Doctoral Thesis

“Wayang Authoring”

A Web-based Authoring Tool for Visual Storytelling for Children

by

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Submitted to fulfill the requirements for a degree of
“Doktor der Ingenieurwissenschaften”
- Dr. Ing. -
at Department of Mathematics and Informatics (FB3)
University of Bremen

Bremen, 2011

"There was a language in the world that everyone understood, a language the boy had used throughout the time that he was trying to improve things at the shop. It was the language of enthusiasm, of things accomplished with love and purpose, and as part of a search for something believed in and desired."

Paulo Coelho

:: The Alchemist ::

Abstract

This research focuses on the development of the *Wayang Authoring* tool as it aims to assist children in creating and performing stories, developing an appreciation for cultural artifacts, and enhancing intercultural empathy while building a young storyteller community in a virtual world. This study seeks a framework of interaction design of an authoring media which is appropriate to support children's narrative development. The concept of the tool is based on the narrative element of the ancient Indonesian art form *wayang*, a traditional two dimensional shadow puppet theater. To understand the user's requirements and the cultural dimension, children and professional story performers who use *wayang* have been involved in the design process. In order to evaluate the tool, several workshops have been conducted with children from different cultural backgrounds as well as with their teachers. *Wayang Authoring* is composed of three elements: the imagination-building element, the creative acting element and the social interaction element. Children take existing materials as an inspiration tool, imagine what they themselves want to tell, create a story based on their own ideas, play with their creations, share their stories and creations with others, and reflect on their experiences at the end. This virtual creative production tool is expected to provide a space for young people to change their role from a simple user to a (co-)creator in the virtual and narrative worlds. The core contributions are in the field of web technology for storytelling. The uses of web-based authoring media enable children to put themselves into the process of developing stories. When they are connecting stories, they are connected and immersed with other children as well. They have to act and play by themselves or with others within the stories in order to experience the narratives. They train to have the skills to interact, to share their ideas and to collaborate constructively. This makes it possible for them to participate in today's media-driven culture. This research found that a better understanding of how stories are crafted and brought to life in a performance tradition offers a better design of interaction of an authoring media. The handling of cultural artifacts supports the ability to understand different cultural codes and to pursue the learning process surrounding the original culture behind these artifacts.

Zusammenfassung

In dieser Arbeit liegt der Schwerpunkt auf der Entwicklung der Anwendung *Wayang Authoring*, einem Tool das Kinder dabei unterstützt Geschichten zu erfinden und durchzuspielen. Daneben soll es die Wertschätzung für kulturelle Ausdrucksformen und Objekte fördern während es den Aufbau einer virtuellen Community junger Geschichtenerzähler initiiert. Mit dieser Forschungsarbeit wird an der Gestaltung eines Frameworks für das Interaktionsdesign und einer *Authoring*-Applikation gearbeitet das die Entwicklung der narrativen Fähigkeiten von Kindern unterstützt. Das Grundkonzept dieser Applikation basiert auf Aspekten der narrativen Kunstform des traditionellen indonesischen Schattentheaters *Wayang*, ein Puppentheater mit zweidimensionalen Figuren. Um die Applikationsentwicklung an den Bedürfnissen der Zielgruppe zu orientieren und die kulturelle Dimension zu berücksichtigen, wurden Kinder und professionelle *Wayang*-Geschichtenperformer in den Prozess einbezogen. Für die Evaluation dieser Applikation wurde eine Serie von Workshops mit Kindern, die unterschiedlichen kulturellen Hintergrund haben, und mit ihren Lehrern durchgeführt. Die Applikation *Wayang Authoring* lässt sich in drei Bereiche gliedern, den Bereich für die Bildung der Imaginationen, den Bereich für das kreative Spiel und den Bereich für die soziale Interaktion. Ausgehend von vorgefundenem Material wird die Vorstellung angeregt, und die eigene kreative Aktivität, das Erfinden, Spielen und Umgestalten der Geschichte übergeleitet. Die Geschichten können mit anderen geteilt und schließlich die eigenen Erfahrungen reflektiert werden. Diese kreative Produktionsapplikation soll jungen Menschen die Möglichkeit bieten vom passiven Nutzer zum Gestalter in einer virtuellen und narrativen Welt der Medien zu werden. Der zentrale Beitrag dieser Forschungsarbeit liegt auf dem Gebiet der Web-Technologien für das *Storytelling*. Web-basierte *Authoring*-Applikationen schaffen Zugänge für Kinder sich selber in das Geschichtenerfinden einzubringen. Wenn sie dabei in den Fluss aus dem Verbinden von Geschichten eintauchen, verbinden sie sich auch mit anderen Kindern. Um die Geschichten zu erleben spielen sie für sich oder mit anderen innerhalb der jeweils entstehenden Geschichte. Dabei üben sie ihre Fähigkeiten zu interagieren, mit anderen ihre Ideen zu teilen und konstruktiv zusammenzuarbeiten. Dies kann sie vorbereiten auf die Teilhabe an der heutigen mediengesteuerten Kultur. Im Projektsetting erwies sich das Verständnis dafür, wie Geschichten in einer Performancetradition gemacht und zum Leben erweckt werden, von Vorteil für das Interaktionsdesign der *Authoring*-Applikation fürs Geschichtenerfinden. Darüber hinaus eröffnet der Umgang mit Ausdruckelementen und Objekten einer anderen Kultur Möglichkeiten für das Verständnis der damit verbundenen kulturellen *Codes* und regt zur Beschäftigung mit der dahinterliegenden Kulturtradition an.

Acknowledgments

This thesis arose in part out of years of research that has been done since I joined the 'Digital Media in Education (dimeb)' research group. In that time, I have worked with a great many people whose assorted contributions to the research and the making of this thesis deserve special mention. It is a pleasure to convey my gratitude to them all in my humble acknowledgment.

I am greatly thankful to my supervisor, Prof. Dr. Heidi Schelhowe, whose encouragement, supervision and support from the preliminary to the concluding level enabled me to develop an understanding of the subject. Under your supervision I become stronger in developing ideas as well as joining in the research community. I have learned a lot from you, not only in terms of research but in education and life as well.

I gratefully acknowledge Prof. Dr. Andrea Sick as my co-supervisor for her advice, supervision, and crucial contribution, which made her a backbone of this research and thus to this thesis. She has provided invaluable ongoing support, especially in regard to the theoretical parts of my thesis for which I am very grateful.

I convey special acknowledgement to Ki Ledjar Subroto, Mas Nanang 'Kancil', and Jochen Zülch for their willingness and patience to teach me *Wayang Kancil* and involve me in the *wayang* performances.

I am very grateful to Frankie Tun for the support in conducting and organizing workshops in his class and for motivating the children to be involved and work together in the workshops.

I am indebted to many of my colleagues for supporting me, especially Michael Lund, Anja Zeising, and Christoph Trappe. I would also like to thank to Dr. Regine Wolters for her constructive comments on this thesis.

I would like to thank Suntharajan Rajalakshmi Subramani, Joachim Dietl and Marcus Ecken for their support in developing ideas, interesting discussions and conducting workshops.

My gratitude also goes to all the children and young people who took part in the workshops. Without them, this research would not have been feasible.

Special thanks also go to the Digital Media in Education (dimeb) research group at the University of Bremen, the International School of Bremen (ISB), and Schulzentrum Rockwinkel in Bremen for their support.

This thesis would not have been possible without support from the Catholic Academic Exchange Service (Katholischer Akademischer Ausländer Dienst–KAAD), the University of Atma Jaya Yogyakarta (UAJY) and the University of Bremen, which granted this research. I also extend thanks to KAAD for the opportunity to meet, share and learn with international students in several seminars and cultural events (*KAAD-Jahresakademie*).

Words fail me in expressing my appreciation to my wife Novita Yulianti whose dedication, love and persistent confidence in me, has taken the load off my shoulders. I am indebted to her for being unselfish and allowing her intelligence, passions and ambitions to collide with my own. I would like to show my gratitude to my parents, my brothers and sisters, and to all my family.

Finally, I would like to thank my friends and everybody who was important to the successful realization of thesis, as well as expressing my apologies for not mentioning every one individually.

Bremen, June 2011

RJB. Wahju Agung Widjajanto

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Chapter 1
Introduction

Mouse deer and elephant

One sunny morning in the forest all the animals had woken up, but not mouse deer. He was still sleeping. Suddenly, a loud thump woke him up. It was elephant. ….

(Wednesday, 18th October 2000)

These are sentences that were used by 30 children to start writing their story during a workshop. This introduction evoked their imagination of a situation in a forest as a beginning to their journey on their story. They continued to write their fantasy until the story was finished. Most of them added new actors besides the mouse deer and the elephant, and also some dialogues between actors were written. Interesting on their story was that all those stories were different, even when using the same introduction sentences. Another thing is that they followed a simple story plot, which contains introduction, conflict and solution.

In addition, the children also drew an illustration based on their imagination about their story. They then used it as a picture book to retell their story. Besides this, they learned to visualize their fantasy; they learned also to understand the visual story of friends who were telling the story using a picture. Visual element is important especially for young children, who usually think in visual and iconic forms, as well as for poor readers who rely more on visualization of ideas to train memory skills (Huffaker & Calvert, 2003). The work of Allan Paivio indicated with his dual-coding theory that learners are more likely to understand concrete (non-abstract) words when they are supplemented with reference pictures than when only pronounced (Paivo, 1986). The combination of the activities writing, telling and drawing a story supports children's literacy ability.

Storytelling is an exploration, whereby young children understanding people and places previously unknown. Stories provide children compelling mechanism for expressing themselves, understanding their world, and relating with their culture. Storytelling leads to the continuous development of self-portrait of children as they interact with the environment they experience and know (Boltman, 2001). Storytelling is an interesting area to be investigated. This study will explore how technology can be used to support children to enhance creative

storytelling, self-expression, and an understanding of story structure as well as help to share cultural diversity.

Motivation

> *"At its core, storytelling is the art of using language, vocalization, and/or physical movement and gesture to reveal the elements and images of a story to a specific, live audience… It is the live, person-to-person oral and physical representation of a story to an audience."*
>
> *(McWilliams)*

The quote shows that our stories will always be started orally. Storytelling appears around the globe in many different formats. One of them is *wayang. Wayang* is an ancient form of storytelling with puppets that originated in Indonesia. Communities that enliven the *wayang* tradition exist meanwhile all around the world. Experiences in oral traditional storytelling art and experiences in web technology led me to carry out a study in this area. I thought it looked interesting and motivated me to develop an authoring media based on a kind of traditional storytelling with puppets.

As society has evolved over many generations, the language has shifted from oral to written form. The nature of human learning and communication has remained in the spoken word, although it has moved to the written form. It has changed even further through the development of technology supporting mass communication and new styles of learning. Language and communication have turned to digital.

Applications for digital storytelling have received growing attention over the last few years. Commonly, the main research into technology and storytelling up to now has concentrated on interactive games and fiction as well as mystery simulations. Currently, academic researchers and professionals are developing new kinds of technology that support children in creating, telling as well as sharing stories.

By using digital media as a major medium, various new kinds of storytelling are created, such as interactive fiction, text adventures, role plays and games with story elements. The advantages of digital storytelling are that the stories can be easily stored, retrieved and retold. The creators can rework their stories and even enable a kind of reflection. Authors can publish their digital stories to readers world wide who have internet access. The can also extend their network as they share their work and cooperate with others on collaborative stories, and

enable interaction between authors and readers, authors and authors, and even readers and readers.

Boltman affirmed that if every person is her or his own storyteller, then the idea of storytelling technology as a research focus is important (Boltman, 2001). If storytelling can be used as a tool for creative expression, then it is necessary to find alternatives to take part in this medium. With participation experience children will be able to create and share their creations, and they will be involved in the participatory culture (Jenkins, 2009). Participatory culture can be understood when members believe that their contributions matter and experience some degree of social connection with others. Ways for children to participate in storytelling need to be explored, especially focusing on various kinds of expression. Fisch stated that the ability of children to *"bring their creations to life"* through video, sound as well as animation *"can provide powerful motivation toward engaging in the process of authoring and an equally powerful reward for its completion"* (Fisch, 2004, p. 4).

I found that the widespread adoption of the World Wide Web has primarily changed the landscape of software development. The web has become the de-facto development environment for applications and new software systems in the past few years. In the new era of web-based software, applications run on the web as services. Even though virtual worlds cannot substitute the rich experience of performing with real puppets and a face-to-face-audience, I want to ponder the potentials of web design and usage for the field. New possibilities may emerge from a worldwide availability and from intercultural exchange of local knowledge of storytelling. For this ongoing development web software can alleviate own construction and design activities. The popularity of client-side scripting allows extended functionality and new kinds of interactivity in web applications. The web offers new and amazing communication and cooperation possibilities all over the world, especially with the rise of social networking sites and the semantic web.

The developing Web 2.0 community changes the role of user from a simple user to a co-creator. It will turn us into a more active culture where everybody will be able to join the creative communal production culture. If this potential is targeted for a tool that evokes imagination and enables the user for active story creation by productive acting in a media, one of the requirements is focusing on the design of the potential interactions. The challenge is that the complexity of the software and the technical difficulty should be reduced from the user's view in order to give broader possibilities that enable more space for the imagination of the user and that foster own activity of the user. The field of the story performance tradition of *wayang* provided me with inspiration for narrative behaviors and actions that helped me develop ideas to design the model of the interaction for *Wayang* Authoring.

In oral traditional storytelling, mostly the structure of the story is linear. With the non-linear characteristic of hypermedia, the web medium influences the structure of stories. The two different media give diverse experiences in story creation and story performance. This study is

expected to investigate recently emerging kind of technologies that aim to support storytelling for children focusing on how a digital media technology is used to support construction of story.

Research aim and questions

The aim of this study is to explore the potentials of authoring media to support a creative storytelling, self-expression, and an understanding of story structure for children, and to assist children in developing an appreciation for cultural artifacts, and enhancing intercultural empathy while building a young storyteller community in a virtual world.

This dissertation focuses on the studies of children's digital storytelling technologies. The main questions of this study:

- Which interaction design of an authoring media is appropriate to support children's creative storytelling and self-expression?
- Which kind of visual interactive web-based tool can support children collaborate on a story and to understand story structure?
- Do children change the process of creating stories in different media?

Methods

Wayang Authoring as an environment that builds on cultural understanding and diversity was implemented in order to bring this concept into life and to provide evidence of its benefits. Literature research was carried out to discover the state of the art of several aspects, such as storytelling, storytelling technology for children and social software. To understand the user's requirements, children and professional story performers who use *wayang* have been involved in the design process. In order to evaluate the tool, a number of discussions and several workshops have been conducted with experts and with children from different cultural backgrounds as well as with their teachers.

Composition of the dissertation

The presentation of this dissertation is provided in seven chapters as follows. After introducing the idea, research questions, and the aims of this study in the first chapter, the field of storytelling is explained in the second chapter. The meaning of storytelling in the context of

children's narrative development is explored. The state of the art of storytelling technologies for children is presented.

The third chapter explains the structure of a story. This chapter describes the dramatic structure from Freytag and ten geometric structure variations of stories from Samsel and Wimberly, and the relevance of them to this research.

The literature study of interaction design and social software is described in the fourth chapter. Some existing social software is explored to gain more understanding of this area in order to support the design process of the authoring tool that supports children's creative activity in the narrative field.

The fifth chapter illustrates the design process of *Wayang* Authoring. The requirements and scenario, the concept and the implementation of the prototype are described. This chapter also explores the potential of a tagging system as a model to compose a non-linear story.

The system's evaluation and the findings are discussed in the sixth chapter. The evaluation of the *Wayang* Authoring system is aimed to show that the tool can support creative storytelling and self-expression, provide support to the understanding of story structure, and support intercultural empathy as well. The evaluation workshops with children and the teacher are described.

The seventh chapter discusses the results, including the contribution and future work of this research.

Chapter 2
Storytelling

In this chapter, storytelling is discussed in order to explore the meaning of storytelling in the context of children's narrative development. A traditional form of storytelling, namely 'wayang', is chosen and explained as a basic idea to develop an authoring tool for children. Some children's storytelling technologies are discussed to discover the state of the art of storytelling technologies for children.

