting from story constructs and working backwards, metadata that describes the people and places pictured is necessary at the least covering the collection of metadata for characters and settings in the story.

A more difficult task is to help users generate tags that will help them filter their media collection based on audience when they desire to tell a story. The audience is an important consideration in how a story is told. We often modify our stories

Table 1: Metadata-Story Construct Mapping

Annotation Type	*Story Element*
Positive Emotion	Setup/Resolution
Neutral Emotion	Setup/Resolution
Negative Emotion	Conflict
People Present	Characters
Place	Setting
Rating	Audience

of life experience such that they are most relevant and interesting to our audience. Accordingly, users will be encouraged to think about their audience. However, in the context of generating metadata in a process most likely divorced from the actual storytelling process, how do we encourage users to generate metadata that is generally useful as well as useful in the storytelling process. I recommend the rating of images as a means to convey the audiences for which this image and by proxy the story it appears in may be appropriate. An image may be considered appropriate for a story for adults and not children. Alternatively, an image and thus a story may be appropriate for friends but not parents and grandparents. By rating the images, the user can then be assisted in finding images that are appropriate for their target audience.

A more difficult connection to make is between personal experiences and plot. Personal experiences do not occur in neatly packaged plots. However, through reflection and meaning making, plots describing our experiences can be formulated. So how do we capture the notion of plot through user reflection on digital images? I suggest emotion as the answer. By characterizing emotions evoked when viewing and reflecting on a particular image as positive, neutral and negative, I propose emotion can be used to map onto the notions of setup, resolution and conflict (See Table 1.)

The metadata I lay out here more deeply describes experience. In addition to usefulness in 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 allow search for more abstract ideas across media collections.

The annotation phase of Storytellr is designed to be a guided manual annotation interface. Rather than provide an interface through which users independently generate ideas for tags to annotate their photos, this interface has been designed with a specific focus on helping users generate tags useful for search during the storytelling endeavor. The Storytellr annotation process occurs in conjunction with uploading photos to the Flickr photo service. As denoted by the gray vertical bar in Figure 5, the annotation process can occur as part of the overall storytelling process but can and most likely will occur apart from the search and construction phases.

In this phase, the user is prompted by a set of questions to generate annotations that can be leveraged during the storytelling process (See Figure 6). 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. I posit that the image will help the user to reflect on and elicit their actual experience as has been found in [10]. Because the guided annotation may increase the cognitive load of 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 from allowing quick and minimal interactions to help save time and provide a starting point. The option to add custom annotations is also provided minimizing user restriction. Custom annotations provided previously are saved in a database for the user and also appear as options during subsequent uploading sessions. The annotation interface also provides the opportunity to enter other general annotations that may not be targeted at storytelling, but are useful for search.

Requiring users to answer questions may provoke thoughts about their experiences and capture those experiences more descriptively in the tags created for their images, particularly for telling stories later. Prompting thought does however extend the photo uploading process which can be viewed as a characteristic of the convergence of novice and professional practices. As novices engage in more professional-like activities, more time will be required (*e.g.* answering prompts); however, I hypothesize that the additional time spent interacting with supports meant to bridge novice and professional practice will not exceed the time and effort that would be required to become a professional. 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.

4.1.2 Search Phase

Metadata is often used to describe particular resources in a way that makes those resources easier to find. For example, documents in a digital library are tagged with keywords that users are likely to submit to a search engine so that they can find those documents. Similarly, tags are assigned to photos to help search engines and thus users find photos among the sea of images hosted on a local machine or by a photo service. The search phase is intended to leverage the annotations provided in the previous stage to find photos to weave into a story in the construction phase. Where this step differs from traditional search is that it attempts explicitly to engage the users in exploration of their digital photo collections and extraction of meaning from their experiences in the world to develop an understanding of those experiences mean in the larger context of life and expressing that meaning through stories.

Eliciting this story is the ultimate goal of this step with a secondary goal of finding media for the user's story. The model of storytelling that I have proposed is based on the Aristotelian [17] approach. It is not my intention to follow the recommendations of Aristotle to the letter, but extract the most elemental characteristics without which a story could not exist. The story constructs I have chosen to explore are listed in column 2 of Table 1. My goal then is for users to tell stories which have an identifiable plot that communicates some significant moment of change (involving characters in some setting) to an audience.

Figure 6: Storytellr Annotation Screenshot

Assuming sufficient annotation of images has occurred, the storytelling process begins with an evaluation of the collection of the media available for telling a story. An often difficult task as described by various resources [16, 39, 11] and also observed by our own work [24] is arriving at a decision about the story topic and allowing that topic to guide the storytelling endeavor. With iTell [23], I used prompts as a means to help users develop this sense of story and follow that through the rest of the process. I plan to use prompts again to help users to develop a sense of story while browsing what their collection holds in parallel (See Figure 7).

The search phase presents the user again with a set of questions; however, the questions take on a different role. In the annotation phase, the questions were meant to generate metadata to make search for images for storytelling easier. The questions at this step shift focus to developing the story and so 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 which could potentially be useful for telling the story.

The metadata attached to the images in the annotation phase is leveraged here.

