

Tangible Interfaces for Interactive Point-of-View Narratives

Alexandra Mazalek

B.Sc. (Honours) in Computer Science and Mathematics
University of Toronto
June 1999

Submitted to the Program in Media Arts and Sciences,
School of Architecture and Planning,
in partial fulfillment of the requirements for the degree of
Master of Science in Media Arts and Sciences at the
Massachusetts Institute of Technology
September 2001

© Massachusetts Institute of Technology, 2001
All rights reserved



Author: **Alexandra Mazalek**
Program in Media Arts and Sciences
August 24, 2001



Certified by: **Hiroshi Ishii**
Associate Professor of Media Arts and Sciences
Thesis Supervisor



Accepted by: **Dr. Andrew B. Lippman**
Chair, Departmental Committee on Graduate Students
Program in Media Arts and Sciences

Tangible Interfaces for Interactive Point-of-View Narratives

Alexandra Mazalek

Submitted to the Program in Media Arts and Sciences,
School of Architecture and Planning, on August 14, 2001,
in partial fulfillment of the requirements for the degree of
Master of Science in Media Arts and Sciences

Abstract

This thesis presents three storytelling systems for interactive point-of-view narratives using tangible interface technology. The focus is the design and development of computational story models and interfaces that enable users to experience new forms of interaction with stories in the digital medium.

Specifically, I propose that having multiple tightly related character viewpoints can be used as a means of structuring comprehensive and coherent interactive story experiences. Furthermore, I also claim that by using tangible interfaces that are tightly integrated into the narrative model and story content, users can have rich interactive story experiences in which the interaction/interface does not distract from their engagement in the story.

Thesis Supervisor: Hiroshi Ishii
Title: Associate Professor of Media Arts and Sciences

Chapter 1

Introduction

Storytelling is an important part of human culture. We all listen to other people's stories, but we also all tell stories of our own. We find great pleasure in experiencing good stories. They touch us emotionally, and help fulfill our artistic and aesthetic desires. Extending across generations and cultures, stories can also be extremely instructive. They teach us about the world and about our history, and they inform us about the major themes that have affected both individuals and societies for millennia, helping us put our own lives into perspective. And by creating our own stories, we can structure and express our own experiences, understandings and opinions about the world in a form that can be passed on to others.

In the fast-paced and technologically advanced society of today, storytelling is no less important than it has been in the past. Whether in the form of myths, plays, novels, or films, our stories as well as those of our predecessors can help guide us forward. But, inundated by the television shows and videogames of our mass media culture, we can sometimes feel we have lost all real sense of time. Although contemporary media can give us the illusion that we are always in touch

with the world, we still seem to be losing the stories of our past, the stories that give us a sense of who we are and how we fit in. In his book *The Power of Myth*, Joseph Campbell comments: "We are not well acquainted with the literature of the spirit. We're interested in the news of the day and the problems of the hour." [11, p.1] He suggests that our myths have not been able to keep up with our technology, and that in our schools we learn only technologies rather than great stories that impart the wisdom of life experienced.

Yet the computational age provides many opportunities for us to communicate our stories – text, graphics, sound, and video can all be combined together using the digital medium. Desktop moviemaking, hypertext pages on the Internet, and even simple word processing are all powerful means by which people can create and distribute their stories. Perhaps we can make use of these technologies to tell meaningful stories that might fulfill the human need for storytelling, and become the myths of our contemporary society.

In this thesis, I will examine some of the new forms of storytelling made possible by digital technologies. But before beginning our exploration of storytelling in the computational age, let us look back at how storytelling has evolved across the centuries.

1.1 A Brief History of Storytelling

There are many theories on the origins of storytelling. Anne Fellowski provides an analysis of its history in her book *The World of Storytelling*, and suggests that it originated in the play activities through which people entertained their particular social group informally [31]. She also describes evidence to support a variety of other theories. For instance, storytelling might have stemmed from a human need to explain and understand our surrounding physical world, or from a religious need to honor supernatural forces. Or perhaps storytelling evolved from an aesthetic need for beauty and form through expressive language, or from an inherent desire to communicate and record our experiences.

There is probably some amount of truth to all of these theories. According to Joseph Campbell, early people enacted rituals and created myths to help them cope with the certainties of life, such as the passage from childhood to adulthood, and death [12]. He explains that the earliest evidence of mythological thinking can in fact be associated with graves and ritualized burials anywhere from 150,000 to 50,000 BC. Cave paintings dating from 40,000 to 10,000 BC are also early evidence of mythological thinking and storytelling. Early artists tried to tell their stories by painting pictures on cave walls or rocks – they told of encounters with animals, sacred rituals, and the experience of life and death.



Figure 1: The drawing shows a dancing shaman from *Les Trois Frères* cave (above). "The Scene of the Dean Man" from the *Lascaux* cave is famous for its narrative possibilities (right).

Long before the development of written language, stories were passed down the generations through a tradition of oral storytelling [4]. They took the form of myths and legends, and helped people understand and explain the world around them. Around campfires and water holes, the wisdom of the elders was passed on to young children. Ideas, ideals, values and standards of behavior were all handed down from one generation to the next. Early oral tales from many cultures have been preserved for us, and are still told or read today. Some examples include creation myths, such as the *Book of Genesis* in the Bible, handed down by the ancient Hebrews, or stories of heroes, such as the Sumerian *Epic of Gilgamesh*. Other notable examples are the works of Homer such as the *Iliad* and *Odyssey*. Homer created his stories around 1200 BC, long

before the Greeks developed a credible, lasting alphabet, and his works were then passed orally from generation to generation for hundreds of years.