2.1 Definition of storytelling

> *"Storytelling is the interactive art of using words and actions to reveal the elements and images of a story while encouraging the listener's imagination"*
>
> *(National Storytelling Network)*

Storytelling is an ancient art by which meaning, experiences, events and actions are conveyed through words, images and sounds. This art form is traditionally an oral performance with an interactive relation between storyteller and audience (McKee, 1997). Storytelling is first and foremost an interactive performance art form, and it is a co-creative process between the storyteller and the audience. It starts with a personal interpretation and is also a process or – even more – a medium offering and sharing content and meaning to audiences.

In the days before printing, people used only their voices to tell stories. They communicated with and expressed themselves to others. Legends were kept alive and roamed the world through the storyteller. Storytelling is a significant part of human history. Before books, video and recording gave us methods to distribute information, storytelling was the main form of communication, entertainment and instruction. Fairy tales, history, legends and family stories were all told around the fireplace and as well as in town halls. In several areas of the world, oral storytelling is still the main means of sharing cultural history and traditions (Mork, 2009).

Oral storytelling changed following the invention of Gutenberg's printing press in 1455. This invention changed human communication and put printed storytelling into the hands of society. Book stories became the basis for many of the new media events as oral tradition had been for written narratives when they first appeared. Photography, film, radio, television, video, and finally digital media had an impact on narrative practice. With digital media as a

major medium nowadays several new kinds of storytelling were created, such as text adventure, interactive fiction, role-plays and games with story elements (e.g., The Sims).

There are several motivations of storytellers to tell stories. Many storytellers select tales merely to entertain. They tell jokes, silly stories, or tall tales. Others want to teach something, such as how to be more considerate to animals, the environment, or other people. One storyteller likes to encourage his listeners to try new things. Mothers tell stories to help children to not be afraid of thunder, lightning or scary shadows in their rooms. Some tellers use personal stories to promote an understanding of another culture (Mork, 2009).

For this study, we need to discuss ways to find the answer to the questions: What does storytelling mean? How does storytelling differ from other categories (e.g., news or announcements)?

There are several definitions of storytelling. One was defined as the core of the National Storytelling Association (NSA). The NSA defines storytelling as "*the art of using language, vocalization, and/or physical movement and gesture to reveal the elements and images of a story to a specific, live audience"*. As defined by the NSA, a central and unique aspect of storytelling is its dependence on the audience to construct particular visual imagery and detail in order to accomplish and co-create a story. It can be identified that storytelling always involves the presentation of a story, a narrative. In short, stories are always composed of a character that acts upon a starting question or situation and reacts on events. The gap between her/his aim and the result of her/his acting, the gap between her/his vision and her/his personality creates the dramatic tension. The storyteller often uses a set of incidents or fragments of plots that are mixed and composed in an improvisational manner (McKee, 1997).

McKee stressed that storytelling is an oral performance and interaction between storyteller and audience (McKee, 1997). Anne Pelowski in her book 'The World of Storytelling' defined storytelling is *"the art or craft of narration of stories in verse and/or prose, as performed or led by one person before a live audience; the stories narrated may be spoken, changed, or sung, with or without musical, pictorial, and/or other accompaniment and may be learned from oral, printer, or mechanically recorded sources"* (Pellowski, 1991, p. 15). From this definition, it can be found that performance, storyteller and audience are a component of storytelling. She gave more options of the medium–it does not necessarily to be oral but can also be musical or pictorial or a combination.

The National Storytelling Network defined "*Storytelling is the interactive art of using words and actions to reveal the elements and images of a story while encouraging the listener's imagination"* ("National Storytelling Network," n.d.). This definition also mentions interaction between storyteller and listener, or we can say the audience. The most interesting aspect of this definition is that storytelling encourages the active imagination of listeners. The role of the listener in storytelling is to actively generate vivid, multi-sensory images; characters; actions;

and events–the reality–of the story in her or his mind, based on the performance by the storyteller and the listener's own understandings, beliefs, and past experiences. The completed story which is unique and personalized takes place in the mind of the listener. Therefore, the listener becomes a co-creator of the story.

From those definitions and for the purpose of this study, storytelling is defined as a performance of a story with an interactive act between storyteller and audience, which at the same time encourages the audience's active imagination. From this definition, we can determine if an activity is storytelling or not.

A story or a narrative is one of the important aspects in storytelling. What is a story? A story imposes a structure on the events that we narrate so that listeners (including the storyteller) can understand it, and thereby gain some particular perspective on the events (Polanyi, 1989). Johnson in his essay defined a story as *"an arrangement of words and images that re-create life-like characters and event"'* (Johnson, 1995). A story includes the concepts of a series of events containing the passage of time and the transmission of meaning (Boltman, 2001). For this study, a story is summarized as a composition of several events or actions, which are following a particular sequence as a storyline to increase tension, and achieve a final resolution in order to convey a meaning. It is different with news, which is in substance containing a report of recent events or previously unknown information (Potter, 2006).

We can see from the summary that a story contains several events. For the purpose of this study, it is of interest to focus on the structure or the sequence of events of a story. The structure of the story will be discussed in more detail in the third chapter.

2.2 Storytelling with puppets

The puppet show is a popular form of entertainment. Sometimes it is an ancient heritage, a reminder of an age long past; occasionally, a medium for a contemporary artist's experiments with shape, color and movement. For centuries, it has been used to relate myth and legend and enact simple traditional farces. Now, as well as undergoing a tremendous revival as entertainment for both adults and children, it is becoming more and more widely used in education and therapy.

The meaning of puppetry could be different. The difference is depending on persons who provide the explanation, whether the artist or the audience (Tillis, 1992). The artist views the puppet as a medium under her/his control that could release her/him from any responsibility. She/he can act freely in this unreal world because the consequences are only in that world (Calvillo-Gámez, 2008).

Tillis defined the puppet as a *"theatrical figure perceived by an audience to be an object, which fulfills, given design, movement and frequently speech, the audience's desire to imagine it as having life, by creating a double-vision perception and imagination, the puppet pleasurably challenges the audience's understanding of the relationship between object and life"* (Tillis, 1992, p. 65).

Some approaches use puppets and shadow play for the educational purpose. For example, according to Reggio pedagogic the shadow is the first immaterial phenomenon a child plays with. The playful confrontation with shadows enables the comprehension of the world of abstraction and concepts. In this view, shadow theater could enhance the development of intelligence (Rodari, 1996).

2.2.1. *Wayang* theater as an ancient form of puppets' storytelling

Storytelling with puppets appears around the globe in many different formats. One of them is *wayang*, an ancient storytelling tradition from Indonesia that still exists today. Communities that enliven the *wayang* tradition exist all around the world. One reason *wayang* is chosen as a basis for the development of an authoring system is because of the rich visual tradition of shadow theater adapting to a huge range of archetypical images. Often the visual appearance is the abstraction of a human characteristic, a specific emotion or behavior. This has an expressive and symbolic character, composed by reduction and a contrast of detailed ornamentation that makes them into an aesthetic object.

Wayang is the general word for many kinds of traditional theater in Java, Bali, Lombok, and several other parts of Indonesia and Southeast Asia, both for puppet theater as well as actor's theater. *Wayang kulit*, the most well-known *wayang*, is an ancient form of storytelling that originated in the Indonesian island of Java. Over centuries, its religious character has increasingly developed into a distinct art form; foreign influences introduced new stories, characters were added, and novel refined styles were developed at the courts.

Wayang belongs to the Asian and Middle Eastern tradition of shadow theater with puppets. Traditionally Western shadow theater uses human actors and Eastern tradition uses puppets, but today there is an intercultural exchange between both traditions. The difference between the two kinds of shadow theater becomes smaller.

Wayang kulit consists of two words, *wayang* and *kulit*. *Wayang* is a Javanese word meaning shadow or ghost and *kulit* means leather. The *wayang kulit* is a two-dimensional puppet, made from buffalo or goat leather, like a paper doll, but with arms that swivel (see Figure 2.1). A *wayang kulit* puppet is a representation of mainly human characters and the physical world. Every part of the puppet's design has a symbolic significance.

Wayang characters are different to human beings, but human beings are the most important source of the 'raw material' from which *wayang* characters are made: human beings (as well as some other sources, such as animal forms and behavior) are observed and analyzed; their features and attitudes rearranged, some exaggerated, some ignored, sometimes caricatured, or ennobled (Mrázek, 2005).

Figure 2.1. *Wayang* puppets made of leather. They are operated from below by one, two or three rods. The rods are usually known as *cempurit*; the central rod running through the center of the puppet's body is named as *gapit*, and the sticks with which the puppet's arms and hands are operated are called *tuding* (Mrázek, 2005).

Wayang kulit utilizes a white translucent cloth screen with a lamp hung near the center (see Figure 2.2). Two banana trunks are placed horizontally at the lower edge of the screen, into which the sharp end of the main controlling stick of the puppets can be stuck. The puppets are fixed or moved on or near the illuminated screen so they cast shadows onto it. The puppets, the puppeteer and the musicians can be seen from one side of the screen, while the shadows projected by the puppets from the other. Usually, the audience can watch the performance from both sides (Mrázek, 2005).

The master puppeteer (*dalang*) controls the puppets' swiveling arms using thin sticks which are attached to the puppets. Musicians and singers play traditional bronze musical instruments and *gamelan* drums. Formerly, puppeteers were considered to be cultured literary experts who conveyed aesthetic and moral values through their art. The actions and expressions of characters representing the "ordinary person" became a means for criticizing sensitive political and social issues. The special role of these characters may have contributed to *wayang*'s continued existence over the centuries (UNESCO, 2003). *Wayang* stories adopt characters from ancient myths, Indian epics as well as heroes from Persian tales. The techniques and repertoire of the performance were orally transmitted within the families of puppeteers, puppet-makers as well as musicians. Master puppeteers memorize a huge number of repertories of stories and tell ancient narrative passages and poetic songs in a creative manner.

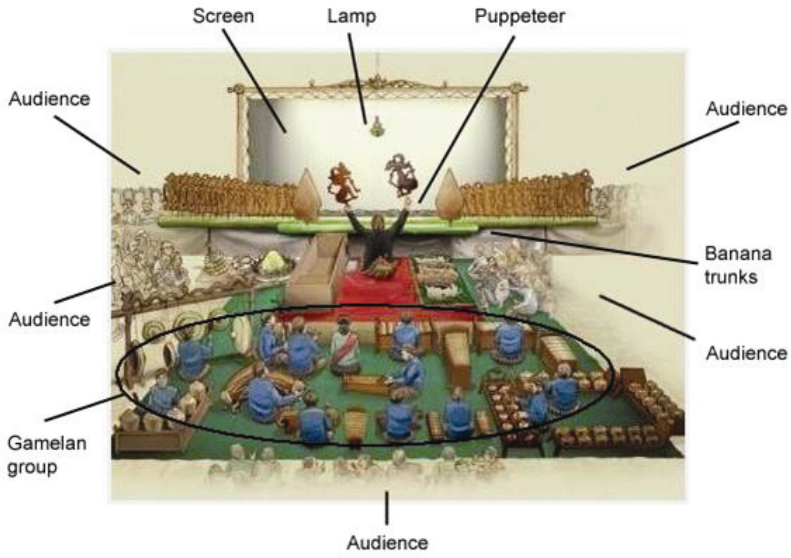

Figure 2.2. Illustration of the *wayang* performance viewed from behind the puppeteer. A large screen (*kelir*) with a decorated frame dominates this space. Two long rows of puppets are arranged symmetrically to the sides of the middle part of the screen where the puppeteer places or moves the puppets that act in the performance (Source: National Geographic Indonesia).

Wayang has the functions of entertainment as well as moral guidance, and is a combination of five arts, namely *seni widya* (arts of philosophy and education), *seni drama* (performing and *karawitan* musical arts), *seni gatra* (leather cutting and painting arts), *seni ripta* (thematic and literally arts), and *seni cipta* (conceptual and creative arts).

UNESCO proclaimed the *Wayang* Puppet Theater as a Masterpiece of Oral and Intangible Heritage of Humanity on 7th November, 2003 and the ensuing Action Plan aimed to encourage its revitalization as a living practice (UNESCO Culture Sector – Intangible Heritage – 2003 Convention). The project intends to enable more effective transmission of the knowledge and skills from master artists to young artists which are required for the performance of *wayang* theater. An inventory of *sanggars* (informal *wayang* schools), *wayang* practitioners, audio-visual educational kits as well as guidebooks on various forms of *wayang* will increase the public's appreciation of this tradition (UNESCO, 2003).

2.2.2. Children and *Wayang Kancil* project

Different forms of *wayang* have been developed from age to age, and today there are more than 60 varieties of *wayang*, spread all over Indonesia. One of them is called *Wayang Kancil*, where most of the actors are animals, and the audience is mostly children. Therefore, *Wayang*

Kancil is chosen as the case for study. Although the audience of *Wayang Kancil* is relatively small, *Wayang Kancil* still exists today. For this study, the researcher interviewed and carried out workshops with a *Wayang Kancil* puppeteer Ki Ledjar Subroto. He is a senior *wayang* artist from Yogyakarta, who still develops these puppets and also performs in this style.

Wayang Kancil performances have a very similar arrangement of screen, puppeteer and *gamelan* to that of classical *wayang kulit* (Pursubaryanto, 1995; Bilby, 1997). The *dalang* (puppeteer) sits in front of a large cloth screen with a display of puppets (see Figure 2.3). Occasionally, *Wayang Kancil* is performed without a screen at all.

Figure 2.3. Ki Ledjar Subroto performing *Wayang Kancil* at Arnhem Museum, The Netherlands.

The *dalang* tells the *Kancil* stories, moves the puppets and gives signals to the drummer, the leader of the *gamelan* ensemble about the music, when to start, speed up, slow down and finish the pieces. The accompanying gamelan group consists of about 25 musicians and singers. *Dalang* uses the same signaling methods as in classical *wayang kulit*, tapping the puppet box with a *cempala* (wooden mallet) or *keprak* (a metal plate hung from the side of the puppet box) as a cue for the *gamelan* music, as well as giving an individual voice to each puppet. Usually, but not always, performers of *Wayang Kancil* wear traditional Javanese dresses, like they do for classical *wayang kulit* performances. The audience is not expected to stay in the same position, and spectators are welcome to watch the performance from any position around the stage, just as they would for an all-night performance. The audience of the

performances of *Wayang Kancil* is usually made up of children and young people. The average performance lasts about 1.5 hours.

The stories used in the performances are based on the folktales of *Kancil*, a 'mouse-deer' (a very small deer similar to chevrotain) famous throughout South East Asia. *Kancil* is notorious for being very clever and able to trick both animals and humans alike, in a similar way to the stories of Brer Rabbit, a central figure in the Uncle Remus stories of the Southern United States. Presented in easily understood terms, the *Kancil* tales aim to educate listeners, pass on moral teaching, and even make social criticism through animals that are able to speak like human beings. Through wit and cunning, *Kancil* always attains his goal, frequently against much larger adversaries such as the crocodile and the tiger. During performances the stories are often changed to cover environmental issues: *Kancil* becomes an eco-warrior, using his cunning and skill to thwart the destruction and pollution of the natural environment by his enemy (Asian Music Circuit, 2001).

Figure 2.4. *Wayang Kancil* performance at Übersee Museum, Bremen. The puppeteers, *gamelan* players and audience are children, parents and teachers.

Wayang Kancil is developed not only in Indonesia but also in other countries such as England, the USA, Germany, the Netherlands, Australia, and Japan. Tamara Fielding from the USA is a storyteller who uses *Wayang Kancil* as a medium to tell stories. She has performed *Wayang Kancil* on a USA cable television program for children, called Tell Me a Story (Fielding, 1999).