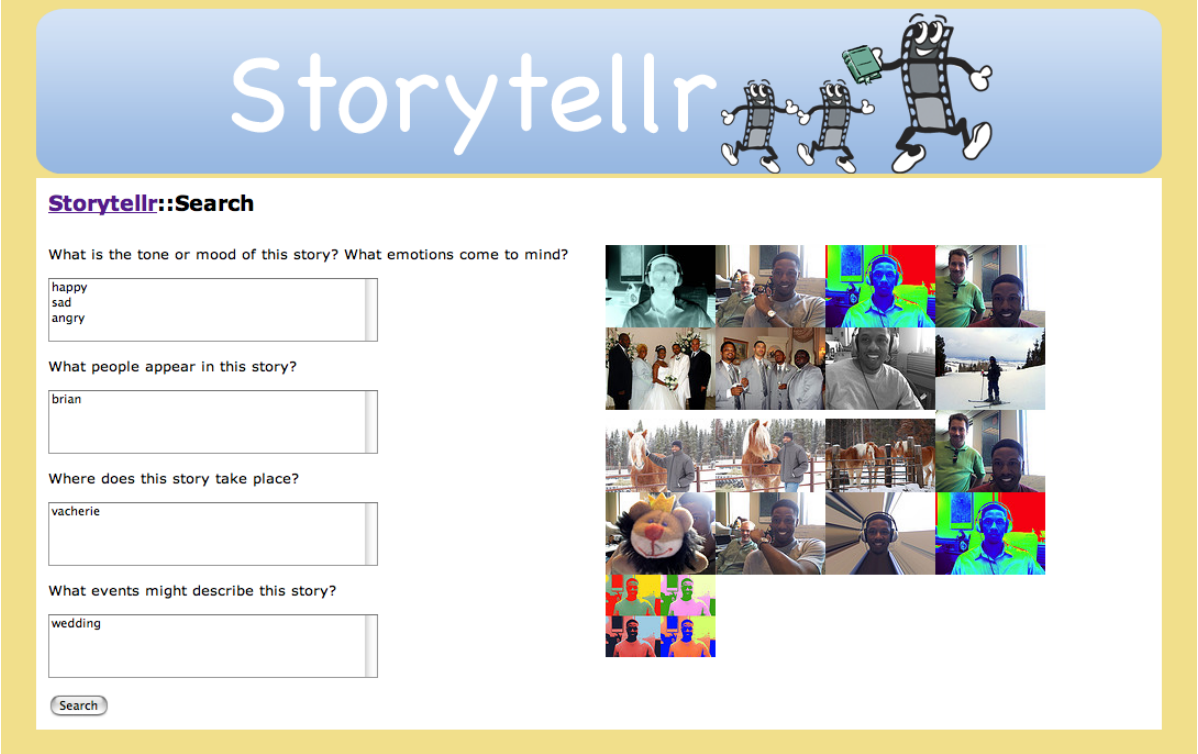

Figure 7: Storytellr Search Screenshot

The answers to the questions are converted into queries and submitted to the Flickr search engine. The results of these queries are continually updated as the user continues to answer questions. Through a mapping from the annotation types to story constructs (See Table 1), the results are presented in relation to story constructs the photos could represent. Clicking on images adds them to a timeline which can then be further manipulated in the construction phase to create a story.

4.1.3 Story Construction Phase

The construction phase is designed to allow users to combine their images with voice and music to produce a retrospective 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 Construction 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, I envision the Construction phase supporting the molding of the user's experience into a dramatic progression of events. The goal of this phase is to help users determine what events comprise the initial conflict or complication in their experience, how the user overcame the conflict and how the experience concludes. See Table 5 in Appendix D for a description of each plot element I intend to support. Figure 8 depicts a possible design for this phase; however, I am still engaging in the design process.

Figure 8: Storytellr Constructor Screenshot

The interface could be divided into three sections: preview, search and timeline (See Figure 8). The preview would allow the user to play the timeline in its current state. The search section of the interface would allow the user to continue to search for images during the process of story construction. The timeline section in the mockup is broken down into three slots. The first slot is intended for photos that establish story context and build towards the climax of the story. The second slot is intended for images associated with the climax of the story. The last slot is meant for holding photos that present the resolution or the ending of the story. Although the timeline is visually separated, there would be no constraints placed on how the photos can be placed on the timeline. For each photo the user could enter text for the portion of the story for which the photo is associated. The user can then record the text as a voiceover for that image. Once the user finalizes their story, they would be able to export it and share it with their intended audience.

CHAPTER V

EVALUATING STORYTELLR

Storytellr is designed to fit within current photo practices while introducing storytelling activities to support communication about personal experiences through digital photographs. In this chapter I will to outline my plan to evaluate users' satisfaction with the Storytellr experience and the stories they produce. Recall my research questions:

1. How do experiences as media consumers and media producers impact the effort and desire of people to create personal stories?
2. Can structuring photo activities as storytelling lead to a satisfying experience and output for story authors?
3. Can structuring photo activities as storytelling produce a satisfying outcome for viewing audiences?
4. Can structuring photo activities as storytelling produce plot-driven stories according to professional practice?
5. How does a suite of annotation, search and construction supports impact the storytelling process?
6. Can structuring photo activities as storytelling lead to adoption of digital storytelling as a means of communicating personal experiences?

I will explore hypotheses for each of these questions and elaborate on how I plan to evaluate each. The rest of this chapter will explore each question, one per section and conclude with a timeline for completion. My evaluation is also summarized in Tables 2 and 3. See Figure 9 for a visual description of my research questions and their relationship to the studies I plan to conduct.

5.1 How do experiences as media consumers and media producers impact the effort and desire of people to create personal stories?