Theatre evolved as another form of storytelling, in which actors take on the role of characters in a story that is performed in front of a live audience [41]. Generally believed to have originated in religious rituals, theatre eventually grew to be an independent art form in ancient Greece, where it was first used to celebrate the rejuvenation of the earth, and later drew on Homeric legends for its subject matter. Greek playwrights such as Thespis and Aeschylus developed dramatic conventions that would influence theatrical arts across the centuries to come. For instance, according to Greek tradition, Thespis invented the drama when he augmented the dithyramb (a form of choral song) to have a single actor who wore different masks to portray several characters. With the possibility of dialogue between the actor and chorus members, more complex themes and modes of storytelling could be developed.

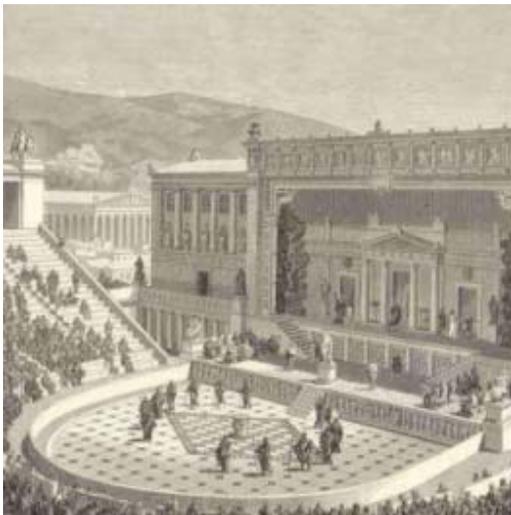


Figure 2: The first Greek plays were performed at the *Theatre of Dionysus* in Athens (left). The vase fragment depicts actors from ancient Greek theatre (above).

Over the years, theatre evolved around different parts of the world. For instance, between the classical and medieval periods in Europe, it was kept alive by popular entertainers – mimes, minstrels and storytellers – who wandered the country alone or in small groups. During the late Middle Ages, these popular entertainers found a more secure place at

royal courts and in the households of nobility, where they acted, sang, and played music for their masters. In Japan, dances had been common in religious rituals since prehistoric times. Japanese No theatre is a fusion of dance, drama, and song that was developed in the 14th century, and draws influences from theatrical and musical arts in China, Korea and India.

The development of stable writing systems around the world allowed people to start recording their stories [45]. For instance, the works of Homer were finally written around 700 BC, and they became the textbooks in the schools of Greece, and the cornerstone of Western literature. During the Middle Ages in Europe, Christian scribal monks recorded many of the great sagas and heroic epics from the oral tradition. Examples include the Anglo-Saxon *Beowulf*, and the German *Song of Hildebrand*. The invention of the printing press by Johannes Gutenberg in Germany around 1450 drew on earlier inventions from China (paper, block printing, and moveable clay type), and marked the Western world's first practical means of disseminating ideas, information, and stories from a single source to a large and distributed audience [19]. From that point on, printed books rapidly became a widespread storytelling medium.

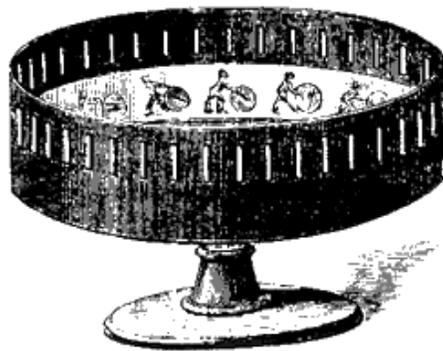


Figure 3: The Zoetrope consisted of a revolving drum with many small slits. A series of pictures that changed slightly from one to the next were arranged on the inside. By spinning the drum, one could trick the eye into seeing a single moving picture.

Near the end of the 19th century, technological innovations such as the Kinetoscope and Kinetograph by Thomas Edison, and the Cinématograph by the Lumière brothers enabled storytelling in the form of motion pictures. These technologies were based on earlier devices such as the Zoetrope that used persistence of vision to create the illusion of motion

from still images (see figure 3). As motion picture machines evolved, a cinematic grammar or language of storytelling was devised, and many stories were adapted to fit this new medium. The storytelling language is now known as the cinematic "montage" (editing), which can build time and space not out of sentences and paragraphs, but out of sequences of shots separated by cuts. In this way, sequences of film are structured into coherent narratives that can be communicated to an audience. The first example of this cinematic structure is generally considered to be D.W. Griffith's 1915 film, "Birth of a Nation" [33]. The film's development of plot and dramatic use of editing became integral to the structure of Hollywood and mainstream filmmaking.

Over the course of the 20th century, innovations such as the transmission of sound and motion pictures over radio and television provided new means of distributing information and stories to wide-ranging audiences. At last in 1945 came the invention of the first electronic computing machine. Since then, the rapid development of personal computers and digital formats for audio and video has opened up many possibilities for the expansion and development of the art of storytelling.

1.2 Technology and Storytelling

Across the centuries, technological innovations have enabled new mediums for creative expression, and storytelling has evolved to fit each one. In his Master's thesis, Phillip Tiongson describes three stages in the development of an expressive medium: first a medium is invented through advances in technology; next an expressive language is defined through experimentation, an understanding of past conventions, and a vision for the future; and finally, as the medium matures and stabilizes, the tools for working within it become increasingly accessible, allowing both professional and amateur artists across the world to tell new kinds of stories [42]. For instance, the invention of motion picture cameras enabled a cinematic form of expression. Certain early films captured scenes from real life, such as the first film by the Lumière brothers, *La sortie des ouvriers de l'usine Lumière* (Workers leaving the Lumière factory, 1895). Many other early films were simple translations of the theatrical form of storytelling: stage plays acted in front of a camera.

Certain films also played with the illusion of cinema: in the "trick" films of Georges Méliès, people appeared and disappeared at the will of the filmmaker. His most well known work, *A Trip to the Moon* (*Le Voyage dans la Lune*) was created in 1902. Through this sort of creative experimentation, cinematic storytelling conventions were defined, allowing today's filmmakers to tell their stories using a language unique to the cinematic medium.