Sarah Bilby is another person who actively participates in the process of development *Wayang Kancil* outside Indonesia. She comes from England and spent several years in Java, studying and performing puppetry and *gamelan*. In 2001 she conducted a project entitles 'Here Comes Kancil'. 'Here Comes Kancil' was a *Wayang Kancil* and *gamelan* project, organized by the Asian

Music Circuit in association with East Sussex Country Music Services, the Beacon Community College in Crow borough and William Parker School in Hasting. The focus of the project was a series of *Wayang Kancil* and *gamelan* workshops for secondary-school children and youth-club groups (Asian Music Circuit, 2001).

Bettina Sharmann and Jochen Zülch conducted a project about *Wayang Kancil* and *gamelan* for the children from 1996 until 2009 in Bremen. The children learned about *gamelan* and also how to make and perform *Wayang Kancil*. A picture showing a live performance of *Wayang Kancil* at Bremen can be seen in Figure 2.4. The researcher had been working with and accompanying them on the preparation and their performance during the design process and evaluation of *Wayang* Authoring prototype.

2.3 Storytelling, technology and children

> *'Once upon a time…' a magic words which open the door into new worlds where anything is possible because the normal rules of logic do not apply; worlds where children (of all ages) can let their imaginations loose in a framework of safe familiarity.*
>
> *(Alan Maley)*

In this section, children's storytelling and the technologies to support it are discussed. Before they even know how to read or write, children like to tell and listen to stories. These stories evoke imagination expressed through objects or signs. With storytelling, children become fascinated with the marks they leave behind (Ackermann, 2002).

Children particularly use storytelling to experiment with their developing notions of a role. Storytelling also enables children and adults to explore what it means to occupy different roles in the social world. Cassel and Ryokai stated that pretend play is a kind of co-produced storytelling where children share the character roles, and take turns being a narrator (J. Cassell & Ryokai, 2001).

Children tell stories, which are part of their everyday experience, in order to understand the world, to develop a sense of the self, and to participate actively in their culture (Boltman, 2001). Narratives help them describe this experience. In early stage of children life, they share their daily experiences through telling stories. Children are gaining an understanding of themselves when they participate in storytelling. Storytelling is a dynamic activity which

connects people to a community. Children share something about themselves with people around them, when they create and tell stories. This experience shows that storytelling is not only personal experience, but also a universal experience encompassing world cultures. Stories are vehicles of teaching values and ideals, and carrying the basic beliefs of a culture. Values and wisdom of a culture are conveyed from adult to children through the stories. Children tell stories as a vehicle of active participation in their culture. They tell stories to appreciate and understand their own culture as well as others (Malkina, 1995). Any story can offer a cultural experience. Fairy tales are part of the lore of ordinary folk; modern stories mirror personal and/or national experiences.

Moreover, children can benefit from storytelling in a number of ways. It helps them build up vocabulary and assists in developing reading and writing skills (Grugeon & Gardner, 2000; National Council of Teachers of English, 2000; Nicolopoulou, 2002). Additionally, storytelling introduces and develops oral language patterns and improves language abilities (Auwärter, 1986), strengthens observation and memory abilities (Glos & Umaschi, 1997), prepares the way for abstract thinking, aids in the development of deeper mental processes, and assists in the development of symbolic imagination as it offers a place to exercise that imagination (Nicolopoulou, 1997).

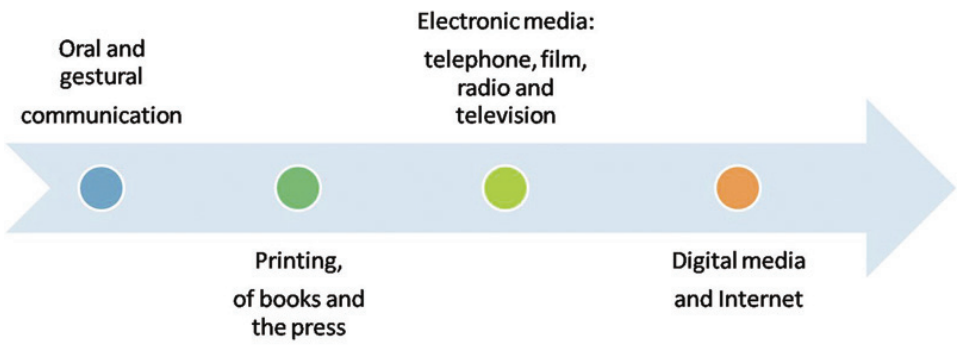

Figure 2.5. Media evolution (NMC, 2005)

Media evolves from oral to digital as shown in Figure 2.5. The most important recent milestones in this communicative and technological development are: the appearance of electronic media such as telephone, radio and television paving the way for mass communication which was dominant since the 1950s and the rise of digital media, especially the internet since the 1980s (Tornero, Celot, Pi, & Varis, 2007).

Digitization has led to digital systems being able to handle all types of data represented in digital form. Consequences of digitization for media production are the ways in which it affects data expressions, and how this might have a contribution on changing audience roles.

The unlimited possibilities for reworking digital representations can be applied to all digital productions such as text, web pages, and photography. Digital storytelling allows the stories to be easily stored, retrieved and retold and the authors can rework their stories. This process provides a kind of reflection for the authors.

Digital technology gives authors the possibility to enhance their stories throughout image, sound, and motion. Digital storytelling combines the art of telling stories with a mixture of digital graphics, texts, recorded audio narration, video and music to present information on a specific topic (Robin, 2006). Digital storytelling can enable ordinary people, including children, to relate their own lives. A new genre of storytelling was developed from computer games, carrying the tradition of cinema narration into these new media. The environment, the characters and the action can be produced, individually or cooperative.

The digital media or the computer not only adds multimedia, but also has a capacity to process data, add computational power and connect people via the internet. Digital communication tools and digital data change the ways that stories are produced, consumed and distributed: digital technology is important in the practices of digital storytelling and digital media. The introduction of the graphical web browser to the World Wide Web opened a new opportunity in the way narrative could be understood, produced, and transferred to children. Authors can publish their digital stories to a broader readership that has internet access anywhere worldwide. They can extend their network as they share their work and collaborate with others on collaborative stories and enable interaction between authors and readers, authors and authors and even readers and readers.

Digitization also facilitates new opportunities for audiences, including viewers, readers, and listeners, to engage in the creation of stories in multiplatform media production. These opportunities provide ways for innovative narrative construction. They also allows for interactivity with stories, something that has evoked discussions on user-generated content and the readers as active contributors to stories.

Nowadays, children have become a new and important group of technology users and actors. Technology is modifying the way they live, play, communicate, and learn. However, they are a very different user population, with tastes, inquisitiveness, needs, culture and complexities of their own (Boltman, 2001; Shore, 2008).

One might wrongly think that oral language and oral communication skills might not be necessary in a technological era– in an era of books and bytes. However, the competency to effectively express our needs and ideas in various forms to various audiences is important.

Children require many ways to express themselves. Moreover, they also need to exercise a variety of tools to perform this expression, including their voice. Language literacy is necessary in various environments, whether digital or traditional (Boltman, 2001).

Children develop a verbal literacy, even before entering school, in the form of reading and writing text. They also build up iconic or visual literacy by viewing and interpreting images and symbols (Ackermann, 2002), or by using human-computer interfaces (Subrahmanyam, Kraut, Greenfield, & Gross, 2000). Now, technology has created a third kind of literacy, often referred as digital fluency (Huffaker, 2004).

Digital fluency builds as children and end-users in general become natural and comfortable with using computers and other digital technology (Huffaker, 2004; Shore, 2008). As Resnick mentioned, *"When you learn to read and write, you are in a better position to learn many other things. So, too, with digital fluency. In the years ahead, digital fluency will become a prerequisite for obtaining jobs, participating meaningfully in society, and learning throughout a lifetime"* (Resnick, 2002, p. 33).

Some scholars see in digital technologies a means to enable children to have more authority and direction in their learning, mostly throughout a direct exploration of the environment around them, tools to express and design their own ideas, and ways to collaborate and communicate on a global level (Huffaker, 2004; Negroponte, Resnick, & Justine Cassell, 1997). *"Digital technologies can be instrumental in helping youngsters bridge the gap between oral and written communication, and mediate their expressions in novel ways"* (Ackermann, 2002).

It is important to invest in developing technologies in order to encourage children creativity and allow children to control the processes – they feel powerful when they know they can create and control their play, toys and material (Papert, 1980). Besides, as children emerge as important technology consumers, the existence of a useful, effective and meaningful support to children's real needs is critical.

A strong desire arises on the part of technology designers to combine design with human-human interaction. There are many existing trends in the area of children's technology, which impact and reflect on the continued aims of technology developers. These trends show that even though children are now important technology users, parents and educators are questioning the function of technology for youngsters (Boltman, 2001; Shore, 2008). Moreover, technology designers are at the same time moving away from the traditional interface and shifting their attention towards storytelling (Boltman, 2001). In the next section, some children's storytelling technologies which are related to and important for the development of the *Wayang* Authoring tool are reviewed.

2.4 A review of children's storytelling technologies

In this section, the kinds of storytelling technologies that support children's storytelling activities are discussed. Storytelling is an interactive relation between storyteller and audience to convey a meaning of a story or perform a story while encouraging the audience's active imagination. Children usually use storytelling to express their experience, to share the character roles, and to take turns being the narrator. Additionally, in storytelling children perform their command language and through their actions and their language, they tend to create the world in which they are playing (J. Cassell & Ryokai, 2001).

Currently, almost all technologies for children are becoming very sophisticated and more attractive. Following an investigation of the relevant technologies involved in this developing research area, a range of diverse technologies at various stages of development was noticed. Many researchers are trying to develop new technologies in order to facilitate personal expression and storytelling. These kinds of new technologies aim to support the rich tradition of storytelling, while simultaneously seeking to facilitate a variety of cognitive, emotional, and social needs of children. Moreover, they strive to create new means and places for children to tell stories (Boltman, 2001). That can enhance the positive effect of storytelling for children to create a meaning of the world and social interaction.

At the commercial level, the available storytelling software that tells stories to children encourages them to learn how to read by relating passages from children's literature, enabling them to illustrate stories or by filling in the blanks in incomplete stories (Bers & Justine Cassell, 1999). Some provide them with a kind of pseudo-authoring environment, where children can choose some texts or characters to build stories, or allow children to illustrate stories through using a word processor (e.g., Kid Works Deluxe, The Amazing Writing Machine). Flux Time Studio and Flip Boom Classic are two examples of authoring media that enable children to create animation and cartoons that they can save or send to their friends. 123 Sesame Street online is a website for children, which brings creative expression and digital learning to children and caregivers worldwide. Sesame Street uses animation, puppets, and live actors to stimulate young children's minds and to improve their letter and word recognition as well (Revelle, 2003).

In the areas of education and human-computer interaction, researchers have dedicated extensive efforts to the development of storytelling software. The MIT Media Laboratory, namely the research group: "Gesture and Narrative Language", has been investigating and developing storytelling software. The most recent project of this research group is the implementation of a new interface generation, supported by a tangible media and a computer-augmented toy concept (Amaro & Moreira, 2001; Boltman, 2001). The Tangible User Interface has the ability to "augment the real physical world by coupling digital information to everyday physical objects and environments" and offers the possibility of natural interfaces that are

intuitive to use and learn. Tangible media research shows a potential to enhance the way people interact with and leverage digital information in a variety of application domains, including learning, collaborative planning and authoring, and problem solving. In an effort to combine the digital and physical worlds, many researchers are integrating common objects from a child's world, for example stuffed animals, into the technologies they develop.

Recently, researchers are paying attention on carrying out research related to the tangible user interface to support the learning process (Marshall, 2007; Zuckerman, Arida, & Resnick, 2005). However, the traditional technological interface (e.g., a screen, a mouse, and a single keyboard) still has a great potency to support the learning process, particularly web technologies. The popularity of client-side scripting allows extended functionality and new kind of interactivity in web applications. The web offers new and amazing communication and cooperation possibilities all over the world, especially with the rise of social networking sites (e.g., *Facebook*, *Friendster*) and the semantic web.

With a closer look at storytelling technologies, an attractive kinds of applications currently being developed to facilitate various aspects of children's storytelling can be found. There are some commonalities in the objectives of the storytelling software systems, e.g., supporting self-expression and collaboration. Examples of storytelling technologies that support collaboration and self-expression are KidPad, FaTe2, and StoryBuilder.

Social communication is also an important objective of storytelling systems. Besides FaTe2, KidCam is also intended to support social communication. KidsCam is a 'wearable' device that audio-visually records events in the child's everyday life, and connects them to a collective memory of interrelated episodes. This technology facilitates and supports the development of social, emotional and communicative skills of children in the context of the everyday activities (Panayi et al., 1999).

For this study, four examples of children's storytelling technologies that use non-tangible interfaces namely KidPad, StoryBuilder, The MUST and FaTe2 are discussed in detail. These technologies are chosen and evaluated to gain knowledge of the interaction model of the storytelling systems that support creative expression, to understand how the systems work to enable collaboration for children to build stories and how the systems facilitate children to understand the story's structure.

a. KidPad

KidPad is a children's storytelling application which is a shared drawing tool in 2D with a zooming interface (Benford et al., 2000; Druin, Stewart, Proft, Ben Bederson, & Hollan, 1997). This application is a zooming storytelling tool that supports children to create stories individually or collaboratively. KidPad provides a single display with multiple mice, so two or

more children can use different tools independently using their own mouse at the same time. Its first development began at the University of New Mexico and was then continued at the University of Maryland. The KidPad development and research is being supported by several organizations, including the National Science Foundation and the European Union.

The goals of this project are to develop tools that support visual and verbal literacy, to support collaborative learning experiences for children, and to provide expressive storytelling tools for young children.

The narrative structure of a story in KidPad is defined by applying spatial hyperlinks to objects in a picture. KidPad provides tools that can be selected, used and dropped anywhere on the drawing area, instead of using a common user interface WIMP (Windows, Icons, Menus, Pointer). Particular tools in KidPad support collaboration because they facilitate two children to carry out a task that they would be unable to do alone. As an example, if a child wants to draw in green she or he has to work together with another child. There is no green crayon available, but if the yellow and blue crayons are put together the colors will mix together and the two mice can draw in green.

Figure 2.6. Screenshot of KidPad screen contains a story, the local tools and a hyperlink (Source: http://www.cs.umd.edu/hcil/kiddesign/kidpad.shtml)

Stories produced in KidPad are constructed from scenes that are linked to each other. Scenes are constructed from text, drawings and other elements. The position of scenes in two-dimensional surface of KidPad may have a meaning within the story. As an example, drawing something inside a figure's head might symbolize their thoughts. A scene may have more than one link. These links create different paths through the story. When users want to tell a story, they should follow links which they interpret as the scenes. Some screenshots the interfaces of KidPad are shown in Figure 2.6, Figure 2.7 and Figure 2.8.

Figure 2.7. In order to fill the screen, the end location of the hyperlink will be zoomed
(Source: http://www.cs.umd.edu/hcil/kiddesign/kidpad.shtml)

Figure 2.8. Screenshot showing the next screen in the story. A hyperlink from the island to the sun is created by using the magic wand tool.
(Source: http://www.cs.umd.edu/hcil/kiddesign/kidpad.shtml)

b. StoryBuilder

StoryBuilder is an online collaborative storytelling environment for children aged 8-10, comic-style rendition of the add-a-sentence-to-a-story activity that allows groups of children to participate in multimedia story creation, developed by CBC (Canadian Broadcasting Corporation). The idea of StoryBuilder is to provide a balance between creative, interactive story-building and a more formal, structured approach to creating stories (Antle, 2003).

Using StoryBuilder, children can create multimedia comic-style stories. They can then save stories to their online personal space (KidSpace), submit them to CBC4Kids (Canadian Broadcasting Corporation for Kids) for publication in the ongoing story, or email them to friends as a story chain. A guest illustrator begins each story by creating a series of mutable backgrounds, objects, characters and animations. Children can also submit the graphical elements for the next story (Antle, 2003).

The interface uses simple symbols to control page sequences and graphical manipulations. The symbols and their functions were user-tested with children as part of critical task analysis. Icons consistent with other computer applications (e .g., MS Windows O/S) were used for save, submit, email and delete functions.