In an effort to understand if and how Storytellr satisfies it's users, it is essential to ascertain the perspective each user brings to the storytelling process. As discovered with the evaluation of iTell, users bring different approaches and expectations to the process of telling stories. I will conduct a "Perspective" study to investigate people's preferences regarding the *creation* and *viewing* of media artifacts. Learning about the perspective of potential Storytellr users will bring to the storytelling process will

help refine the design of Storytellr. It will also help explain the experiences of users of Storytellr and viewers of Storytellr stories. I will investigate how people view the following activities:

- consumption of end-user media,
- telling plot-driven stories vs. using other forms of communication with media (*e.g.* slideshow),
- expectations of other amateur media artifact producers (*e.g.* length, engagement, plot, etc.), and
- perceptions of effort required to produce a video artifact.

Gathering the views of participants prior to using Storytellr will help explain their behavior as they use Storytellr. Their preconceived notions of storytelling and media production will help illuminate reasons for their approaches and reactions to their Storytellr experiences. To investigate this question of perspective, I will employ a combination of surveys and interviews to collect data about preferences, expectations and experiences of users. Adult participants of all levels of experience with media will be included to develop a broad understanding of perspectives. Participants will be asked questions about what types of media artifacts they prefer and when the prefer to view them. Likewise they will be asked about the artifacts they tend to create and when and why they choose to create them. I will also ask about their expectation of quality for people of varying levels of experience. For example, does a viewer expect a better artifact from a professional director than from a close friend who does not have professional experience or anyone without professional experience for that matter? My goal is to recruit approximately 30 people for this study.

5.2 Can structuring photo activities as storytelling lead to a satisfying experience and output for story authors?

One of the primary goals of this thesis is provide everyday people with a means to effectively communicate about their personal experiences. As I observed at the Center for Digital Storytelling, barriers such as story development, tool use and process management hinder communication through personal media using narrative as a form. The development of Storytellr is intended to lower these barriers while providing a satisfying experience for the author.

For this thesis, I will be exploring satisfaction through the following metrics:

- visible and reported emotions (*e.g.* pride, excitement, laughter, smiling)
- time required, and
- confidence (in repeating the process)

I hypothesize that users will visibly and verbally express their enjoyment with using Storytellr to create a narrative. They will tell a story in less time than they predicted and feel confident about doing it again. They will take pride in the artifact they create and will be happy to share their artifact with peers.

From the "Perspective" study, I will recruit 15 of the 30 participants to tell a story using Storytellr in a lab setting. I will survey, observe and interview participants to assess the ability of Storytellr to lead to a satisfying experience and story. Users will be required to use the flickr service (if they do not already) to take part in my thesis evaluation. Participants will be initially asked to use Storytellr exclusively for uploading images to flickr. For Storytellr to provide benefit, images must be annotated through the Storytellr annotation process. For approximately two months, only the annotation interface will be available to allow this to occur. I am currently planning this phase to take place from the Thanksgiving holiday through the new year. Following the annotation period, users will be asked to come into a lab setting to create a story using the search and construction phases of Storytellr. I will observe users during process and also encourage them to think aloud as they use the system. After each participant has created a story, I will administer a survey and interview (See Appendix B for a sample of each) each participant to determine their level of satisfaction based on the metrics noted above.

5.3 Can structuring photo activities as storytelling produce a satisfying outcome for viewing audiences?

While the primary concern of this thesis is supporting novices with creating stories from their personal media, it is important to understand that personal stories are typically created to be shared. As such, I am planning to explore whether intended audiences find stories produced by Storytellr satisfying. I plan to evaluate satisfaction in the case using the following metrics:

- identification of the intended message (or moral)
- perception of quality as compared to stories created using other tools

I hypothesize that intended viewers and also unintended viewers will be able to identify the intended moral of the stories produced with Storytellr.

To test my hypothesis I am planning to recruit 20 people as viewers to inspect the 15 stories that were created in the study described in the previous section. I will attempt to recruit the audience with whom each author intends to share their story; however, this may not be possible for practical reasons. Each participant will view each video and I will ask a series of questions (See Appendix C) following each story to determine whether they can find a lesson or moral in the story. This will help determine whether the author effectively communicated his/her message. The interview will also solicit each participant's perception of the quality of the video.

5.4 Can structuring photo activities as storytelling produce plot-driven stories according to professional practice?

In addition to evaluating the stories produced using Storytellr according to author and audience experiences, I am also interested in objectively evaluating Storytellr stories to determine the extent to which they are plot-driven. I expect that experts at creating plot-driven stories will be able to identify plots in the stories users create with Storytellr using the following metrics:

- causally linked events - events in the story are logically connected to one another
- initial conflict - the main character is presented with a recognizable complication
- building tension - the events leading to the climax provide the viewer a sense of suspense
- climax - the turning point in the story; sets the stage for the complication to be resolved
- resolution - the events that follow the climax and conclude the story

I will recruit 5 experts and provide them with an evaluation instrument to objectively determine whether or not the 15 authors have created plot-driven stories according to the criteria listed above. I will also solicit each expert's opinion of each story's production value.