The development of personal computers over the past twenty years has allowed people to begin adapting storytelling as an interactive digital medium. In 1989, Brenda Laurel reminded us how difficult it is for people to imagine what has not yet been invented, and that extrapolating from the state of interactive entertainment at any point in time risks incorporating the limitations of the past into the future of interactive storytelling [26]. Early digital stories range from hypertext novels, to adventure games and multimedia CD-ROMs. The first computational narrative model that comes to mind is generally the branching story structure, which is based on the choose-your-own-adventure books of the 1970s. In this model, stories branch out into multiple different pathways, and the author provides preset branch points at which the user (or reader) must choose which one to follow. It is clear that in these early interactive systems, the grammar to guide and help structure storytelling within the digital medium is still rather limited. There remains a vast world of creative opportunities to be explored and exploited, and with the increasing stability and accessibility of digital technology today, storytellers worldwide are able to free themselves from the cinematic and literary traditions of the past in search of novel approaches to computational storytelling.

1.3 Interactive Narratives Meet Tangible Interfaces

In 1998, I attended my first CHI (Computer-Human Interaction) conference. There, a presentation by two graduate students from the Tangible Media and Hyperinstruments Groups at the MIT Media Lab caught my attention. They were using plastic triangular pieces that could be snapped together as a means of navigating through non-linear stories [24]. This was my introduction to the concept of "tangible interfaces",

and I was fascinated! I had been creating stories using digital video and conventional GUIs (Graphical User Interfaces), and I immediately saw the potential of tangible interfaces for communicating digital stories to audiences in a rich physical form.



Figure 4:
Triangles
is a tangible
interface in the
form of a
physical/digital
construction kit of
plastic triangular
pieces.

Over the past two years as a student in the Tangible Media Group, I have created three separate storytelling systems that use tangible interface technology. This thesis thus contributes to the field of interactive storytelling through the design of computational story models and tangible interfaces that enable users to experience new forms of storytelling. In particular, the computational models I have explored use multiple points-of-view as an approach for structuring narrative interaction, and the tangible interfaces have served as a means of communicating the stories to audiences.

Storytelling is a vast field that is continuously expanding as new mediums and forms of expression are developed. I chose to focus on three key points in digital storytelling: interactivity in narratives, multiple points-of-view, and the design of tangible interfaces to communicate stories. It is important to ask how these three points work together to form the focus of my research, and the next few subsections address this question.

Why Interactive?

Many people believe there is an inherent conflict between interactivity and immersive or engaging narrative experiences. When a user is immersed in a story, they are less inclined to interrupt the experience

through some form of interaction. Furthermore, from the perspective of creating a story, interactivity risks greatly increasing the complexity of the narrative structure. For instance, instead of a single defined narrative path, the branching story model must provide many paths, all of which must make sense in view of the story being told. Despite these problems, storytellers have enjoyed experimenting with interactivity over twenty years. They have been attempting to overcome the problems of complexity and immersion by exploring different narrative models for their stories. The benefit of interactivity for authors and viewers alike is that a given story can take on a variety of meanings through alternative tellings. Furthermore, as Michael Murtaugh explains in his Master's thesis, relinquishing certain aspects of authorial control can allow viewers to form a personal connection to the story [29]. In this sense, interactive narratives offer the potential to tell more complex and personally meaningful stories than those delivered to a mass audience. Interactivity may serve to increase viewer engagement by incorporating their specific knowledge and preferences. For instance, a computational system can gather the viewer's knowledge about story events as they navigate, and then direct the course of the story accordingly. Interactivity also creates the possibility of "reviewable" stories in which each telling can reveal different perspectives and insights. The digital medium allows us to tell stories in a new way, and although it might sometimes be difficult to see from the interactive storytelling landscape of today, it should be possible to create immersive stories in which users are driven to interact.

Why Multiple Points-of-View?

In character-driven narratives, different characters with distinct personalities and unique points-of-view are used as a basis for creating a story. As Maureen Thomas, creative director of the Cambridge University Moving Image Studio, explained to me at a Narrative Workshop run by Glorianna Davenport at the MediaLabEurope in Dublin, "if you start from character, the story simply writes itself." In contrast to the character approach, creating a story from plot-points can be much more difficult. With a framework of actions and events in place, finding the right set of characters to fit them can be a tricky task. It may even be the

case that for a given set of plot-points, there may not exist a believable set of character personalities to enact them. Furthermore, while plot-driven stories can incorporate interactivity by branching out into different narrative paths, character-driven stories can use multiple points-of-view to incorporate interactivity into a single story space, allowing for decreased complexity in the creation of the story. Also, branching structures can sometimes fragment the plot, leaving viewers unsatisfied with the story experience. Giving viewers the choice between multiple character viewpoints on a given story is one possible strategy for structuring interactions into coherent story experiences. This approach will be explored in greater detail in Chapter 2.

Why Tangible?

When creating a story, it is important to consider the form and environment in which it will be conveyed to its audience. This environment needs to provide an atmosphere for immersion in the story. In theatre, we experience a story together with other audience members as it unfolds on a stage in front of us. In film, the frame that is projected onto a large screen in a dark theatre provides a window into a story world that draws us in with ease. When reading a novel, our imagination is free to "see" the story in our own way, and we become immersed in the words written on each page. In contrast to these forms, traditional computer interfaces seem static and clunky. All day long I sit in front of a computer screen, clicking on a mouse, and typing on a keyboard. I am reminded of Professor Hiroshi Ishii's words: this form of interaction "impoverishes the senses". This is the last thing I want when experiencing a story. Tangible interfaces provide interactive narratives with a means of escaping from the computer box into our physical environment. They enable us to go beyond visual/auditory senses and make better use of our sense of touch.