Using StoryBuilder, children can participate in story creation in one of three primary modes. In the first mode, children can participate in the posted story by creating their version of the next page in the ongoing story and submitting it to CBC. In the second mode, children can create story sequences themselves (from scratch but using pre-existing elements). In the third mode, by using the email-to-a-friend function, children can initiate and contribute page by page to an ongoing story that they have created with their friends. StoryBuilder allows a child to edit pages received and to add pages before emailing the story onwards to the same or another friend.

Their summative evaluation showed that StoryBuilder with an online environment supports children's collaboration storytelling. It enables children to create and submit the next page in an ongoing story using pre-existing elements.

c. The MUST

MUST (MUltimedia STorytelling) is a web-based multimedia tool for interactive storytelling which was designed for 7 to 12 years old kids. MUST supports a structured and systematic narrative process which is defined based on the storytelling "patterns" in the model of western folktales developed by Vladimir Propp. MUST emphasizes Propp's idea that any story has a tension, and many events occur that contribute to the story until a positive solution is reached, and helps children in storytelling activities by playing at different levels of complexity.

Some goals of MUST to stimulate children's imagination, help children in storytelling activities by using a known repertoire of archetypes and shared cultural elements (derived from Propp's theory), stimulate kids to analyze, compare, and discuss their tales artifacts, thus developing cognitive skills related to analysis, synthesis, and evaluation (Garzotto & Rizzo, 2005).

The first version of the MUST prototype offered three main sets of functionalities: selecting/drawing characters and environment; writing a linear (i.e., non-hypertextual) tale;

and dramatizing the tale. Figure 2.9 illustrates the MUST's interface to create characters and environments.

Garzotto and Rizzo reported from their evaluation with elementary school teachers that suggesting Propp's macro-structure and his repertoires of tale elements to kids usually promotes various cognitive skills such as analysis capabilities, or powers of planning and organizing the story telling and story-writing activities, and, more generally, kids' communication capacities.

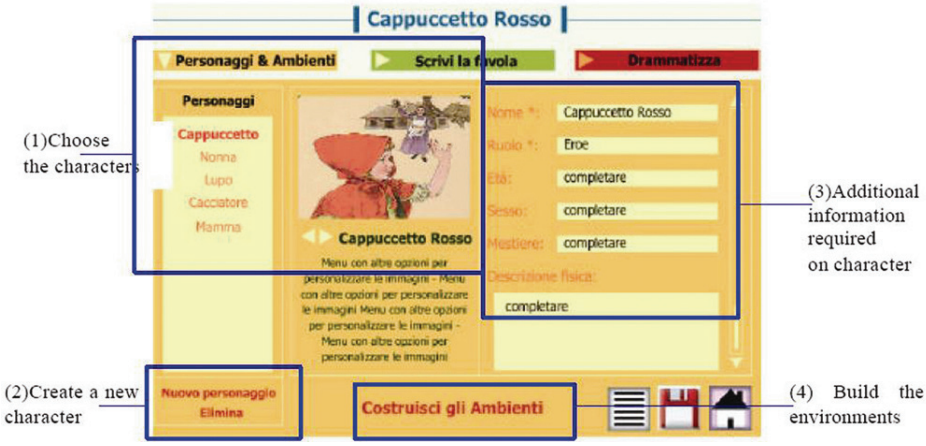

Figure 2.9. The MUST's interface to create characters and environments (Garzotto & Rizzo, 2005).

d. FaTe2

FaTe2 is a web based, multi-user, multi-dimension hyperspace, where children (aged 8-11) can meet, chat, play, and perform storytelling activities in collaboration. FaTe2 merges and extends the technical and methodological achievements of preexisting projects: FaTe (Fairy Tales and Technology) and Learning@Europe.

The general goals of this project are to exploit the paradigms of hypertext, interactive multimedia, and interactive games to promote active learning of narrative and communication skills for children aged 8-11, and to expose them to ICT technology in a playful way and to provide a social interaction space for kids to collaborate in edutainment narrative activities (Garzotto & Forfori, 2006).

FaTe2 supports a variety of collaborative activities, in two and three dimensions interaction spaces, which can be grouped in four main categories: exploration, story-building, play, and

communication. Moreover, FaTe2 enables children not only as story consumers or spectators but also as narrators and directors. It offers an open-ended story framework where we give space to *"children's voice"* (J. Cassell & Ryokai, 2001), encourages spontaneous storytelling and story structuring, and provides a means to stretch children's imagination, practice their language, and develop important narrative skills. FaTe2 promotes two kinds of collaborative story-building activities: the creation of a new linear story, and the creation of a hyperstory from a built-in story.

Figure 2.10. A 2D Scene of FaTe2 (Garzotto & Forfori, 2006).

The client side is based upon a Shockwave and a Flash player. On the server side, a Macromedia Flash Media Server manages the interaction between each client and the web server that is used to deploy the application, and maintains the consistency of the 3D shared world state. It detects the events triggered by the different users and distributes the effects on the various clients, so that they can be perceived by all users in the shared 3D environment. Figure 2.10 shows an example of the FaTe2's interface.

From the evaluation of FaTe2, it is found that young children like to engage in collaborative works using the computer with "*individual manual"* tasks in relation with what they have been exploring on the computer (Garzotto & Forfori, 2006). This project strive to understand the unique needs of children in order to develop innovative *"hypertext experiences"* for children and suggested the integration of hyperwriting and hyperreading concepts with other paradigms, to better meet the children's needs.

Relevance to the research

It was found from the KidPad evaluations that young children are able to express their stories by drawing virtual objects and connect several scenes to build a non-linear story. The children can use the collaborative feature of KidPad by using multiple mice on the same computer. The researcher learned that children can use virtual objects to tell a story. Additionally, the narrative structure of a story can be defined by utilizing the hyperlinks.

In contrast, StoryBuilder is a comic-style version of the add-a-sentence-to-a-story activity that allows children to create and submit the next page in an ongoing story using pre-existing elements. From this system, it has been found that a story's sequence can be built from existing stories. Therefore, providing a feature to arrange and re-arrange story sequence is important. Moreover, web technology is a good choice to build online environment, which supports collaboration in creating stories.

One of the lessons that has been learned from The MUST is that in order to stimulate children's imagination an authoring tool should provide a known repertoire of archetypes or a library of predefined stories. Children learn to understand a structure of a story by connecting one scene to other scenes.

FaTe2 offers 'hypertext experiences' by building a hyperstory from a built-in story. The children's roles are as a narrator and a director. An understanding from FaTe2 has been gained that online collaboration in building stories enhances children's engagement to use the system and encourages spontaneous storytelling.

These findings show that a story can be expressed by drawing virtual objects, writing texts, or by using mutable characters and animations. In order to support collaboration, web technology is a good choice to develop an authoring tool. In addition, the hyper technology can be used to facilitate the understanding of the story's structure for children. However, in order to achieve the aims and to answer the questions of this study, it is needed to develop a new authoring system. None of those systems are aimed at supporting children's intercultural empathy and developed based on narrative objects from a particular cultural storytelling tradition. Besides, none of those tools provides a space for children to structure and restructure a linear and non-linear story's sequence by utilizing tagging system.

2.5 Summary

Storytelling is a part of human history by which means experiences, events and actions are conveyed through words, images and sounds. Storytelling appears around the globe in many different formats. For the purpose of this study, storytelling is defined as a performance of a story with an interactive act between storyteller and audience, which at the same time

encourages the audience's active imagination. From this definition, we can determine if an activity is storytelling or not.

Children tell stories, which are part of their everyday experience, in order to understand the world, to develop a sense of the self, and to participate actively in their culture. Children use storytelling to test out their developing notions of their role in society. Storytelling also enables children and adults to search for what it means to fill various roles in the social world.

An attractive kind of applications currently developed to support various aspects of children's storytelling. There are some commonalities in the objectives of the storytelling software systems, e.g., supporting self-expression and collaboration.

From the accounts of and descriptions of some storytelling technologies (KidPad, StoryBuilder, The MUST, and Fate2), it has been found that web technology is a good choice to build an online environment which facilitates children in collaborative story-building. Besides that, hyper technology is one solution to support an understanding of story structure by connecting several scenes. However, it has been noticed that none of these technologies is planned or designed based on a particular cultural tradition that comprehends the specific pattern of expression of a particular culture in order to support intercultural empathy. Therefore, a new system to fulfill the aims which is providing a storytelling system that supports creative storytelling and self-expression, and simultaneously contributes to the field of storytelling as an interaction design for children in its relevance to the understanding of story structure, to build a young storyteller community in a virtual world and to support intercultural empathy as well is proposed.

Chapter 3
Structure of Stories

This chapter focuses on the structure of stories in various mediums. Storytelling and the development of media have alternately influenced each another, and each new medium has established a new kind of storytelling. A story is more than actions and events. The sequence of actions and events according to a meaning creates a specific kind of structure. A story's structure is not the meaning of a fixed order but more the rules and the ways of combinations of events that creates a meaning. Therefore, understanding a story's structure is important in the narrative development process.

3.1 Transmedia storytelling

The differences in performance across the various media, due to each medium having its own distinct structure, affect the meanings of the stories being told and also how they are shaped and shared. Performativity need not be solely on the stage. Auslander stated that we exist in a mediatized culture, and that performances have broadened across media, affecting the other media with performative improvisation from both audiences and performers (Auslander, 1994). The stories we have read, heard and seen in a single medium have not lacked effect, but combining several media gives a completely new experience as Jenkins mentioned about transmedia.

Henry Jenkins coined the term transmedia to explain how stories can be told using various media in such a way as to obtain the advantages of what each medium does best. As he stated,

> *"Transmedia storytelling represents a process where integral elements of a fiction get dispersed systematically across multiple delivery channels for the purpose of creating a unified and coordinated entertainment experience. Ideally, each medium makes its own unique contribution to the unfolding of the story." (Jenkins, 2007)*

With transmedia experiences, as it is principally not possible for people to have proficiency in all media, we might actually notice a strengthening in a particular medium as artists and authors focus on their proficiency and go back to mastering and specializing in their medium of choice (Davidson, 2008). This means that the choice of media is not by content of the story but more by the expertise.

Although the term transmedia emerged in the 21st century, the characteristics of transmedia can be identified in the *wayang* tradition. Mrázek stated that the media or the arts are more like artistic techniques than materials, or more like musical instruments than sound waves. He stated that the media in *wayang* – narration, dialogue, puppets and puppet movement – and their particular ways of working and functioning are creations of an artistic tradition, rather than universal, pre-existing categories (Mrázek, 2005). Puppet movement and puppet compositions, narration, dialogue, and music are combined and used to build the whole of the performance. Narration and dialogue appear to be in a class apart because they both use verbal language; but the case is not as simple. During both of them, the puppets are on the screen, and both the narration and the dialogue closely interact with the images. In the case of the dialogue, this is immediately obvious: it is the characters, acted by puppets on the screen that are represented speaking; the voice and the words are 'fused' with them. In the case of narration, the interaction with the visual image is also close; the narration describes the scene and the characters and their actions, and is always closely juxtaposed to the visual images. Dialogue and narration are never quite purely verbal media – they are connected to the visual images and constantly interact with them. However, if we want to see the separation between the media more clearly, we can look at the structuring of the performance in time. There is a very clear separation into three kinds of moments that what could be called:

- Narration moments
- Dialogue moments
- Puppet-movement moments

During the puppet-movement moment the opening of the audience is represented in the medium of puppet movement, and there is no dialogue and no narration; then the *dalang* or the puppeteer narrates (the puppets are immobile, arranged into pictorial composition), and then comes the dialogue, during which the *dalang* only moves the hands of the puppets. The moments are represented by periods of music. In each of the moments, one medium comes to the fore, even though it is not necessarily in any 'pure' form, that is, the other media may play a minor function. The media themselves are rarely clearly separate, but the different moments (in each one medium predominates) are (Mrázek, 2005).

In this study, the web is used as a medium to revive traditional storytelling with puppets. Virtual worlds cannot substitute the rich experience of performing with real puppets and a face-to-face audience. But instead this study wants to ponder the potentials of the web and its design for this field. This study is also inspired from statements from Brenda Laurel. The performative nature of the web, one type of hypertext and hypermedia on computers, has led Brenda Laurel to consider computers as theater. According to Laurel, computer has *"capacity to represent action in which humans could participate"* (Laurel, 1993, p. 1). The *readers* are actors within the hypertextual narrative, performing the actions and creating outcomes through the choices they make.

A part of this study also pays attention on the structure and process of narrative in hypermedia, in particular the web, and explores the potential application to support telling stories. Hypermedia relates to dynamic multimedia objects that contain hypertextual aspects. According to Landow and Delany, "*hypermedia is a multimedia extension of hypertext that is more complex and interactive, integrating visual and auditory experiences as well as text and links to give more contextual synthesis of the information explored"* (Delany & Landow, 1994). As an example of a hypermedia object is a webpage using java scripting and interactive graphics, sounds and videos (Davidson, 2008). A characteristic of hypermedia is non-linearity structure, which allows us to navigate through an information space using associative linking. This leads to idea of intertextuality as we describe in the next section.

3.2 Intertextuality

Intertextuality relates to the several implicit connections in each text to other texts. None of the text is written so that it is totally isolated from other texts and can stand exclusively by itself. Hyperlinks in hypermedia and hypertext documents provide such intertextuality in a way that is not possible in printed texts. They can move directly from the hyperlinked images, terms or phrases to other contexts, both inside and outside the given hypermedia, in which the same images, terms or phrases still work and retain their meaning (Delany & Landow, 1994).

Intertextuality can also be understood as the process of illustrating one's experience with multiple texts and connecting these various texts with the present text being experienced (Davidson, 2008). Long and Strine described how the process of experiencing a text is necessary for an audience to understand the text being experienced (Long & Strine, 1989). When we read a book, we bring our intertextual experiences from all the other books we have read and use them to play with the current text. From this playfulness, we create a deeper meaning of the involving text(s).

The appreciation of long-established textual objects, such as novels and films, is dependent to a certain measure on the decoding of intertextual references to other media in these texts. Thus, the pleasure of consuming these texts can be seen to be contingent to a certain extent on the user's ability to identify and decode these allusions. This intertextual element also exists in new media, particularly since media content is increasingly brought to the consumer through different channels simultaneously.

Intertextuality can be found in *wayang* tradition also. For example, a character is used not only in one story; he or she can appear in different stories with different meanings and actions. A story is a part of another story or a story is a biography of an actor from another story. For this study, we want to use this characteristic in the system to provide a suggestion to children

when they want to combine or connect stories. A theme of a story or actors in a story will be proceeded to bring out suggestions. With this kind of suggestion, the process of story-building is expected becomes simplified.

3.3 Structure of a story

Stories require a structure on the events that we narrate so that listeners (including the storyteller) can understand them, and thereby gain some particular perspective on the events (Polanyi, 1989). A structure of narrative consists of four characteristics: *"setting, character, theme and plot"* (Davidson, 2008). Action schemas or scripts are knowledge structures which even very young children use to organize their general knowledge about events. Scripts also guide children's comprehension and their recalling of stories about familiar events (Hudson, 1988). A story's structure as a topic of education fosters the ability to detect a meaning by reading.

Models for developing good stories have been proposed for thousands of years. Around 2300 years ago Aristotle wrote his treatise called Poetics, in which he focused on tragedies, or serious drama.

Many aspects of poetics are useful for authoring multimedia stories as well; the most important being the plot. According to Butcher, Aristotle said that *"[…] for by plot I here mean the arrangement of the incidents […] But most important of all is the structure of the incidents […] so the plot, being an imitation of an action, must imitate one action and that a whole, the structural union of the parts being such that, if any one of them is displaced or removed, the whole will be disjointed and disturbed."*; and every story must have a beginning, middle and end (Aristotle, 2008; Lee, 2001).

In the next section, a structure of a dramatic work such as a play or film, focusing on Gustav Freytag's analysis of ancient Greek and Shakespearean drama is discussed. The discussion continues by analyzing the geometric structure variations of stories.