5.5 How does a suite of annotation, search and construction supports impact the storytelling process?

The research questions I have presented so far consider the impact of the stories produced using Storytellr. Storytellr is intended to fit within current practices with photographs and so this research question is concerned with the role the suite of supports plays in the construction of plot-driven stories. I hypothesize that the prompted annotation and search will aid users with developing a sense of what they desire to communicate to their audience. I also expect that the construction phase will help users create a plot-driven story to communicate their message. I plan to use the following metrics to investigate this question:

- reports of development of a sense of the moral of an experience
- reports of how the supports influence interaction with the tool
- observation of design elements lead users to a plot-driven output

Through observation and interviews of the 15 participants who create a story, I plan to elicit the aspects of the supports that did and did not work and why. This will allow me to further refine my design criteria for storytelling tool design.

5.6 Can structuring photo activities as storytelling lead to adoption of digital storytelling as a means of communicating personal experiences?

While I do not intend for this research question to be a major portion of my thesis work, I am interested in what effect (if any) introducing Storytellr into an online photo community will have. I plan to post messages to a few online photo communities advertising Storytellr to the general public. I will then log the following statistics on the use of the tool:

- number of accounts created
- number of stories created
- number of repeat story creators
- number of requests for features

I will also record any discussions of the tool in online communities. I expect an online deployment to reveal emergent behaviors due to persistent use that may not be readily apparent in a more controlled setting.

5.7 Expected Contributions

- Storytellr will provide a storytelling experience that is accessible, satisfying and produces pleasing artifacts for novice users,
- Storytellr will produce a media artifact that provides a satisfying and informative experience for audiences
- Storytellr will constitute an approach to storytelling that produces plot-driven stories while allowing users to leverage familiar and common activities, and
- studying an online deployment of Storytellr will provide a view into the preferences and perceptions of people regarding media stories

Table 2: Research Question Evaluation Summary

Research Question	Hypothesis	Metric	Evaluation Plan
Can structuring photo activities as storytelling lead to a satisfying experience and output for story authors?	Participants will enjoy the storytelling process and short production cycle while making meaning from experiences. They will take pride in the story they produce and will be confident that they could more stories.	• Time Required • Pride • Excitement • Laughter • Smiling • Confidence in creating another story	• Employ a combination of observation and semi-structured interviews to collect data on each user's experience with Storytellr and the story they produce (See Appendix ??). • Perform a qualitative analysis to determine the extent to which the behaviors in the previous column occur and find what other interesting phenomena emerge.
Can structuring photo activities as storytelling produce a satisfying outcome for viewing audiences?	Audiences will find plot-driven stories produced using Storytellr more engaging than other non-plot driven forms (e.g. slideshows). Audiences will also be able to identify the intended message of the story author.	• Identification of the intended message (or moral) • Perception of quality as compared to stories created using other tools	• Survey audience members about their perception of the author's intended message and quality of the story (See Appendix ??).
Can structuring photo activities as storytelling produce plot-driven stories according to professional practice?	Users of Storytellr will produce an artifact that can be objectively evaluated as having a plot structure.	• causally linked events • initial conflict • building tension • climax • resolution	• Recruit a set of professionals to perform a content analysis of the stories created with Storytellr using a provided rubric (See Appendix ??) • Solicit each professional general opinion of the quality of each story
How does a suite of annotation, search and construction supports impact the storytelling process?	Prompted annotation will generate annotations for images what will help users select images during the prompted search. Prompted search will also help with users select images while simultaneously causing them to think about story structure. The construction phase will help organize their message into a dramatic arc.	• Reports of development of a sense of the moral of an experience • Reports of how the supports influence interaction with the tool • Observation of design elements lead users to a plot-driven output	• Employ a combination of observation and semi-structured interviews to collect data on each user's experience with each phase of Storytellr. • Log the use of each phase and analyze the data to determine the effects the supports have (if any).
Can structuring photo activities as storytelling lead to adoption of digital storytelling as a means of communicating personal experiences?	A small set of people will find telling plot-driven stories using Storytellr interesting and create multiple stories to share	• # of accounts created • # of stories created • # of repeat story creators • # of requests for features	• Deploy Storytellr in a photo community and log the use of the tool • Monitor conversations in the online community about Storytellr

Table 3: Research Studies Summary

Claims	Data	Collection Method	Participants	Analysis Method	Study
Structuring photo activities as storytelling can lead to a satisfying experience and output for story authors.	• Time Required • Pride • Excitement • Laughter • Smiling • Confidence in creating another story	• Interview • Observation • Survey	• 15 adult participants from diverse backgrounds	• Qualitative Analysis	1
Structuring photo activities as storytelling can produce a satisfying outcome for viewing audiences.	• Identification of the intended message (or moral) • Perception of quality as compared to stories created using other tools	• Interview • Observation • Survey	• 20 adult participants from diverse backgrounds that have not used Storytellr	• Qualitative Analysis • Quantitative Analysis	2
Structuring photo activities as storytelling can produce plot-driven stories according to professional practice.	• Causally linked events • Initial conflict • Building tension • Climax • Resolution	• Interview • Survey	• 5 professional experienced at creating plot-driven media artifacts	• Content Analysis	3
A suite of annotation, search and construction does supports impact the storytelling process.	• Reports of development of a sense of the moral of an experience • Reports of how the supports influence interaction with the tool • Observation of design elements lead users to a plot-driven output	• Interview • Observation • Software Logging	• 15 adult participants from diverse backgrounds	• Qualitative Analysis	1
Structuring photo activities as storytelling can lead to adoption of digital storytelling as a means of communicating personal experiences?	• # of accounts created • # of stories created • # of repeat story creators • # of requests for features	• Software Logging	• As many as participate	• Quantitative Analysis	4