1.4 Thesis Structure

This thesis chronicles my explorations in the design and implementation of interactive narratives with tangible interfaces, and describes the theoretical principles I have identified along the way. The process was

one of iterative design across three separate storytelling systems, in which the ideas and limitations of each contributed to the development of the next.

In Chapter 2, I examine the concept of multiple viewpoint narratives from a theoretical perspective, and describe past work in the fields of point-of-view and tangible narratives. I also identify two main hypotheses for the design of my systems.

Chapters 3, 4 and 5 are devoted to the design, development and analysis of the three storytelling systems I have built: the *genieBottles* system, a narrative installation entitled *It May All End in Aleppo*, and the *Tangible Viewpoints* system.

Chapter 6 concludes the thesis by summarizing the lessons learned and discussing possible extensions to the *Tangible Viewpoints* system.

Chapter 2

Laying Down the Foundations

I have examined the human need for storytelling, and how it has evolved over the ages. I have also hinted at how interactivity can be structured using multiple character viewpoints, and how tangible interfaces can provide a rich means for interaction with stories.

At this point, it is time to lay down specific foundations for the design of tangible interactive point-of-view storytelling systems. In this chapter, I look at past work in two related fields: multiple viewpoint stories and tangible narratives. I then go on to discuss the principles and hypotheses that led to the design of three interactive storytelling systems: an audio-based "bottled" story entitled *genieBottles*, a narrative video installation entitled *It May All End in Aleppo*, and finally the interactive *Tangible Viewpoints* system.

But first, I begin by examining the term point-of-view in narrative theory. Since the term covers a vast range of functions in the English language, it is important to clarify the meaning in the context of this thesis, and to look more closely at how it can be used in the creation of interactive stories.

2.1 Defining Point-of-View

How is the term *point-of-view* used differently in the following two sentences?

- 1) From my point of view at the top of the building, the cars below looked like little toys.
- 2) John told me that from his point of view it had been a mistake to sell the house.

The first sentence uses point-of-view to denote the physical position from which something is viewed, while the second uses it to mean an opinion or mental attitude toward a question. Although these sentences demonstrate how the term is used in everyday language, neither one provides a definition that can be applied directly and precisely to the concept of point-of-view in narrative theory and storytelling.

In his book *A Theory of Narrative*, F.K. Stanzel quickly casts aside these ordinary uses of the term point-of-view, and instead identifies a meaning that is specific to narrative terminology. He writes that point-of-view is the "standpoint from which a story is narrated or from which an event is perceived by a character in the narrative." [37, p.9] This definition in fact reveals two distinct contexts in which the term point-of-view has been used in narrative theory: (1) to narrate or communicate to an audience, and (2) to perceive or experience as a character in the fictional space. Since applying the term point-of-view to both contexts can lead to confusion, Seymour Chatman refers to the first using the term *narrative voice*. He defines point-of-view and narrative voice as follows:

"Point of view is the physical place or ideological situation or practical life orientation to which narrative events stand in relation. Voice, on the contrary, refers to the speech or other overt means through which events and existents are communicated." [13, p.153]

So narrative voice is the expression, while point-of-view is only the perspective in terms of which the expression is made. Seymour Chatman explains that the perspective and expression need not be lodged in the same person, and that different combinations are possible [13]. For example, narrative voice and point-of-view coincide in stories where the narrator both perceives events and recounts them in the first person. On the other hand, point-of-view is frequently assigned to a character that is

not the narrator, and the narrator recounts events in the third person. Chatman hence writes: "point of view is in the story (when it is the character's), but voice is always outside, in the discourse." [13, p.154]

Looking at the Stanzel and Chatman's theories has helped identify a definition of the term point-of-view appropriate to storytelling. But how can the concept be extended to multiple characters, each with their own point-of-view? And how does interactivity fit into the picture?

2.2 From Point-of-View to Interactivity

In Chapter 1, I briefly mentioned the difference between plot-driven and character-driven narratives. Although both character and plot are necessary for a story to exist, narrative theorists have long argued over which is subordinate to the other. In his *Poetics*, Aristotle repeatedly underlines the primacy of action, of which the characters are mere agents [2]. Similar to Aristotle, the Formalists argue that character is a functional product of plot. They avoid analyzing the psychological essence of characters, and instead concentrate only on their actions [13]. For instance, theorist Vladimir Propp studied over a hundred Russian folktales and concluded that they were all constructed from a certain set of plot components. For him, the characters in the folktales were simply products of what the stories required them to do [32, p.20]. In modern art narratives on the other hand, the contemplation of character seems to be predominate. According to Seymour Chatman, modern characters like Leopold Bloom in James Joyce's *Ulysses* cannot be reduced to any single aspect or pattern [13, p.112]. Their traits are numerous and complicated, and cannot be considered mere consequences of the story's plot. It is the character's personalities that seem to determine their actions.

In reality, applying a generalized statement about the importance of plot over character or vice versa to all stories is impossible to do. The question should be one of emphasis. This seems to be what Tzvetan Todorov is getting at when he distinguishes two broad categories of narratives: those that are plot-centered (or *apsychological*) and those that are character-centered (or *psychological*) [43]. To quote Henry

James, "What is character but the determination of incident? What is incident but the illustration of character?" Where the chief emphasis falls in a given story is more a matter of the changing tastes of authors and their publics [13].