3.3.1. Freytag's Pyramid

Freytag's Pyramid (see Figure 3.1) is a way to examine a plot consisting of five components in an ascending and descending manner, introduction (exposition, inciting moment) – rising action – climax – falling action – denouement (catastrophe, resolution) (Freytag, 1900). In the introduction, the plot, characters, and complications are introduced. This initiates the rising action or the events that bring the story to a climax. The audience finds the climax at the peak point of dramatic tension or at a main turning point in the plot. A resolution of a moment in

the narrative is when the rising action is turned to falling action, which is composed from the events that come after the climax and brings the story to the denouement. The denouement is the final outcome or resolution of the main dramatic complications. In addition, the denouement can include a reversal in the protagonist's fortunes, which is typically the result of a discovery or a recognition of something of great importance that was previously unknown by the protagonist.

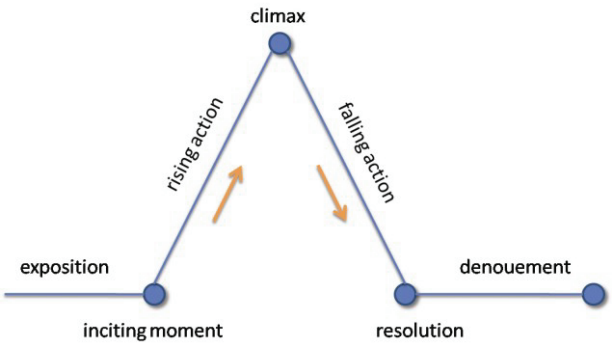

Figure 3.1. Frytag's dramatic pyramid

Frytag's dramatic pyramid can be used to analyze the dramatic structure of *wayang* performance. *Wayang* performance in general has three acts: *Pathet Nem*, *Pathet Sanga,* and *Pathet Manyura*. The performance usually starts at 9.00 pm and will be end at 4.00 am. The following part describes the structure of a *wayang* performance in detail:

1. Act One (*Pathet Nem*)
   Pathet nem is symbolizing childhood, performed from 9 pm until midnight, and consists of 6 scenes:
   a. *Jejeran Raja*: symbolizes that the baby begins to be accepted and nurtured by his mother.
   b. *Paseban Jawi*: symbolizes a child who is already getting to know the real world.
   c. *Jaranan:* symbolize the immature nature of children.
   d. *Perang Ampyak:* symbolizes a child who has begun to mature.
   e. *Sabrangan:* symbolizes a child who has grown but his character is still dominated by emotions.
   f. *Perang Gagal:* symbolizes a person who does not yet have a definite purpose in life.

2. Act Two (*Pathet Sanga*)
   Pathet sanga is symbolizing adulthood, performed at midnight until 2.00 am, and consists of 3 scenes. In this act, the hero is thinking about problems, and subversive clown figures enter and dispense wisdom and ribald humor.

a. *Bambangan:* symbolizes a person who has begun to obtain knowledge.
b. *Perang Kembang:* symbolizes a growing adult.
c. *Jejer Sintren:* symbolizes a person who has set a goal in his life.

3. Act Three (*Pathet Manyura*)
   Pathet manyura is symbolizing seniority, performed from 2.00 am until 4.00 am, and consists of 3 scenes. This act contains resolution of conflict/problem with many battles.
   a. *Jejer Manyura:* symbolizes a person who already knows the purpose of his life and is close to achieving his dreams.
   b. *Perang Brubuh:* symbolizes a person who has reached his life goal.
   c. *Tancep Kayon:* symbolizes a person who has died.

In this study, it is of interest to look at the process of performance of the *wayang* story rather than at the dramatic structure of *wayang* stories. The story of *wayang* is performed in a linear process, always starts from act one, continues with act two and ends with act three. But there is still a possibility to change the story's sequence for some stories. In *wayang* there are four types of play or *Lakon*:

a. Standard play (*Lakon Pakem*) is played strictly following rules from the book.
b. Improvisation play (*Carangan*) is played following the rules with improvisation.
c. Contemporary play (*Sempalan*) is played completely *out-of-the-book*.
d. Biography play (*Lakon Banjaran*) is played covering a biography of a certain figure.

Wayang stories besides having the linear structure also have a non-linear structure, e.g., a contemporary play. This situation gives us an opportunity to perform *wayang* stories in a medium that supports non-linear structures, e.g., the web. Before the exploration of story structures which are appropriate with the authoring tool is proceeded, the variation of story structures will be discussed in the next section.

3.3.2. Geometric design structures of stories

Every story has a structure that can be visualized as a process. Linear stories have linear processes; non-linear stories have non-linear processes. Ten geometric structure variations from Samsel and Wimberly is explored in this section: sequential, branching, conditional branching (branching with barriers, branching with forced paths, bottlenecking, branching with optional scenes), exploratorium, parallel streaming, worlds, and multilinear (Samsel & Wimberly, 1998).

1. Sequential (Linear)

Sequential structure is the basic construction of both interactive and linear media projects as shown in Figure 3.2. The user will strictly follow a defined serial path. One process is followed

by another process. The user has to travel across node B first from node A before traveling to node C.

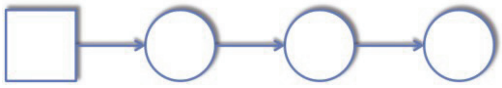

Figure 3.2. Sequential structure

2. Sequential with Cul-de-Sacs

In a certain conditions, a node in a linear sequence can have isolated branches. This condition enables users to leave the sequential path and enter the branch which will not change the main objective of the piece. Such situations are called cul-de-sacs. Examples are games, puzzles or sidebars that explore themes of the work, but without changing the objective of the work or the outcome of the story.

Figure 3.3 shows the geometric model of a sequence with cul-de-sacs. It is interesting to note that its entrance is also its exit. This model can be used by software designers to design interactive narratives.

As an illustration, an interactive tutorial might have a node that provides a demonstration of important concepts. Within the node might be found several items or key words, which can be explored more by the user. The user is able to enter another node by clicking on one of the items and obtaining detailed information about the item. By doing this, the user will gain more understanding of the item or the key words contained in the material. This process will not change the tutorial process itself. After the user has finished exploring the definition, she or he will return to the tutorial node and continue the process.

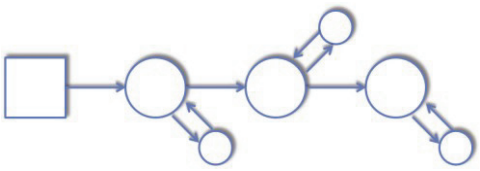

Figure 3.3. Sequential structure with cul-de-sac (Samsel & Wimberly, 1998, p.25)

This sequence with cul-de-sacs model has been used in many children's edutainment CD-ROMs, such as Mindscape's The Animal. As an example, a trip to the zoo will link them to archived data (Samsel & Wimberly, 1998). A child can travel through the story and click on an

object within a scene. By this action, the child will be sent to a cul-de-sac situation, which is a node that contains information such as a photograph of a pelican, a text description of a polar bear, an audio clip of a monkey, or a video clip of a lion. After the child has explored that information, she or he can return to the main body of the zoo story or replay the information. This cul-de-sac model simply enhances the user experience.

3. Branching

In some conditions, the user arrives at a situation where she or he has to choose one path from several available options. The program continues to a new node based on the path the user chooses. These situations are called branching. An interactive story or program often offers this model.

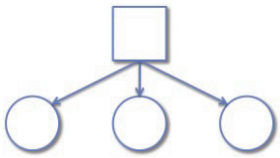

Figure 3.4. Traditional branching structure

The branching model can be used to illustrate the basic concept of interactive theory, which is called user choice. In this model, when the user is confronted with a path decision, he or she has to choose one node from several options (A, B, or C) in order to continue along the path as shown in Figure 3.4.

This branching structure poses the danger that the story can get out of control very quickly. This condition is mentioned by the author Neal Stephenson; he voiced his concern that this type of structure is a "tree of death", where the forking storyline continues until there are a number of results that are not controlled (see Figure 3.5).

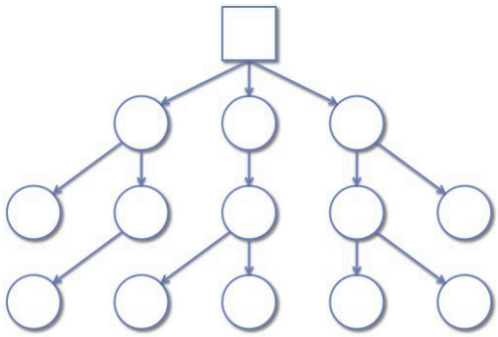

Figure 3.5. Extended branching structure (Samsel & Wimberly, 1998, p.26)

a. Conditional Branching: Branching with Barriers

A subset of the branching structure is conditional branching. A variant of this subset is called branching with barriers. In this structure, the user has to solve a predetermined condition such as a problem or a puzzle before she or he can continue on to the next node. This structure is illustrated in Figure 3.6.

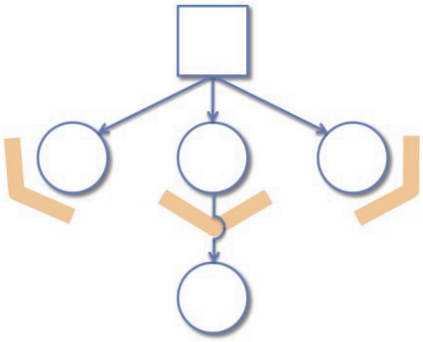

Figure 3.6. Branching with barriers structure (Samsel & Wimberly, 1998, p.27)

b. Conditional Branching: Branching with Forced Paths

Another structure of conditional branching is branching with a forced path structure. In this structure, the program will often continue along the path regardless of the user's actual choice, even though the program offers many options and choices. This model actually does not allow the user to change the path, providing only the illusion of choice.

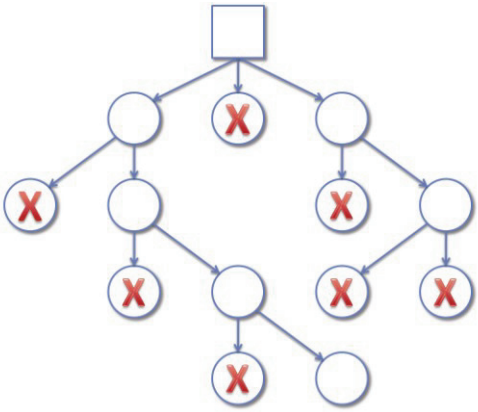

Figure 3.7. Branching with forced path structure (Samsel & Wimberly, 1998, p.28)

A branching structure as seen in Figure 3.7 using “forced paths” or critical paths offers the end-user more options and/or more paths to choose from, but only one solution advances the story.

c. Conditional Branching: Bottlenecking

A different type of conditional branching, which is used in an interactive narrative is called ‘bottlenecking’. A structure is referred to as bottlenecking when different branching nodes come back to the spine of the story. This structure can be used when we consider the exponential possibilities created by a traditional branching structure. An illustration of this structure can be seen in Figure 3.8.

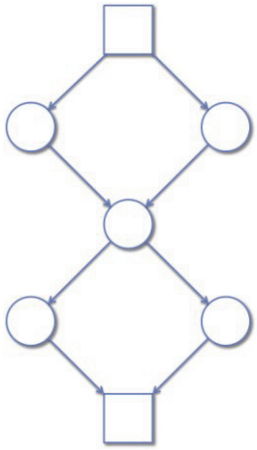

Figure 3.8. Branching with bottlenecking structure (Samsel & Wimberly, 1998, p.29)

This structure will make the interactive narrative more manageable because the different story nodes come back to a single story spine. This type of design structure has been implemented in a number of popular media games and “interactive movies” over the past several years, including Origin’s popular Wing Commander series (Samsel & Wimberly, 1998).

d. Conditional Branching: Branching with Optional Scenes

One variation of the conditional branching structure is branching with optional scenes. This structure allows users to choose between alternative scenes that spin out from and return to the primary spine of the program. This model is frequently found in training and education applications, where it is important to illustrate several concepts and ideas. The illustration of this model can be seen in Figure 3.9.

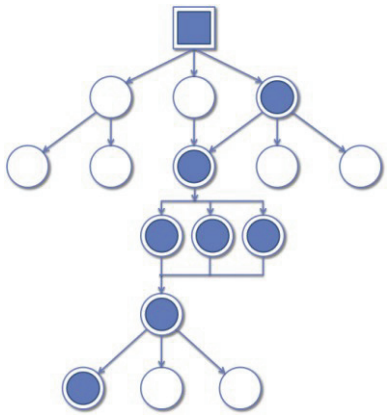

Figure 3.9. Branching with optional scenes structure (Samsel & Wimberly, 1998, p.29)

4. Exploratorium

Exploratorium is a structure which enabling the user to *"pause"* during the program to explore a *"world within a world"* (Samsel & Wimberly, 1998). Numerous interactive storybook titles employ exploratoriums – from the humorous Living Books titles, Arthur's Birthday and Just Grandma and Me to Disney's Pocahontas Animated Storybook to simulated environments such as Imergy/Simon and Schuster's Star Trek Captain's Chair (Samsel & Wimberly, 1998). The exploratorium structure can be seen in Figure 3.10.

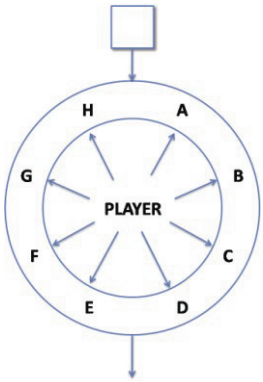

Figure 3.10. Exploratorium structure.
Letters A, B, C, D, E, F, G, and H are "hot spots" or entertainment click-ons imbedded into program (Samsel & Wimberly, 1998, p.32).

5. Parallel Streaming

A parallel streaming structure provides several paths or states that exist within the same application at the same time at different levels. This structure allows the writer in an

interactive narrative to make a single linear story, while enabling the user to change the paths or states. This structure provides user experience for the same series of events from different points of view. Figure 3.11 illustrates this structure.

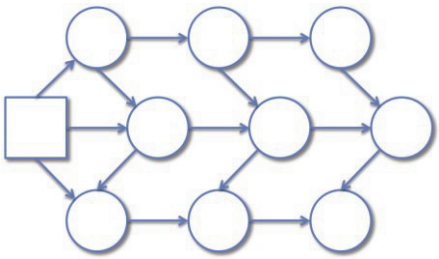

Figure 3.11. Parallel streaming structure (Samsel & Wimberly, 1998, p.33)

6. Worlds

A basis of a world structure is when two or more environments are interconnected by a common thread, such as a theme, goal, mission, or story. *"Add to that world series of predefined events or tasks that the user trigger/accomplish in order to move the story or mission forward and you have a design structure that works very well with interactive media programs"* (Samsel & Wimberly, 1998).

This structure provides users with an important and fun experience when exploring the surroundings of the story environment after they have finished the story.

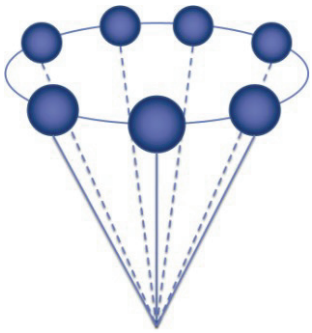

Figure 3.12. World structure.
Notice that the world is in the shape of funnel (Samsel & Wimberly, 1998, p.36)

This structure as shown in Figure 3.12 enables the user to travel through an interesting environment in order to find clues to the story. The user action in exploration is as necessary as the action of discovering the narrative. By triggering particular author-defined events, the

user enhances the story. The combination of actions of exploring worlds, finding all the clues, and interacting with the triggers brings the user to the end of the story or game.

This world structure can be looked at in a different way. If it is seen from an overhead view, it will be like looking down into the center of a cone as seen in Figure 3.13. The eight outer nodes illustrate the plot points or tasks that the user must complete. The next sets of tasks are represented by the eight inner nodes.