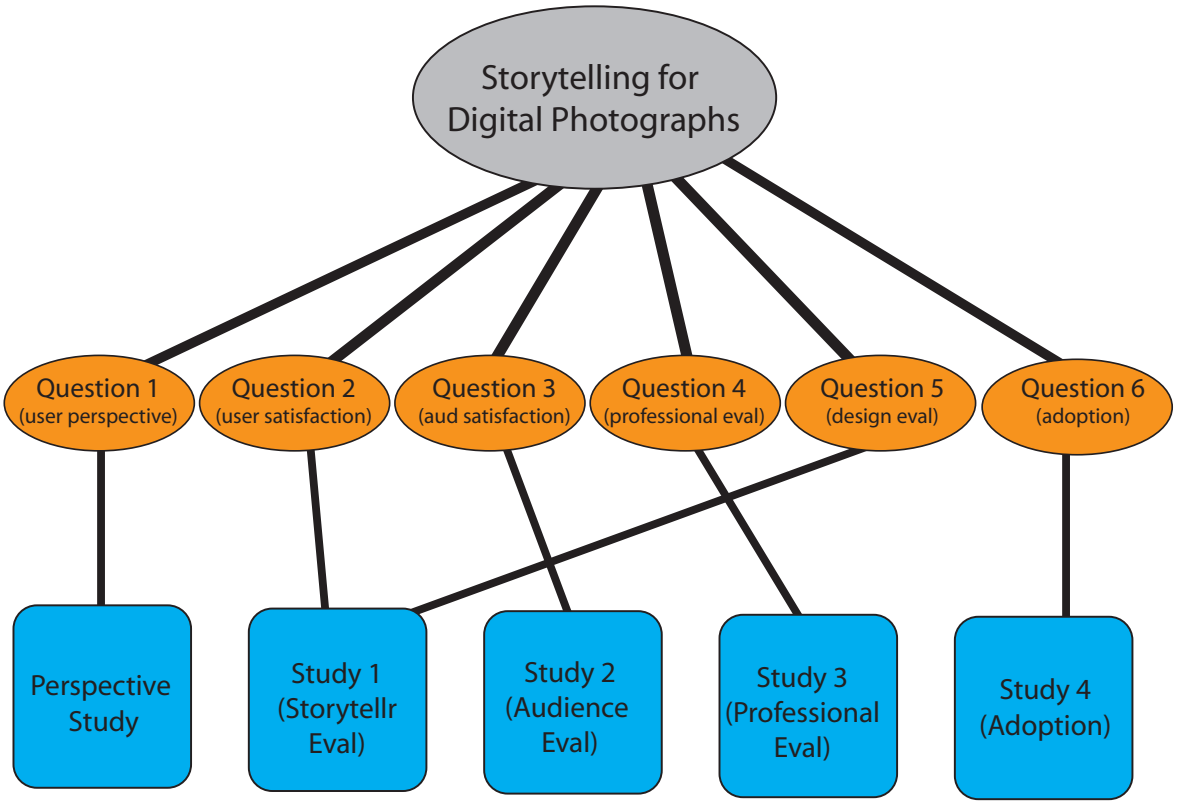

Figure 9: Thesis Question Diagram

CHAPTER VI

PLAN FOR COMPLETION

I plan to begin my Perspective study in late July (See Table 4). I will conduct both the *creation* and *viewing* portions simultaneously. I will begin analyzing the data from this study in late August, early September. In conjunction with the perspective study, I will continue to develop the Storytellr system prototype with a target completion of early October. In mid-November, I will deploy only the upload interface to the participants in Study 1 (See Table 3). I have planned this to coincide with the Thanksgiving and Christmas holiday which tend to be family holidays where photos are taken. A separate, but identical version of the system will be advertised to online photo and video communities to allow for a deployment over a considerable time period. The complete system will be available to people who choose to use it. This deployment will explore my adoption research question (See Section 5.6). In January 2008, I will complete Study 1 by conducting a lab study of Storytellr where recruited participants will create stories using their own photographs. Following Study 1, I will conduct studies 2 and 3 in February to obtain target audience (See Section 11) and professional (See Section 5.4) reactions to the stories created with Storytellr. I plan to complete data analysis for studies 1,2, and 3 by April 2008. I will present a thesis draft to committee in August 2008 and defend in September.

Table 4: Completion Timeline

Task	**Expected Completion**
Perspective Study	July 2007
Data Analysis (Perspective Study)	August 2007
Storytellr Prototype Completion	October 2007
Storytellr Deployment	November 2007
Storytellr Study	January 2008
Audience Study	February 2008
Professional Study	February 2008
Data Analysis	April 2008
Thesis Draft	August 2008
Thesis Defense	September 2008