For me, the interesting question lies in how the emphasis on either character or plot can be used to structure interactivity in digital storytelling systems, and the advantages or disadvantages of each approach. In Chapter 1, I mentioned a typical method of using plot to guide interactivity by creating stories that can branch out into different paths (the "choose-your-own-adventure" model). Users interact by deciding which path to take at the preset branch points. One downfall of this method is generally acknowledged to be the increased complexity of the writer's task, given that they have to provide many different believable plot lines for a given set of characters. The personalities of the characters are not used to guide the narrative. Instead, their actions are frequently left as a choice for the user at the story's branch points. As in Vladimir Propp's folktales, the focus is more on providing a variety of interesting plot lines than on the contemplation of complex characters. While it can sometimes be interesting to follow characters along a variety of diverging narrative threads, I have generally found it difficult to immerse myself fully into such stories. As Seymour Chatman has underlined, modern narratives have tended to lean toward psychologically complex characters, whose traits and actions do not necessarily add up to a single goal-oriented behavior [13]. Perhaps this is what I have been missing in plot-driven interactive narratives.

In the previous section, we examined point-of-view as the concept of seeing a story from a particular character's perspective. Psychological narratives frequently give us access to a character's thoughts and consciousness, which serves as a typical means of entering his or her point-of-view. The distribution of inside views among different characters in a story can lead us to identify with certain characters over others. Seymour Chatman writes that "despite close physical proximity and the thinness of characters' skins and membranes, wholly different mental universes exist only inches apart." [13, p.216] In traditional narratives, these widely differing "mental universes" generally fit into a

master plot. Over the course of the story, the focus often narrows to a single main character's viewpoint with which we are lead to sympathize. We can call this the "hero model." In contrast, certain modern storytellers have explored the possibility of constructing narratives by using several character viewpoints consistently over the course of the story. For instance, multiple viewpoints can allow the construction of a story from several partial and sometimes conflicting opinions of the past, as in Akira Kurosawa's film *Rashomon* (1950). Alternatively, the author can shift viewpoints as the story moves forward in time – an approach that is often used in "whodunit" mysteries such as the play *Shear Madness* (adapted from the Paul Pörtner's 1963 play *Scherenschnitt* by Marilyn Abrams and Bruce Jordan). In either case, moving from a single character viewpoint to several different viewpoints can provide a means for structuring interactivity in a computational narrative by allowing viewers to select the viewpoint as they move forward through the story.

One of the advantages of the multiple viewpoint approach is that it leaves greater possibility for different viewers/readers to relate to different characters depending on their own personalities and preferences. Furthermore, events can take on a variety of meanings depending on whose perspective they are viewed from. When choosing point-of-view is left to the viewer, a single story space can turn into a myriad of story experiences, each one tailored to the preferences of a particular individual or audience. Janet Murray captures our desire for such experiences when she writes:

"The kaleidoscopic power of the computer allows us to tell stories that more truly reflect our turn of the century sensibility. We no longer believe in a single reality, a single integrating view of the world, or even the reliability of a single angle of perception... The solution is the kaleidoscopic canvas that can capture the world as it looks from many perspectives—complex and perhaps ultimately unknowable but still coherent." [28, p.161]

2.3 Point-of-View Narratives

Multiple viewpoint narratives have been explored in both non-interactive and interactive forms by many different writers, filmmakers

and artists. This section gives an overview of some of the more notable examples.

Non-Interactive Works

I include examples of point-of-view stories from the following three non-interactive categories: (1) literature, (2) cinema, and (3) theatre.

(1) Literature

Examples of multiple viewpoint narratives from literature include William Faulkner's *As I Lay Dying* and *The Sound and the Fury*. In *As I Lay Dying*, each chapter begins with a name caption, and the text that follows is seen from that character's perspective. In total there are fifteen different character points-of-view that emerge over the course of the story. *The Sound and the Fury* on the other hand is told through three different narrators, each with an idiosyncratic and partial perception of the story. The novel is divided into four parts: the first is the direct interior monologue of a mentally disabled character, the second and third are each narrated by different characters, and finally the fourth is in third person omniscient viewpoint. William Faulkner originally asked his publisher to use different colors for the print in the novel, hoping it would make the time-jumping stream of consciousness style of the first section more comprehensible [28].

(2) Cinema

In cinema, multiple point-of-view narratives have been explored in a variety of ways. One of the most widely acknowledged examples is the 1950 film *Rashomon* directed by Akira Kurosawa. The film is a careful observation of a single event (rape and murder) looked at from four different points-of-view one after the other. The stories of the four witnesses are wildly at variance, and as such the film questions the existence of a single unified reality. Kurosawa's approach works well in that the entire story is centered around a single event linking together the four points-of-view.

Another cinematic approach to treating multiple viewpoints is to follow each character around with the camera as their part of the story unfolds.

An example of this is Robert Altman's *Short Cuts* (1993). Unlike *Rashomon* with its single central event, *Short Cuts* has many different stories with a total of 22 main characters. As such, the film can be overwhelming on first viewing.

Jim Jarmusch's film *Mystery Train* (1989) illustrates yet another approach to changing character perspectives in cinema. The film presents, one after the other, three separate episodes that are gradually revealed to be taking place simultaneously. Each episode in fact offers a different character perspective on the same period in time. Compared to *Rashomon*, there is relatively little that links together the different points-of-view. Although certain events are seen over again in the different episodes, there is no single central event. A similar approach is used in Brigitte Rouan's 1991 film *Overseas* that tells the intersecting stories of three French sisters one after the other. As the sisters' paths cross, we see certain events depicted more than once, each time from a different sister's point-of-view. As in *Mystery Train*, the events in which the stories intersect become reference points for the viewer, and the importance of certain events changes from one sister's account to the next.



Figure 5: Production stills from Akira Kurosawa's *Rashomon* (left) and Jim Jarmusch's *Mystery Train*

(3) Theatre

In Theatre, stories often have many equally weighted characters, which can sometimes give the audience a feeling of witnessing multiple character perspectives of the given events. In Anton Chekhov's *The Seagull*, for instance, the 10 different principal characters come on stage

trailing pieces of their seemingly complex personal histories. Furthermore, they have complicated relationships with one another, and our perspective of them keeps shifting as we see them through different characters' eyes.