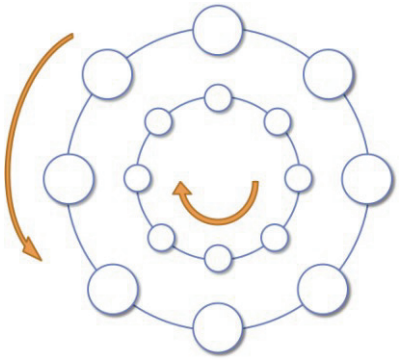

Figure 3.13. Carousel entry into a world structure (Samsel & Wimberly, 1998, p.37)

7. Multilinear or Hypermedia

Another geometric structure of stories is named multilinear as illustrated in Figure 3.14. This structure includes every kind of possible user path or no path at all. Good examples of this structure are the World Wide Web, hypertext fiction, MUDs (multi-user domains), MOOs (multi-user object-oriented environments), and simulations. A multilinear structure provides a different kind of user involvement, because the users themselves have to decide which path will be their own unique path to be traversed. The author only provides sets of rules and boundaries of the interactivity.

A hypermedia structure allows the user act as an interactor or a facilitator of a story. This feature is also found in the World Wide Web or a hypertext story. The user is able to decide which homepage to start from and can select which links to follow through the digital environment. A pathway through the material is determined by the user action. In a same way, hypertext stories are about the traverses as much as they are about the narrative that waits to be combined together.

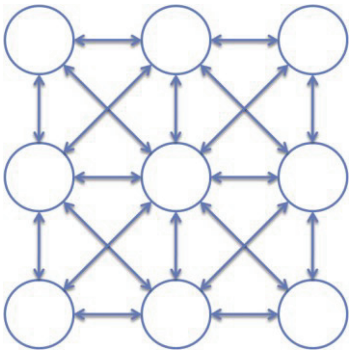

Figure 3.14. Multilinear and hypermedia structure (Samsel & Wimberly, 1998, p.39)

3.3.3. Relevance to the research

One of the lessons that has been learned from this section is that the sequence of events and actions is important in a story. This sequence leads the reader to follow a dramatic flow of the story. There are causal connections between the ideas or events in the story and these connections tend to be related to the main elements of the story. Through these comprehension processes, readers develop an understanding that extends beyond words and sentences, to reach comprehension of paragraphs and extended text. This knowledge forced the researcher to design a space for children to learn and to practice in building a story's sequence in order to support them their narrative development.

A good plot and dramatic story structure of a story will keep the readers' curiosity and their emotional engagement. When a user accomplished a task by using a computer, she/he followed a certain sequence process which is offered by the system. The actions and events of the system and user build a kind of story. It is needed to keep the user attention and their engagement with the system in order to reach their goals. Therefore, the researcher found that the knowledge of the story's structure and the dramatic flow can be used to design interaction between user and system.

3.4 Summary

This chapter introduced the conceptual idea of transmedia storytelling from Jenkins which described how stories can be told through various media in such a way that takes advantage of what each medium does best. Actually, the stories we have heard, read and seen in a single medium have not lacked effect, but combining several media gives a completely new experience.

A structure of narrative composed of four characteristic: setting, character, theme and plot. Action schemas or scripts are knowledge structures which even very young children use to organize their general knowledge about events. This chapter has explained the dramatic structure from Freytag and explored ten geometric-structured variations of stories from Samsel and Wimberly: sequential, branching, conditional branching (branching with barriers, branching with forced paths, bottlenecking, branching with optional scenes), exploratorium, parallel streaming, worlds, and multilinear.

In *wayang* tradition, multiple non-linear structures can be found within *wayang* stories. The audience can follow its own combinations of presented and remembered additional stories according to their own experiences and knowledge. This study focuses on analyzing whether the same character in different stories can enable a similar multiple storylines as well. The concept of intertextuality in this context will be used to provide suggestions for children to help them to build multiple storylines by character.

Chapter 4
Interaction Design and Social Software

This chapter contains two main aspects: interaction design and social software. It is important to discuss interaction design in this study because it determines how people interact with computers and communication. This is a concern of the meaning of a communication service to its users, and the value of experience they have when using it. This study intends to contribute to the field of storytelling as interaction design. The second aspect is the social software concept which will be used to develop the authoring system. Social software as software that allows users to share and interact will be explored to gain a greater understanding this area in order to support design process of the authoring tool that supports children's creative activity in the narrative field.

4.1 Interaction design and user experience

Interactive digital products require and respond to human input, and change their content or behavior based on that input. This means that at least two entities are listening and responding between them. The behavior of this kind of interaction should be defined or designed. Therefore, interaction design plays an important role in the development of interactive digital products. To obtain more understanding about interaction design, the meaning of this term is explored.

The Interaction Design Association (IxDA) defines interaction design as follows: "*Interaction Design defines the structure and behavior of interactive systems. Interaction Designers strive to create meaningful relationships between people and the products and services that they use, from computers to mobile devices to appliances and beyond*" ("IxDA Mission | IxDA," n.d.).

Another definition can be found from Helen Sharp in her book "Interaction Design: Beyond Human Computer Interaction". She defines interaction design as "*designing interactive products to support the way people communicate and interact in their everyday and working lives*" (Sharp, Preece, & Rogers, 2007). This definition places human beings or users at the center of the design process similar to the definition by Bill Verplank in his paper Interaction Design Sketchbook. Verplank wrote "*Interaction Design is design for people – design for human*

use. […] The central concern of Interaction Design is how to design for people – for their physical and emotional needs and increasingly for their intellect" (Verplank, 2009). Verplank said that the interaction designer needs to answer three questions, about how people act, how they feel, and how they understand.

For this study, it is of interest to refer to a definition by David Malouf–"*Interaction Design is not the design of a medium but rather a philosophical shift in how to design for any medium. By concentrating on the dialogue that takes place between people products & services and then the effect that those dialogs have on the behaviors of people, interaction design, answers the questions of why, how, and what with a new lens and expanded impact*" (Malouf, 2009). This definition is close to the understanding about storytelling in the second chapter. The concept of interaction or dialogue between audience and storyteller can be applied to interaction between people and product. Therefore, this interaction design and storytelling concepts have been used in developing process of *Wayang* Authoring tool.

Most interaction design is done by multidisciplinary teams, where the skill sets of engineers, designers, programmers, psychologists, anthropologists, sociologists, artists, toy makers, and others are drawn upon. One of the benefits of bringing together people with different training and backgrounds is the possibility of a lot of more ideas being generated, more creative and original designs being produced, and more methods being developed. However, the disadvantage is the cost involved. In a design team, the more people there are with different backgrounds the more difficult it can be to communicate and have the generated design progress forward (Sharp et al., 2007).

The user experience has become one of the main concepts in interaction design. This is the design element that deals with how a product behaves and is used by people in the real world so that it provides a specific experience. Jesse Garret stressed that each product that is used by someone offers a user experience: computers, sweaters, coffee machines, ketchup bottles, etc. (Garret, 2002). If experiences are in the focus, the application is not only usable for performing a specific work task, but additionally to evoke emotional engagement. In particular, it is about how people feel about a product and their satisfaction and pleasure when looking at it, holding it, using it, and opening or closing it.

User experience is not about how a product works on the inside. User experience is about how it works on the outside, where a person comes into contact with it and has to work with it. That interaction in a context often involves pushing a lot of buttons, as in the case of technology products such as alarm clocks, coffeemakers, and cash registers.

Part of the process of understanding users is to be clear about the primary objective of developing an interactive product of them. The objectives can be classified in terms of usability goals and user experience goals (Sharp et al., 2007), which are explained in the following.

4.1.1. Usability goals

The definition of usability can be found in Nielsen's book *Usability Engineering*. He stated that usability is about *"learnability, efficiency, memorability, errors, and satisfaction"* (Nielsen, 1997). However, the definition of usability from ISO 9241-11 is: "*The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use*" (ISO/TC 159, 1998) becomes the major reference of usability. The ISO definition is in terms of the results of using the product: effectiveness, efficiency and satisfaction are measures of the whole system (product, user, task and environment), not just of the product.

From those definitions it is found that usability is not simply a characteristic of a user interface, but more about facilitating users to achieve their work targets. Furthermore, usability is a function of achieving objectives in terms of a set of attributes for each user (i.e. effectiveness, efficiency and satisfaction) and environment of use (Jokela, Iivari, Matero, & Karukka, 2003). More specifically, usability is divided into the following goals (ISO/TC 159, 1998; Nielsen, 1997; Sharp et al., 2007):

- effective to use (effectiveness): the completeness and accuracy with which users accomplish specified goals.
- efficient to use (efficiency): the resources expended concerning the completeness and accuracy with which users achieve goals.
- safe to use (safety): safety involves protecting the user from undesirable situations and dangerous conditions.
- having good utility (utility): utility refers to the range to which the product provides the proper kind of functionality so that users can do what they want or need to do.
- easy to learn (learnability): learnability refers to how easy a system is to learn to use.
- easy to remember how to use (memorability): memorability refers to how easy a product is to remember how to use, once learned.

After an understanding of usability has been gained, the next step of the process is designing the usability of the product. In order to guide to designing and developing of the authoring tool, a standard of user-centered design, ISO 13407 which is described in the following has been referred to.

ISO 13407 —Human-centered design process for interactive systems

One of the lessons that has been learned from the previous section that one factor for a product or a website to be successful is that its intended user must find it easy to use. This leads to the question: "What can the designer does to create a site that's easy to use?" It

seems the answer for most is usability testing. However, usability testing is only one element of producing usable sites. Therefore, the most reliable and effective approach to ensuring fundamental usability is to follow a user-centered design process. In this section, we discuss an ISO international standard, which as a basis details the series of activities performed in user-centered design and introduce formal levels of organizational maturity regarding usability.

ISO 13407 (ISO/TC 159, 1999) is an international standard providing guidance on human-centered design activities throughout the lifecycle of an interactive product. It addresses the planning and management of human-centered design and is concerned with both hardware and software components.

The standard identifies four principles of human-centered design:

1. The active involvement and a clear understanding of user as well as task requirements. The standard claims that the involvement of users provides a valuable source of information, and that the effectiveness of involvement increases as the level of interaction between developers and users increases.
2. An appropriate allocation of function between users and technology. The standard emphasizes that this decision should not be a simple matter of identifying what the technology is capable of doing, and then allocating all other activities to the human. Instead, this decision should be based on several factors including relative competence of technology and humans in terms of reliability, flexibility of response, and user well-being.
3. The iteration of design solutions.
4. Multi-disciplinary design. The standard suggests a wide range of potential roles to be included in the team, although it emphasizes that the team need not be large as one member may take on a variety roles.

It specifies four human-centered design activities as being central to a system development project:

1. To understand and specify the context of use.
2. To specify the user and organizational requirements.
3. To produce design solutions.
4. To evaluate design against requirements.

The lifecycle model suggested by this standard is shown in Figure 4.1. This process should iterate from the earliest stage of the project through to project completion when the product meets its requirements.

In addition, the start of this lifecycle should be prepared by a planning phase which identifies the design activities and how they will be integrated into other system development activities, who is responsible for these activities, procedures for establishing and documenting feedback

and communication, and milestones and timescales to allow for feedback to be incorporated into the project schedule.

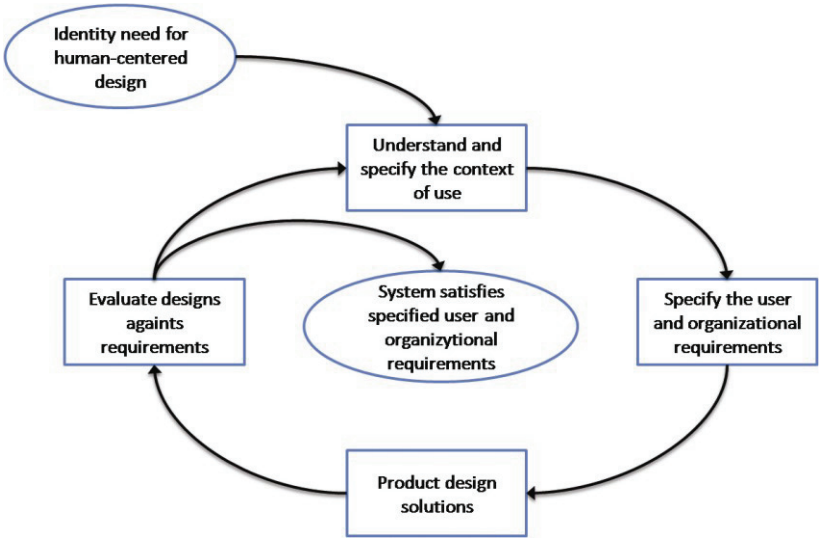

Figure 4.1. The ISO 13407 human-centered design lifecycle model (ISO/TC 159, 1999).

4.1.2. User experience goals

There are a number of user experience goals that are beginning to be articulated in interaction design. They include both positive and negative ones (Sharp et al., 2007), for example:

- satisfying
- enjoyable
- engaging
- pleasurable
- exciting
- motivating
- helpful
- entertaining
- supportive of creativity
- aesthetically pleasing
- cognitively stimulating
- rewarding
- fun
- provocative
- surprising
- emotionally fulfilling
- challenging
- enhancing sociability
- boring
- frustrating
- annoying
- cutesy

Many of these are subjective qualities and are concerned with how a system feels to a user. It can be seen that they differ from the more objective usability. They deal with how users experience an interactive system from their perspective, rather than evaluating how productive or useful a system is from its own point of view.

Recognizing and understanding the nature of the relationship between usability and other user experience goals is central to interaction design. Not all usability and user experience goals will be relevant to the design and evaluation of an interactive product being developed. Articulating the interactions of the various components of the user's experience can lead to a deeper and more significant interpretation of the role of each component (Carroll, 2004).

Four basic activities are included in the interaction design process: identifying needs and establishing requirements is the first activity, followed by providing alternative designs that fit with those requirements. Those processes are followed by developing interactive versions of the designs so that they can be communicated and assessed, and at the end evaluated.

4.1.3. User experience and the web

On the web, user experience becomes even more important than it is for other kinds of products (Garret, 2002). In virtually every case, a website is a *self-service* product. There is no instruction manual to read beforehand, no training seminar to attend, no customer service representative to help guide the user through the site. There is only the user, facing the site alone with only her/his wits and experience to guide her/him.

Morville used a honeycomb diagram to explain quality of the user experience on web applications as shown in Figure 4.2 (Morville, 2004).

Figure 4.2. The User Experience Honeycomb from Peter Morville (Morville, 2004)

Useful: the designer must have the creativity and courage to ask whether the products and systems are useful. The designer has to define a more useful innovative solution by applying her/his knowledge of medium and craft.

Usable: ease of use remains vital, and up till now the perspectives of human-computer interaction and interface-centered methods do not address all aspects of web design.

Desirable: the designer exploration for efficiency must be strengthened by an appreciation for the value and power of identity, brand, image, and other components of emotional design.

Findable: the designer must attempt to design navigable websites and locatable objects that enable users to find what they need easily.

Accessible: the websites should be accessible to people with special needs.

Credible: the designer should understand the design elements that affect user perception whether users believe and trust what the designer tells them.

Valuable: the websites must deliver value to the sponsors. The user experience has to improve the mission for non-profits. On the other hand, it has to make a contribution to the bottom line and enhance customer satisfaction for for-profits.

Businesses have now come to recognize that providing a quality user experience is an essential, sustainable competitive advantage. It is user experience that forms the customer's impression of the company's offering, it is user experience that differentiates the company from its competitors, and it is user experience that determines whether your customer will ever come back (Garret, 2002).

After knowledge about user experience has been gathered, a framework for the digital creation process is needed to be discussed in order to guide the design process. Garret divided a structured process of digital creation into five steps: strategy, scope, structure, skeleton, and surface as shown in Figure 4.3. He split his five planes down the middle: on the left, those elements specific to using the web as a *software interface*; on the right, the elements specific to *hypertext information spaces* (Garret, 2002).

The Strategy Plane

In a strategy plane, the focus is on two primary sets of needs: the user needs and the organization goals. The first step begins with figuring out what customers want to do while visiting the organization's website. The next step is identifying the organization's goals which need to be combined into the building of the site.

The Scope Plane

A detailed description of the functionality of the product should be provided as a *functional specification* on the software side. *Content requirements* should be produced on the information side during this phase. This contains a description of a range of content elements that will be required.