APPENDIX A

ITELL PROMPT INTERFACES

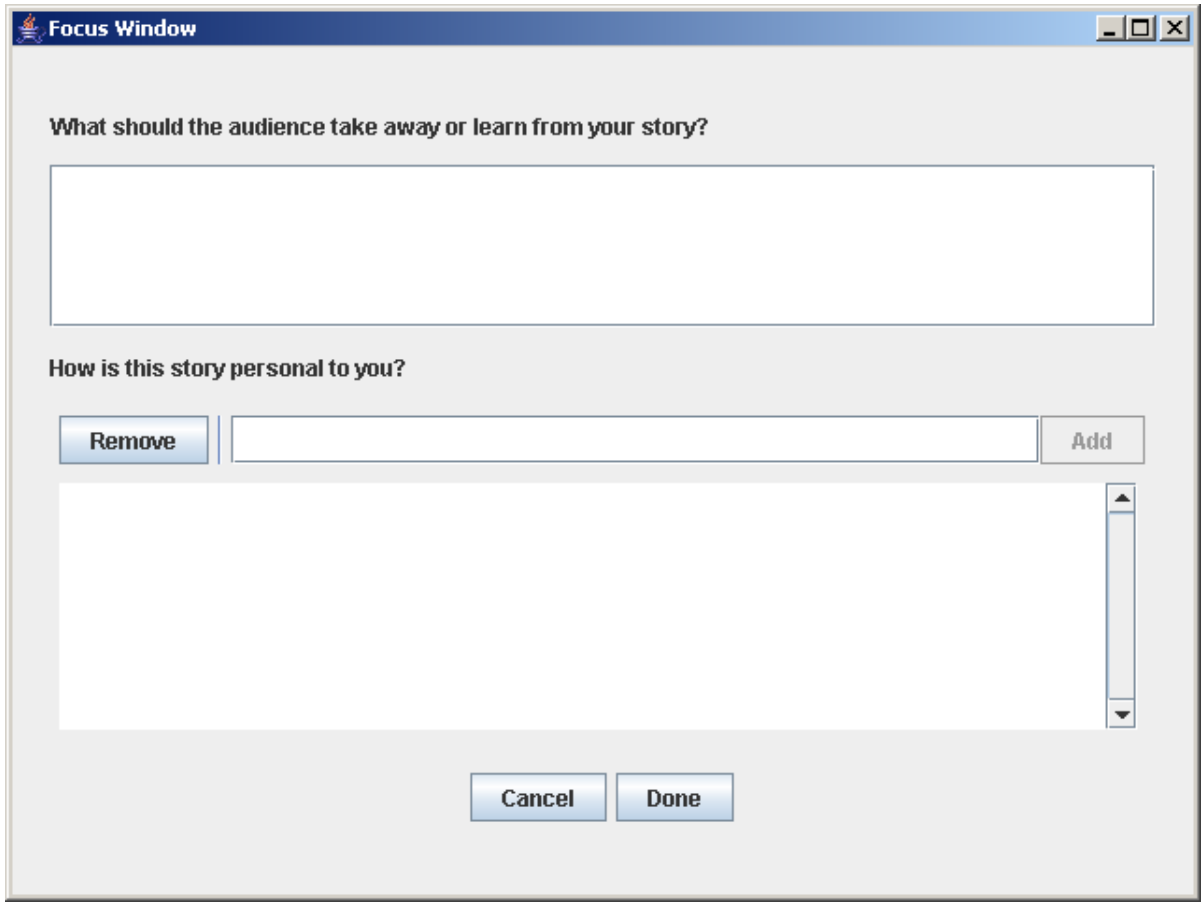

Figure 10: iTell Focus Question Interface

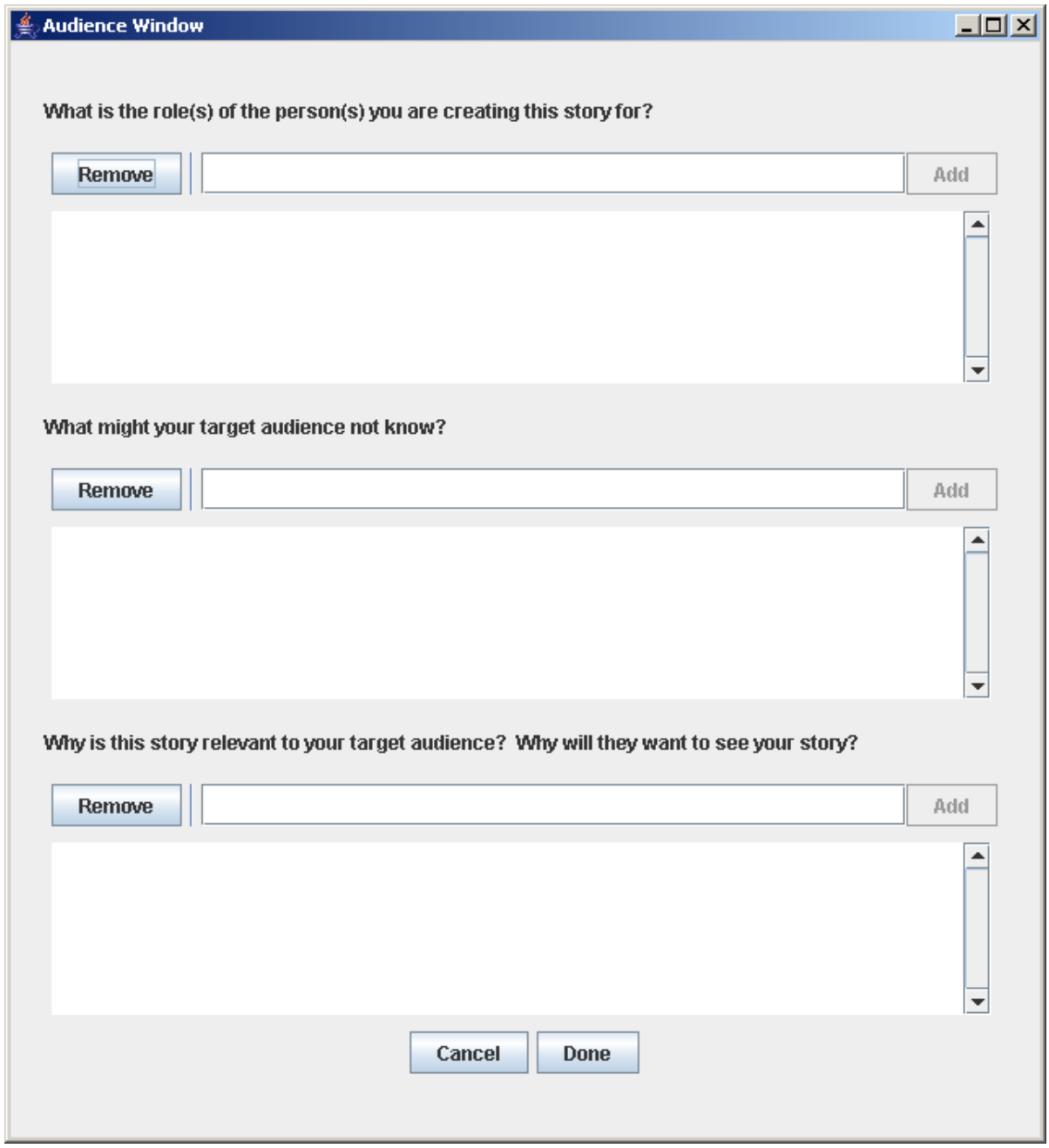

Figure 11: iTell Audience Question Interface

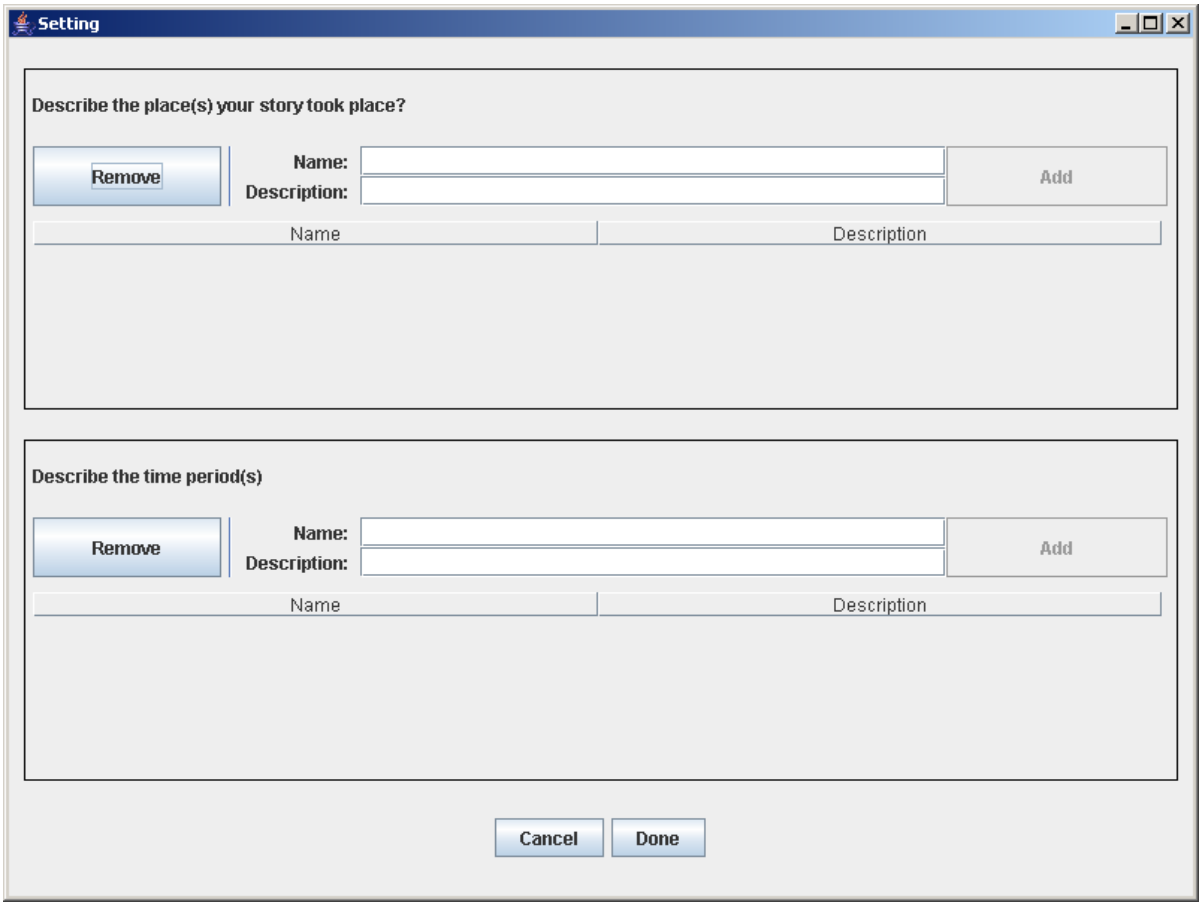

Figure 12: iTell Setting Question Interface

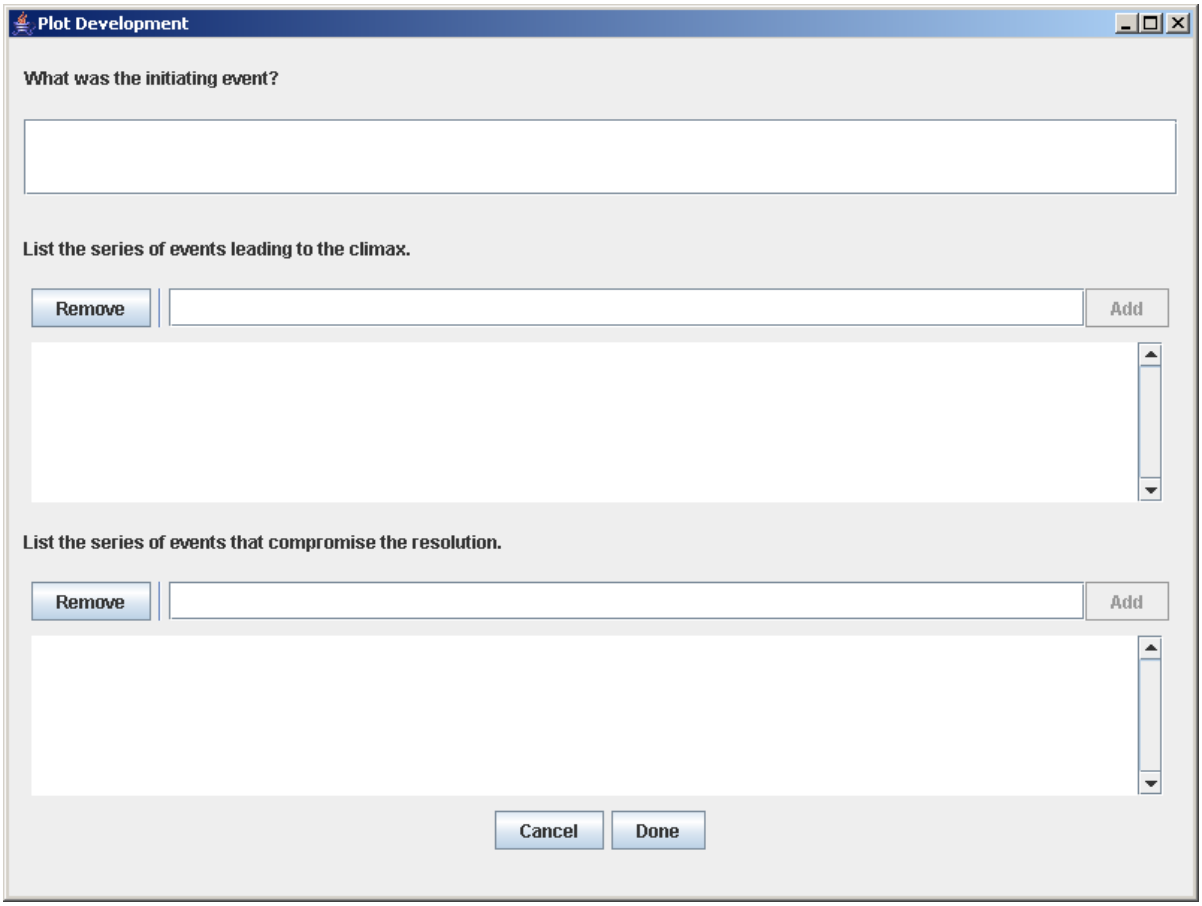

Figure 13: iTell Plot Question Interface

APPENDIX B

USER EXPERIENCE

Sample Survey

Instructions: Please respond to each statement to the best of your knowledge. Write in the number from the table below that most accurately represents your opinion for each statement.

5	4	3	2	1
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

1. I found the "Annotation" phase helpful with tagging my images to help me find photos for my story later.
2. I found the "Search" phase useful and determining the moral of the story I want to tell.
3. I found the "Search" phase useful for finding appropriate images to illustrate my story.