Figure 6:
Photo from a
performance of
Anton Chekhov's
play *The Seagull*.

In an entirely different documentary theatrical piece called *Fires in the Mirror*, Anna Deviere Smith delves into the conflict between African Americans and Hassidic Jews in Crown Heights, New York. After having interviewed a wide range of people, she performs selected portions of the interviews on stage, imitating the look, voice and mannerisms of each person, and speaking their actual words. Through this approach, the audience can gain deep insights into the personal stories of the real-life characters, as well as into the collective story they wove together through their separate viewpoints. Overall, Smith's performance shows the audience that there is no single answer or truth that can encompass the complex reality of the conflict.

Interactive Works

Examples of multiple viewpoint interactive works fall roughly into three different categories: (1) non-computer-based works, (2) hypermedia, and (3) digital storytelling systems. In the first two categories, the story structures are static and lack the capacity to store knowledge. In contrast, digital storytelling systems have the ability to remember viewer interactions, and can thus construct dynamically responsive narratives based on accumulated knowledge and the content/procedures provided by the author.

(1) *Non-computer-based systems*

The first of these categories includes storytelling forms such as interactive live theatre, radio plays, and television.

A notable example for this category is *Tamara*, an interactive dinner play by John Krizanc that takes place in the rooms of a large mansion. The audience members are free to follow actors from room to room, observing their performances, and slowly piecing together the story. The play is structured in such a way that each audience member sees only a portion of the total story depending on the rooms they decide to visit. Audience members' sympathies toward the characters in the play thus differ based on which scenes and whose point-of-view they witness during their wanderings throughout the house.

Another example is a new BBC radio play to be aired in September 2001. *The Wheel of Fortune*, written by Nick Fisher, is actually a collection of three plays that will be broadcast on different channels simultaneously. Each of the three plays focuses on the story of a different character, and listeners will be able to switch between the channels at key points, effectively creating their own plays.

(2) *Hypermedia*

Hypermedia systems allow authors to create links between pieces of story content, including text, images, audio and video, thereby forming a graph structure or story-web that the viewer can navigate.

In her book *Hamlet on the Holodeck*, Janet Murray describes a story format that is used frequently by students in her interactive writing classes [28]. She calls it the *violence hub*. Authors of such stories place an account of a violent event (for example a newspaper article) at the center of a web of stories that explore it from different viewpoints. Helicopter accidents, robberies and canoeing fatalities are all examples of violent incidents that have formed the center of such hypermedia narratives in Murray's classes.

Another hypermedia example is the online story *DarkZOO*, which is a multiple viewpoint narrative that can be viewed from six different

characters perspectives [20]. Unlike most hypertext stories on the Internet, *DarkZOO* is structured in an almost completely linear fashion. When users first enter the story system, they are introduced to the characters and asked to select one of their points-of-view. The story then moves forward in a linear fashion from one chapter to the next. At each page, users have the ability to stay with the current point-of-view or select a different one (with the restriction that not all character viewpoints are necessarily available at every chapter). Users can also view images from the story, or read an integrated version of the novel. As with most hypertext systems, I felt I was gaining very little from the way the interactivity was structured since the story was in no way dynamic or adaptive, and for the most part I felt compelled to read all available points-of-view at every chapter.



Figure 7: The navigation bar in the *DarkZOO* online hypertext story. Joshua's point-of-view is currently selected (indicated by the red border). White text indicates the points-of-view that are currently available.

(3) Digital Storytelling Systems

An early example that fits into this category is Carol Strohecker's 1986 computer controlled videodisc *A Different Train of Thought* [38]. It consists of a single story in which different characters see events in different ways both literally and symbolically, and viewers interact with the story by accessing representations of the characters' thoughts. The video screen is divided in two: the bottom of the screen displays still pictures of the characters in the movie, while the upper part displays the actual moving image. As the story unfolds, viewers can click one of the still images along the bottom of the screen to gain insight into that character's thoughts. What works well in Strohecker's story is that it keeps moving forward regardless of whether or not the viewer decides to interact. Also, when a viewer accesses a given character's thoughts, they can elect to return to the main story at any time, or let the "thought"

segment play itself out, after which return to the main story is automatic. Both these features are beyond the basic ability of hypermedia, which is why *A Different Train of Thought* can be placed in the storytelling systems category.

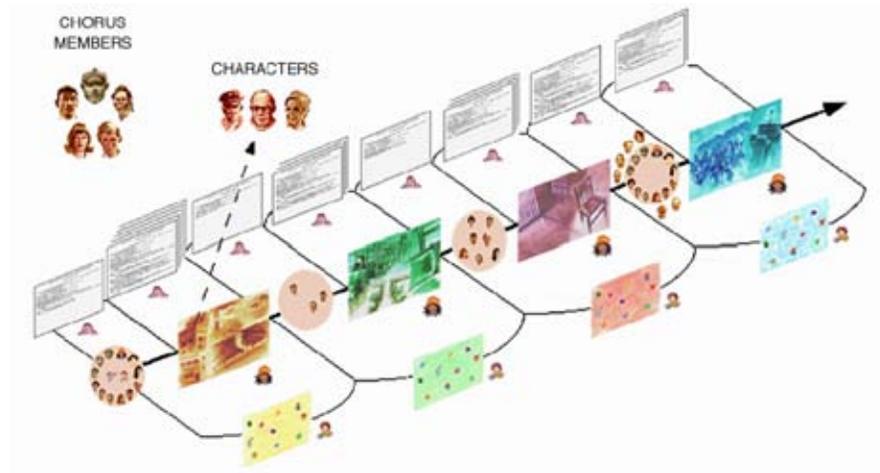


Figure 8: This diagram illustrates the different "folds" in *Tired of Giving In*. By clicking on parts of the screen, users can bring up an associated set of characters and chorus members that engage in a pre-recorded dialog.