The Structured Plane

In this phase, the plan for the presentation of the information is provided. The *interaction design* is planned to take place on the software side. The system behaviors in response to the user are defined. On the other side, the *information architecture* which is the arrangement of content elements is provided within the information space.

The Skeleton Plane

The skeleton of the site must be put in place before the surface is added. The *information design* must be addressed on software products and information spaces. This information design presents information in a way that facilitates understanding. The *interface design* includes the skeleton of the software products. The design contains an arrangement of components to facilitate users in interacting with the functionality of the system. In addition, the *navigation design* in the information space, which is the set of screen components that support the user to move through the information architecture, is provided.

The Surface Plane

In this phase, the designer can finish the look of the site by filling the skeleton with *the visual design*. This process happens either through a software product or in an information space.

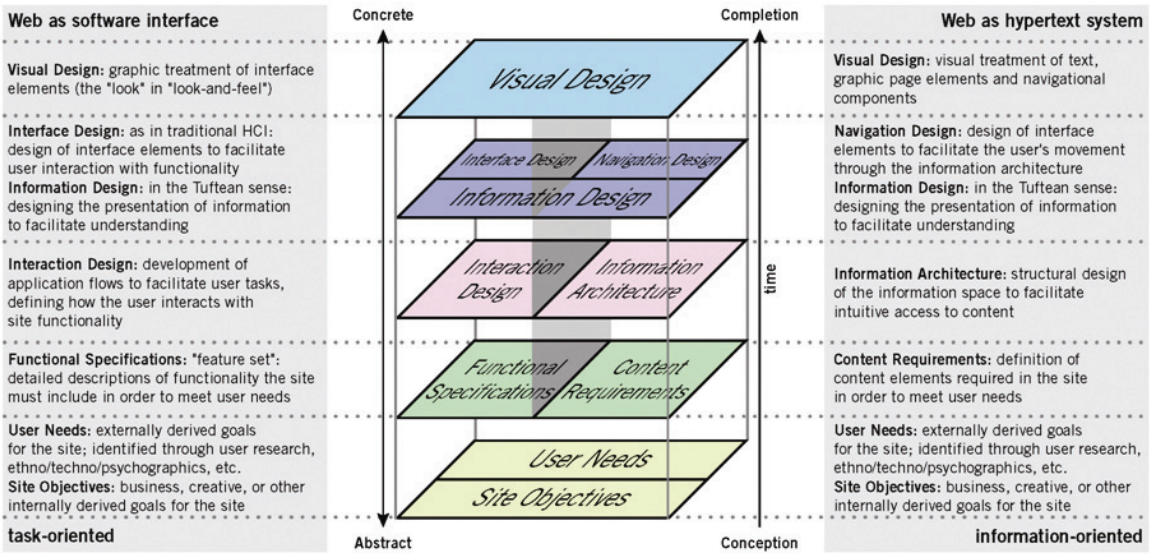

Figure 4.3. Jesse James Garret's Elements of User Experience
(Source: http://www.jjg.net/elements/pdf/elements.pdf).

4.1.4. Relevance to the research

From this section, what has been learned is that understanding what activities are involved in interaction design is the first step to being able to do it. However, it is also important to think how the activities are connected to one another so that the whole development process can be seen. In order to find out the user requirements and to design the user interactions for the development of *Wayang* Authoring, this study involved the children and the professional story performers who use *wayang* in the early phase of the design process and in the evaluation process.

It was found that the honeycomb diagram from Morville and the framework from James Garret are very useful for advancing the conversation beyond usability and for helping me to understand the need to define priorities and these models support a modular approach to the design of *Wayang* Authoring.

4.2 Learning approach

This study is aimed at exploring the potentials of authoring media to support creative storytelling and self-expression for children. Approaches that consider the design of interactive systems in general are already discussed in the previous section. To achieve the aims of this

study, in this section it is of interest to discuss the learning approach for children in order to have an understanding for designing our application for a special domain, namely learning environments. Two learning approaches, namely the '*Reggio Emilia Approach*' from Reggio Emilia and '*Kindergarten Approach*' from Resnick, are explained because even these approaches focus on visual and narrative learning which is important for children at kindergarten age, but I believe that they are still important for narrative development of older children as well.

4.2.1. Reggio Emilia approach

The kindergartens in Reggio Emilia in Italy are an important place for researchers and educators interested in kindergartens. The many people making the pilgrimage to Reggio kindergartens are always impressed with the availability of various materials for creative expression and experimentation, the organization of the space, and the support of collaborative activities. The most impressive part of Reggio kindergartens is the approaches to encouraging children to reflect on what are they doing (Resnick, 2007).

In Reggio the process of learning involves making connections and relationships between feelings, ideas, words, and actions. Through the course of making these links, and directed by the belief that learning is a spiraling process as seen in Figure 4.4 in which ideas, opinions, and thoughts must be expressed, revisited reflected upon, and expressed again, children consolidate their ideas, thoughts, and feelings into a meaningful and cohesive whole (Hewett, 2001).

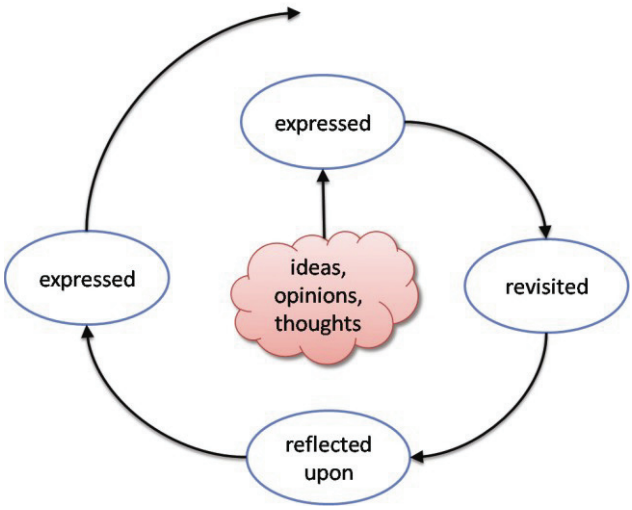

Figure 4.4. The spiraling process of learning within the schools of Reggio Emilia.

There are various kinds of expressing, interpreting, and demonstrating knowledge. In the Reggio Emilia Approach children are facilitated and encouraged to they voice their ideas, understandings, and plans "*using one or more languages, or modes of expression*" (Edwards, Gandini, & Forman, 1993) including, but not restricted to, drawing, painting, writing, drama, dance, puppetry, and sculpture (New, 1990). In reality, this act in itself is viewed as supporting the development of knowledge. "*As children compare these various representations, they confront new possibilities and generate new questions that would not have occurred had they used only one medium*" (Forman, 1996); meaning is improved and expanded. For that reason, the use of different expressions of knowledge can be understood as supporting the building and continual unfolding of various forms of knowing (Hewett, 2001).

The Reggio Emilia Approach to educating young children is actively determined by the child's own unique character and completely embedded within this surrounding culture. That is *"neither a model nor recipe with a set of guidelines and procedures to be followed; therefore, one cannot and should not attempt to simply import it to other location. Rather, it must be carefully uncovered and redefined according to one's own culture in order to successfully affect practice elsewhere"* (Hewett, 2001).

The educational approach of Reggio Emilia is based on creative and artistic methods. Theater and art are an important aspect in this constructive setting of education. The role of imagination and fostering creativity can teach us a setting for constructive and creative education in general. One artistic of Reggio Emilia is the use of shadow theater as a field that can foster children's understanding of abstract concepts.

4.2.2. Kindergarten approach to learning

According to Resnick, the "*traditional kindergarten approach to learning"* is relevant to the needs of the 21st century (Resnick, 2007). In a community characterized by uncertainty and rapid change, the ability to think and to work creatively is turning into the primary factor for success and satisfaction, both personally and professionally. There is nothing more important for today's children than learning to think creatively and learning to come up with creative solutions for unpredicted situations that will frequently occur in their lives (Sawyer, 2006).

Children are continually designing, creating, experimenting, and exploring in traditional kindergartens. This kind of process is repeated again and again in kindergarten. The creations vary (stories, songs) and the materials vary (finger paint, crayons), but the core process is the same as a spiraling process as seen in Figure 4.5 in which Resnick illustrated that children first "*imagine"* what they want to do, then "*create"* a project based on their ideas, "*play"* with their creations, "*share"* their ideas and creations with others, and finally "*reflect"* on their experiences. This leads them to "*imagine"* new ideas and projects (Resnick, 2007).

Children develop and enhance their abilities as creative thinkers during this process. They learn to build their own ideas, experiment with various possibilities, test restrictions, and get input from others. Creating new ideas based on their experiences can be the most important process. The stages in the process, in reality, are not as different or sequential as illustrated in the diagram. The process of imagining, creating, playing, sharing, and reflecting vary in different ways. However, the key elements are there at all times in one form or another. A number of successful creative inventors and artists of the 20th century recognized their kindergarten experiences as the basis for their later success (Brosterman, 1997; Resnick, 2007).

Figure 4.5. The kindergarten approach to learning (Resnick, 2007).

Resnick mentioned that *"digital technologies can play a transformational role in education"* (Resnick, 2007). He believed that digital technologies can be used to support learners of all age spans to carry on learning in the kindergarten style if the technologies are suitably designed. In the process they will grow as creative thinkers.

4.2.3. Relevance to the research

What has been learned from both approaches is that the reflection process that should be considered in *Wayang* Authoring tool. Reflection is a critical part of the creative process. In the Reggio Emilia Approach children are encouraged to reflect on what they are doing by always creating drawings and diagrams like they do for projects. In order to facilitate children to discuss and reflect on their design and thinking process, teachers use artifacts during the

process. But Resnick noticed that the focus of this kind of reflection is commonly on the creation of an artifact. The reflection is not critical reflection on the ideas that lead the design, or strategies for improving and refining the design, or relations to basic scientific concepts and associated real-world phenomena. He introduced new technological tools such as Crickets and Scratch to facilitate children in reflecting on the design process. He explicitly mentioned the spiral process of *"imagine-create-play-share-reflect-imagine"*, and looked for methods for children to apply and communicate these ideas.

4.3 Social software

In today's world, collaboration is not a luxury but a necessity. Creative activity grows out of the relationship between individuals and their work, as well as from the interaction between individuals (Fischer, 2005). Creativity does not happen inside people's heads, but in interaction between a person's thoughts and a socio-cultural context (Engeström, 2001). As mentioned in the second chapter, collaborative storytelling can evoke creative storytelling for children; therefore in this study, the system is designed to provide children with a space for collaborative works in the storytelling field by using the social software concept. In order to gain an understanding of the social software concept, in this section the concept of social software is discussed and a study on some existing social software is carried out.

There has been a great deal of interest recently in the development of tools to foster remote collaboration and shared creative work. With the advent of new lightweight online communication modalities, such collaborative and social creativity (Fischer, 2005; Watson, 2007) is becoming more accessible. Corporations, scientists and educators, among others, are all seeking to develop tools to foster effective collaboration at a distance (C. R. Aragon, Poon, Monroy-Hernández, & D. Aragon, 2009). Systems that support social creativity must facilitate sharing and play, and their design must consider the effects of repurposing, augmentation and behavior adaptation (C. R. Aragon et al., 2009).

There are a lot of definitions of social software out there. According to Tepper, social software *"refers to various, loosely connected types of applications that allow individuals to communicate with one another, and to track discussions across the Web as they happen"* (Tepper, 2003). In more detail, social software can be defined as software which supports, extends or derives added value from, human social behavior— message boards, musical-taste-sharing, photo-sharing, instant messaging, mailing lists, social networking (Coates, 2005). From those definitions we are led us a question: What are elements of social software? We need a functional definition of social software to guide us in developing an understanding about how social software works. Webb listed seven social software elements: *"identity, presence, relationships, conversations, groups, reputation and sharing"* (Webb, 2004):

Identity: is an instrument for identifying users in the system

Presence: is a means of knowing user who is online or available

Relationships: is a way of describing how two users in the system are connected (e.g., in Flickr, people can be contacts, friends of family)

Conversations: is a process of communication between users through the system

Groups: is a method of forming communities of interest

Reputation: is used more in systems which allow meeting new individuals. This is a technique of knowing the status of other users in the system

Sharing: is a method of sharing meaningful resources such as images, videos, notes to other users

These elements form a good conceptual framework for understanding social software. However, not every social software system contains them all. They usually have three or more. Smith developed a social software honeycomb based on the idea of the seven building blocks from Peter Morville's user experience honeycomb (Smith, 2007). He put the most important requirement of any social software system ('identity') at the center of the honeycomb as shown in Figure 4.6. This conceptual framework can be used to analyze what the focus of a system is and what the supporting elements are as we will do later on for some existing social software, i.e. Flickr, YouTube and Facebook in section 4.4.2.

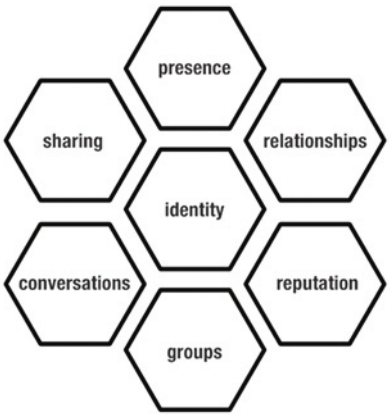

Figure 4.6. Social SoftwareHoneycomb from Smith (Smith, 2007).

In the next section some common components and experiences which are available in social software are presented. Those components and experiences are discussed in more detail in a study of several examples of existing social software.

4.3.1. Emerging tools for the digital community

The Internet and its changes towards a mass medium for communication are often referred to as the social web. The "social web" is a new kind of highly interactive, conversational, participatory websites that has emerged over the last few years (Wilker, 2007). These include blogs, social networking sites, community-edited news sites, services that allow sharing/favorites ("social bookmarking"), content-sharing sites, discussion forums, newsgroups, and wikis. Wilker explained the social web is about:

- **expressing identity**
  The social web enables people to share aspects of their lives with family, friends, or anyone they choose, by using the easy-to-use online tools. It enables people to show a real sense of who they are and what they are interested in, regardless of their motives which are certainly very different.

- **relationships and trust**
  The social web facilitates people to find and start talking with others, who share their interests, whose ideas they like, who make pictures, videos, writings that they find interesting. People can enjoy some positive interactions with this friendly person they have found, and trust will begin to develop. Through the social web, people develop true relations with others.

- **user-driven websites**
  The social web enables the ordinary user to become important. Anyone can post pictures to Flickr or engage with the authors of widely read blogs. The online behavior of the ordinary user becomes important. One click is significant when looking at images on Flickr, giving a thumbs-up to an image on Facebook, or even when using Google as these actions have an effect on the search ranking of the content of these sites. Moreover, the social web enables people to be active and empowered participants in the production and distribution of media. People are able to build and support a new community with a variety of interests, such as education, pleasure, business, and politics.

Tim O'Reilly, one of the people responsible for creating the term Web 2.0, has written, *"Web 2.0 is the business revolution in the computer industry caused by the move to the Internet as platform, and an attempt to understand the rules for success on that new platform. Chief among those rules is this: Build applications that harness networks effects to get better the*

more people use them" (O'Reilly, 2006). And Richard McManus has this to say: *"Web 2.0 at its most basic is using services on the Web. Some examples: Gmail for email, Flickr for photo-management, RSS for news delivery, eBay for shopping, Amazon for buying books. That's why the web is being called a platform — because all of these services are being built and used on the Web. Why Web 2.0 only now though — hasn't Amazon been around since 1995? Why yes, but it's taken until 2005 for broadband and web technology to catch up and reach a 'tipping point' – the web is fast becoming the platform of choice for developers, business, media, public services, and so on"* (McManus, 2005).