4. I found "Construction" phase helpful with connecting my story with my images.
5. I am interested in creating another story like the one I just created.
6. I feel confident I could use this tool again to create a digital story.
7. I had a satisfying experience using this tool.

Sample Interview Guide

1. How much time do you think it took to complete this story?
2. Is this a reasonable amount of time for you to devote to this activity?
3. Was creating this story worth the time it took?
4. Did you enjoy creating this story?
5. Are you satisfied with the story you created?
6. Who do you plan to share this story with? How do you think they will feel about it?

APPENDIX C

AUDIENCE EXPERIENCE

Sample Interview Guide

1. What would you say the moral of this story is?
2. How long do you think it took to create?
3. What level of skill do you think the author needed to create this video?
4. What tools do you suppose the author used to create the video?
5. Was the anything in the movie you expected to see?
6. Was there anything in the movie you did not expect to see?
7. Did the video evoke any emotions? If so, what emotions?
8. What people do you know that you think could create a story like this?
9. What people do you know that you think could *not* create a story like this?

APPENDIX D

CONTENT ANALYSIS RUBRIC

Table 5: Rubric for Analyzing Storytellr Stories

Code	Description
Causally linked events	Events in the story are logically connected to one another
Initial conflict	The main character is presented with a recognizable complication
Building tension	The events leading to the climax provide the viewer a sense of suspense
Climax	The turning point in the story; sets the stage for the complication to be resolved
Resolution	The events that follow the climax and conclude the story

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