Over 10 years later, between 1996 and 1999, Carol Strohecker worked on another point-of-view storytelling system together with Kevin Brooks and Larry Friedlander. Like *A Different Train of Thought*, *Tired of Giving In* also maintains a particular storyline. Viewers explore the story through the multiple perspectives of the different characters and a three-part chorus similar to that in ancient Greek theatre [39, 40]. The authors call their system an experiment in *narrative unfolding*, as the story is revealed not only through varying perspectives, but also at varying levels of detail that can be "unfolded" by the user. The system presents a point-of-view model for structuring computer-based narratives so that viewers can interact without actually changing the course of the story.

Another example of a point-of-view digital storytelling system is the evolving documentary *New Orleans: A City in Transition* [14]. Shot by Glorianna Davenport and Richard Leacock, the piece is a case study of

urban change along the historic waterfront of New Orleans before, during and after the 1984 Louisiana World Exposition. Presenting 5 major stories, and 50 major characters over 3 years of development, the interactive presentation was first realized in 1987 on a networked Unix-based system. It was later re-written in Hypercard. The original system incorporated a free-form associative query mode for browsing the information, and viewers could orchestrate which character's point-of-view they wanted watch the action from.

A final example for this category is Philip Tiongson's *Hindsight*, a java-based web interface for multiple viewpoint interactive narratives [42]. The plot is based on the idea that our actions seem different to us when we look back at them. We tell different stories about our lives depending on our audience and on how we have changed since the actual events took place. In *Hindsight*, the narrative always progresses forward, and the user can switch between the different threads at any time. In this sense, it is similar to Nick Fisher's *The Wheel of Fortune*.

2.4 Tangible Narratives

The idea of using tangible components in storytelling is not new. For instance, children have been telling (and participating in) tangible stories for centuries, using their dolls and other toys as props. In the field of digital storytelling, a number of people have also sought to go beyond traditional computer interfaces for interacting with narratives. Their work can be placed roughly into two different categories: (1) tangible interfaces, and (2) transformational environments and installations.

As human beings, we have developed sophisticated skills for sensing and manipulating our physical environment. Most of these skills are not employed by traditional GUIs (graphical user interfaces). When we interact with a story using a keyboard or mouse, we focus on the screen and the scale of the screen, often losing sight of the architecture and environment around us. In contrast, tangible interfaces and transformational environments are rooted in our physical surroundings. They employ physical objects, surfaces and spaces as tangible embodiments of digital information, thus coupling the dual worlds of

bits and atoms. As such, they can afford natural physical interactions with digital stories.

(1) *Tangible interfaces*

As mentioned in Chapter 1, the Triangles project was my introduction to the idea of using tangible interfaces as a means of interacting with stories. The Triangles creators, Matt Gorbet and Maggie Orth, worked on two separate storytelling systems using the Triangles [23, 24]. The first was a web-based narrative called *Galapagos*. Partial images of characters, events and locations were placed along the faces of the Triangles in such a way that connecting them would complete the images and trigger a story in the form of web pages. The second system, *Cinderella 2000*, was an interactive version of the Cinderella fairy tale. The *Cinderella 2000* story was entirely audio-based, since the authors had learned from the *Galapagos* system that users were not sure how to handle the split visual focus between computer screen and triangular tiles.

The *StoryBeads* project by Barbara Barry illustrates how a tangible/wearable interface can be used for creating and sharing stories [5, 6]. Stories are created by sequencing digital images and text that can be stored inside the beads. The beads also act as a computer network that can trade content with other beads.

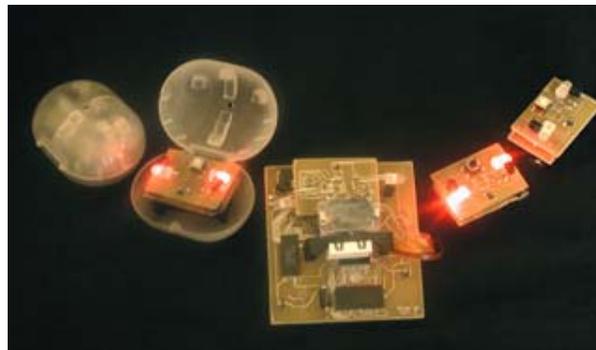


Figure 9:
Photo of a
digital
StoryBeads
necklace.

Much of the work in the Gesture and Narrative Language group uses digital technology to link children's stories to physical toys. Some examples include Kimiko Ryokai's work on *STORYMAT*, a physical play

mat that stores children's storytelling play by recording their voices and the movements of the toys they play with [35, 36]. These stories later revive on the mat as other children play and tell stories with the same toys. In a similar vein, the *Rosebud* project links children's stories to their stuffed animals [21, 22].

The *PETS* project at the University of Maryland is another form of tangible interface storytelling for children [18]. Robotic toy pets are used as electronic storytellers for children. The basic idea is that children can build their own pet by snapping together the modular animal parts of the *PETS* robot. Once the pet is built, children can use a special computer application to tell their stories. These stories can later be acted out by their robotic pet.



Figure 10:
A robot pet
acting out a
child's story.

Finally, together with Professor Hiroshi Ishii and graduate student Jay Lee, I worked on a first project using physical bottles as a tangible interface for storytelling. In *bottlogues*, the voices of three fictional characters (a stag, man and eagle) are contained in a set of three bottles. As each bottle is opened, the corresponding character begins to speak a monologue. If multiple bottles are opened at once, the character's voices overlap. The three voices are placed left, center and right in the stereo field to help users in distinguishing them from one another.

Aside from the *bottlogues* piece, no one seems to have explored tangible interfaces specifically for creating point-of-view interactive narratives.

(2) Transformational Environments and Installations

Although transformational environments and installations are less "tangible" than the example works described in the previous category, they frequently employ tangible objects within the space. Sometimes they even use similar sensing technologies and/or interaction techniques.

The *StoryRooms* project at the University of Maryland creates room-sized interactive storytelling spaces for children [1]. Using a combination of low-tech and high-tech storytelling elements, children are able to author physical storytelling experiences that can be shared with other children. A similar project entitled *KidsRoom* from the Media Lab's Vision and Modeling group guides children through an interactive, imaginative adventure [3]. During the playout of the story, children interact with objects in the room, with one another, and with virtual creatures projected on the wall. The main difference between the *KidsRoom* and *StoryRooms* projects is that in the latter, children create their own immersive story environments instead of simply experiencing them.

Another example is the transformation environment *Wheel of Life* from the Interactive Cinema group [15]. Three mythical sets and scenarios (Water, Earth and Air) were implemented as a theatrical installation in which members of the audience can participate as either "users" or "guides." While "users" move around and explore the space, "guides" must give them clues to help them unlock the secrets of the story.



Figure 11: A character from Toni Dove's *Artificial Changeling* installation piece

A final example is the narrative installation *Artificial Changeling* (1993-1998) by artist Toni Dove. It is presented as a responsive cinematic installation in which one person at a time can interact with film characters and impact the course of the story. Information about the

movements of a viewer standing in front of a rear projection screen is used to alter the direction the story takes.

2.5 Lessons Learned

There are a number of lessons to be learned from all this past work. To begin with, looking at different point-of-view narratives showed us how certain ones center on a specific incident, thereby creating a tight relationship between the different character points-of-view (think of *Rashomon*), while others simply follow different characters around on their separate stories (think of *Short Cuts*). While both approaches can work well in some cases, the latter can be more complex and confusing, leaving viewers feeling lost or wondering how the different story pieces connect. Ensuring story coherency is an important factor in the design of interactive stories in particular, since the complexity of many systems seems to take away from the immersive and transparent quality of the story experience. Creating tight character relationships can thus be used as an approach to ensure coherency in interactive point-of-view stories.

The differences between hypermedia and storytelling systems taught us that making use of the computational power of the computer can serve to create more successful interactive stories. Computational systems have the ability to gather knowledge about user interactions and use the information to adjust the viewer's story experience. Giving users complete freedom in navigation and too many navigable options can be dangerous. Stories like *DarkZOO* can make users feel that in order to get the "full picture" they must exhaust all of the options, which can be distracting from the flow of the story. This problem can be avoided if a story system is made to adapt dynamically as the user moves through it, presenting only relevant options at any given time and narrowing or broadening the scope of these as the story progresses.

A key factor in the design of tangible narratives is the design of the interface/interaction, and the way in which it relates to the story content. In *bottlogues*, the characters did not interact with one another, even when released from their bottles at the same time. Instead, they gave separate monologues with overlapping voices. Although this had a

nice audio effect, it distracted from the story experience because it was difficult to understand the characters' words. Furthermore, this multi-monologue narrative model is at odds with the interface being used. The characters were being released into the same space, and it would have seemed more natural for them to converse with each other. This demonstrates how important it is to tailor the narrative model/story content to the interface/interaction and vice versa.

2.6 The Hypotheses

These lessons can be used as the basis for formulating two main hypotheses for the design of tangible point-of-view storytelling systems:

- (1) By using point-of-view narratives to structure the interaction in a storytelling system, we can avoid the complexity and fragmented nature of branching structures and provide viewers with a single consistent story space. Furthermore, by ensuring tight relationships between characters, or by structuring the story around a main central event rather than many small intersecting stories, viewers can be given a comprehensive and coherent interactive story experience.
- (2) Using tangible interfaces for communicating digital stories provides a rich means of interaction in which the interface can become a part of the story world rather than distracting users away from it. Simply put, the computer interface should not distract or separate us from the digital story content/narrative model. Ideally, there should be a tight relationship between the two in order to ensure a transparent and fulfilling story viewing experience.

2.7 Three Storytelling Systems

Drawing on lessons learned from the past work of others and in the hopes of confirming my hypotheses, I have created three separate interactive storytelling systems that focus on multiple viewpoint narratives using tangible interface technology. The process was one of iterative design across the three systems—a sort of journey of discovery,

with the limitations of each design contributing to the ideas and development of the next. For each system, an appropriate tangible interface and narrative model was first identified and then developed. Sample content was created in order to test the system with users.

The next three chapters follow a parallel structure, each describing the design, development and analysis of one storytelling system. For each system, the following five topics are covered: (1) the design and development of the interface, (2) the narrative and computational structure, (3) sample story content used for testing, (4) user feedback, and (5) reflections. A very brief introduction to each system is given below.

The genieBottles

The goal was to create an interactive story in bottles that would address the limitations identified in the *bottlogues* project. In the *genieBottles* storytelling system, there is a tight relationship between story content and interface, and the narrative model supports dialog between characters if they are released from their bottles simultaneously.

It May All End in Aleppo

The goal of the interactive narrative installation *It May All End in Aleppo* was to build a system (interface and narrative model) that would allow for a more highly defined narrative progression than in the *genieBottles*. The core concept was to design a story in which two characters would each tell their own perspective on a series of past events that involved both of them. I decided to realize this in the form of a responsive narrative installation in which the two characters respond to viewer presence by confiding their perspective on the story's events.

Tangible Viewpoints

The goal was to create a dynamic and adaptive system that could support interaction between the characters (as in the *genieBottles* system) and still maintain a highly defined sense of narrative progression (as in the installation *It May All End in Aleppo*). The basic approach was to organize the pieces of a multiple point-of-view story according to the

character viewpoint they represent, as well as their place in the overall narrative. The interface uses graspable pawns as physical handles on the different character viewpoints in the story.