It can be seen that Web 2.0 as concept is difficult to define concisely. The concept usually, though, involves ideas and terms such as platform, social, communities, and strong user-generated component. Web 2.0 tools usually include some combination of these components (King, 2008):

- **RSS feeds**
  This feature enables users to subscribe to content feeds. Really Simple Syndication (RSS) is an XML-based (Extensible Markup Language) content-syndication protocol that allows websites to share their content with other applications (Cold, 2006).
- **Commenting**
  This feature enables user to write her/his opinions on someone else's content.
- **Tagging**
  This feature enables all users, not only the content author to assign a personally relevant keyword to content.
- **Reading RSS with feed readers**
  This feature enables users to retrieve and read the stuff they subscribe to. RSS is read through programs called *feed reader*s or *aggregators*; thus the user subscribes to a feed by supplying to their reader a link to the feed; the reader can then check the user's subscribed feeds to see if any of those feeds have new contents since the last time they were checked, and if so, retrieve that content and present it to the user (Samper et al., 2008).
- **Mash-ups**
  This feature enables users to build something original by combining two or more things.
- **Web-based applications**
  This feature enables users to use web-based tools to do things, rather than finding information. Therefore, users can do not only simple tasks such as reading and writing emails, managing a bank account, or placing orders.
- **User-generated content**
  This feature enables users to have the service to produce content.
- **A way to 'friend' others**
  This feature enables users to find and select users as friends.

The community-focused experience in many Web 2.0 sites is created through the community-building aspect of these sites – the real-time, or near real-time, interaction that can take place among users (King, 2008).

There are many types of social networking sites today, and they can be categorized loosely into two groups: sites about content and sites about people. The content sites focus on a specific type of content, such as photos (Flickr) or videos (YouTube). These sites are extremely social. They allow commenting, RSS feeds, friending, favorites, personal accounts, tagging, and sending private messages to other users.

People sites are similar, but instead of focusing on people's content, these sites focus on the person. The friending, tagging, commenting, blogging, and favorites marking that take place on these sites occur because of interest in the person.

Experience and community occur within social networking sites in a variety of ways, including connections, participations, and a sense of familiarity (King, 2008).

- **Connections**
  Connecting with others is the main goal of most social networking sites. This connection proceeds directly through the *'friending'* feature. We create a direct digital connection between a person and our self, when we accept another user as our friend. The person is listed in our friends list, and a variety of other opportunities become available depending on the social networking site we are using. For example, in Facebook and Twitter, whenever our friends update their profiles with new information, we receive a copy or a notification of that content. That is one of the main ways friends keep up to date with each other via social networking sites.

- **Participations**
  We are participating in the social networking site's activities by creating, tagging, and commenting on and sending content via a social networking site. Participation is important in a social networking site. There is really no social networking at all if no one does anything.

- **Sense of familiarity**
  We get to know a person as we view a friend's photos in Facebook. We can see his new computer, learn about his friends and his activities, and see the interesting things he does. In this way, we start to become visually familiar with that Facebook friend.

If Jenkins' paper, which he published with the McArthur Foundation in 2005, he used a term "participation culture". A participatory culture is "*a culture with relatively low barriers to artistic expression and civic engagement, strong support for creating and sharing one's creations, and some type of informal mentorship, whereby what is known by the most*

experienced is passed along to novices. A participatory culture is also one in which members believe their contributions matter, and feel some degree of social connection with one another (at the least they care what other people think about what they have created)" (Jenkins, 2009). Jenkins mentions forms of participatory culture include:

- **Affiliations**
  This activity is created by joining memberships, formal and informal, in various forms of online communities centered, such as Friendster, Facebook, message boards, metagaming, or MySpace.

- **Expressions**
  People can perform this activity by producing new creative forms, such as digital drawing, story making, video making, or mash-ups.

- **Collaborative Problem-solving**
  People participate on collaborative problem-solving by working together in a team, either formal or informal, in order to accomplish tasks and build new knowledge.

- **Circulations**
  This activity can be done by shaping the flow of media, such as podcasting, or blogging.

It has been noted in the second chapter that digital media changes the way people tell stories. Digital storytelling is a set of collaborative digital media production techniques that have been used to enable ordinary people including children to relate their own lives by writing blogs or uploading videos and to facilitate social participation in numerous contexts by joining online communities. Furthermore, digital storytelling can facilitate social participation in the process of building community-based capacity for end-user engagement in digital media production. I believe that digital storytelling can be used as a platform for enabling participatory culture. For the purpose of this study, the concept of participatory culture in the context of storytelling is used to develop *Wayang* Authoring system.

4.3.2. Studies of existing social software

After we have discussed about social software sites in general, we will look at some particular sites – YouTube, Flickr, and Facebook– and see where the digital experience is found in each. These three examples of social software are chosen because each has a different focus when we analyze it based on the social software honeycomb. This exploration is intended to find a comprehensive understanding of social software user experiences and how they provide it on the features offered. Moreover, what kind of components can be applied in storytelling context, particularly for this study.

The focus elements of the three social software systems are summarized in the social software honeycomb as shown in Figure 4.7. The dark blue hexagon is the main focus of the system; the light blue hexagons are the supporting elements; the white hexagon is indicated that the element is not available.

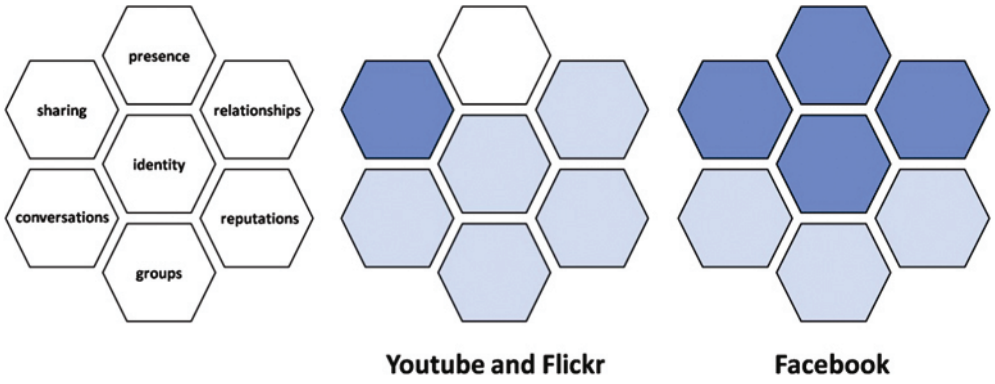

Figure 4.7. Focus elements of YouTube, Flickr, and Facebook.

YouTube

According to the YouTube website, YouTube is the pioneer of online video, and the first destination for watching and sharing videos worldwide through a web system. YouTube enables people to upload and share video clips easily on www.YouTube.com and across the internet through websites, blogs, mobile devices, and email (YouTube, n.d.). From Google's Add Planner we found 490M unique users and average time on the site was 23:20 hours per user in July 2010. This information indicated that YouTube is the leader for video content sites.

Everyone can watch videos on YouTube. People can see actual accounts of the latest events, look for videos about their hobbies and interests, and search for the strange and unusual. YouTube is enabling people to become broadcasters, as more people record special moments on video.

YouTube is devoted to user-generated video. Anyone can create a free account to upload video clips. People can tag them, describe them, and share them. Others can watch them, select favorites, and comment.

YouTube allows much community building based on a shared interest on a topic through watch a video on a topic of interest, leave comments on videos, or create a list of favorite's videos. These give avenue to a community-focused digital experience, focusing on communication. People communicate visually through YouTube via the videos a person shares. People are

allowed to *be there* – to see and hear an event from someone's point of view (King, 2008). That creates a connection to the video authors.

Moreover, there is the experience of being in control. People can watch YouTube videos at their convenience. YouTube is not a streaming, one-time event that people can watch only at certain time or place. There is no cost to watch a video, and users can replay it as many time as they like.

It has been noted in the second chapter that digital storytelling has emerged as a form of narrative expression that is brought into a media production. Sites like YouTube are appropriate for hosting digital stories in short movies format. YouTube currently allows users to upload video with 10-minute maximum duration. Digital stories and video-sharing are connected each other. Ohler in his book '*Digital Storytelling in the Classroom: New Media Pathways to Literacy, Learning, and Creativity*' explained that the future of digital storytelling such as short movies on YouTube, will facilitate *"interactivity and participation locally and at a distance, allowing students to share and collaborate on digital stories*" (Ohler, 2008). As authors, users can upload and share their videos on video hosting sites. Additionally, they are able to interact with other users through comments or ratings. These increase the interactivity level of digital storytelling that was previously difficult to achieve, until the emergence of free video-sharing.

Flickr

According to the short description on the Flickr website, Flickr is the best way to store, sort, search, and share photos online. Flickr helps us organize that huge mass of photos we have and offers a way for us and our friends and family to tell stories about them (Flickr, n.d.). Flickr works very simply: We take a photo, upload it to Flickr, tag it, add a title and description. Other people can now view, comment on, and tag our images. Each Flickr account, each tag, and each search has an associated RSS feed so that people can subscribe to photos in Flickr in many different ways. Google's Add Planner reported that in July 2010 Flickr had around 50M unique users and average time user on Flickr is 7:30 hours.

Flickr gives two kinds of communication as a community-focused digital experience (King, 2008). The first is visual communication. People communicate visually through Flickr via the photos a person takes. A person can get to know other people through the photos they take. A people might feel a connection with the work, the technique used, or the person's photographic skill level. The second type of communication in Flickr is textual communication. Flickr offers textual communication through commenting on photos, leaving notes directly on a photo, tagging photos, or sending someone Flickr email.

Flickr also provides another experience, that of control. On Flickr it is easy to control how users share their images, as shown in Figure 4.8. For each of a user's photos and videos on Flickr, the user can fix the following: *privacy level*, which verifies who can see the image; *usage license*, so the copyrights are secured; *content type*, which means they can flag the videos and photos as either videos and photos, screenshots, or artwork/illustrations; and *safety level*, so other members just see images in their defined comfort zones.

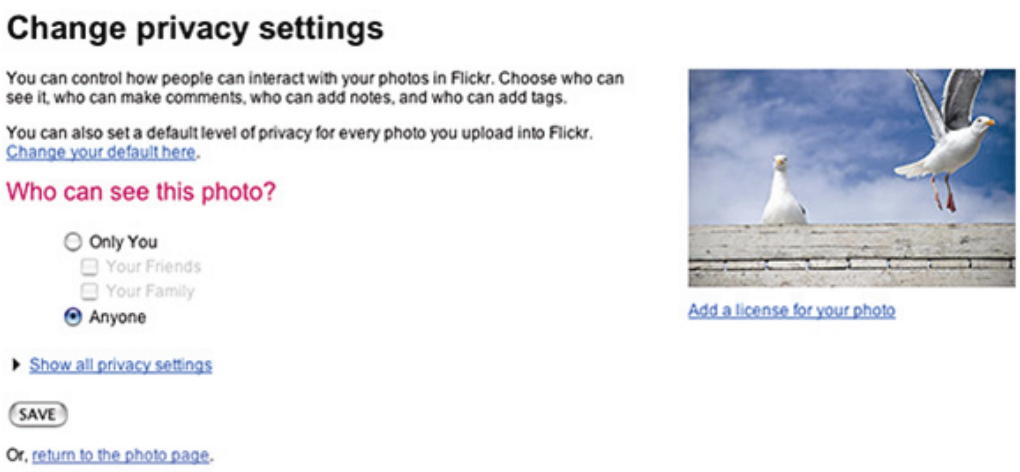

Figure 4.8. Example of setting a photo's privacy level on Flickr
(Source: http://www.flickr.com/tour/share/).

Photo-sharing websites like Flickr represent an increased convergence of social networks – connecting people – with content distribution – connecting people on the basis of their shared interests in and practices of creating content. With photos we present different views of ourselves and tell different stories to different audiences.

There are several different methods of using Flickr itself as the platform for making and sharing stories in fascinating ways. Flickr enables users to assign others as "contacts" and to make and join "groups" (either public or private) where which users can place images to make a shared pool. One example pool or group is '*Tell a Story in 5 Frames*'. *"Tell a Story in 5 Frames has two important parts. The first part is creating and telling a story through visual means with only a title to help guide the interpretation. The second part is the response of the group to the visual story. The group response can take many forms such as, a poetic or prose rendering of the visualization, a critique on the structure of the story, comments on the photograph, or other constructive forms of response*" (Flickr, n.d.). Telling and as well enjoying stories are supposed to produce entertainment for the group's members and give insights into the general elements that support creating a story for a worldwide audience.

Another possibility for telling a story in Flickr is by giving six words in the title section. ”*Have those few words tell the whole tale, and let the picture be its visual interpretation*” (Flickr, n.d.). The author should give six words which can activate imagination of the viewer. And combining with the visual interpretation the complete story will be created in the viewer’s mind.

We can connect them together by using hypertext links embedded into Flickr notes, the window that pop up when rolling over an image. Therefore, we could merge a story together linked linearly or by a branching structure, by using these hotspots on images.

Facebook

According to the Facebook website, Facebook's mission is “*to give people the power to share and make the world more open and connected. Millions of people use Facebook everyday to keep up with friends, upload an unlimited number of photos, share links and videos, and learn more about the people they meet”* (Facebook, n.d.). The Facebook statistics page reported that up to July 2010 more than 500 million active users and people spend over 700 billion minutes per month on Facebook (Facebook, n.d.).

Facebook has all capabilities of other social networking sites, including the ability to add friends, comments, and use private, one-to-one messaging. Users can leave short messages saying what they are doing using the “What’s on your mind?” option. People can also upload photos and videos.

Facebook offers a service that users or third parties can contribute applications that can work with and in Facebook by using Facebook Platform. Facebook Platform is an extension of Facebook, whose aim is to enable people to share and make the world become more open and connected (Facebook, n.d.).

Another service from Facebook is Facebook Connect. Facebook Connect is a powerful set of APIs for developers that lets users bring their identity and connections everywhere. Users can incorporate Facebook Connect into their websites, iPhone apps, and desktop and mobile applications as seen in Figure 4.9.

Facebook Connect handles the user's interaction with their Facebook account, and provides a mechanism for users to connect the user's Facebook login with their existing login scheme. Their application can access the user's profile information and friends list, write on the wall, email the user, and so on. These privileges are under the user's control, which helps build trust in the user’s application (Facebook, n.d.).

Figure 4.9. Facebook Connect (Source: http://developers.facebook.com/connect.php).

The community in Facebook is built on a sense of knowing and meeting people and turning those people into friends and acquaintances. When Facebook is used to share a part of our self with others, those others get a sense of who we are – what we are doing, what we know, or when we go through a life change. This will give the user an experience, a continued friendship experience. Using Facebook Connect will create more engaging experiences on the user's website. Users can find their friends immediately and engage with them. Facebook reported that having more friends lead to more page views and more activity. Connected users produce content 15-60% more than users who have not connected with Facebook Connect (Facebook, n.d.). Another experience is the experience of control. Users control who can be their friend and who can see their profile or users can create groups, invite friends, and accept an invitation to join a group.

Facebook is a modern tool that allows individuals to express themselves in a personal narrative format instantaneously in real-time. Through sharing identities, tracking interests and beliefs, updating actions, uploading photos, signifying relationship statuses, and defining culture and self-image, people are participating in sense making by acting out personal narratives with peers and friends on Facebook. This online community allows storytelling to be shared straight away, thus stretching the boundaries of communities across multiple geographic points. In a sense, Facebook has become the ultimate modern tool for narrative storytelling in everyday lives.

Facebook Stories is an application to facilitate users to share their stories with people around the world. Users can explore stories on a world map, or sort through stories in dozens of themes like "Love", "Family", "Reunions", "Sports", and "Friends". Users fill out a short form

and select a theme, and they are then able to share their story in the application and with their friends through the News Feed.

Facebook also provides a 'notification' service which gives user information when a friend has written a message, tagged a photo or left a comment on their user status. This service evokes users to engage more intensively in their community.

4.3.3. Tagging

From the previous exploration it has been found that all three social software systems are using a tagging system to share content and to give personal information on the resources (e.g., video and images). I believe tagging system has a big potential to be adopted in the authoring tool. In this section the tagging system is discussed in order to gain more understanding of the potential of a tagging system for *Wayang* Authoring tool.

The popularity of tagging systems has increased in recent years. These systems allow users to add "tags" or keywords to internet resources such as images, videos, and web pages, without depending on a determined vocabulary. Using an undetermined vocabulary in this way is less costly than employing an expert to perform a domain analysis to determine an appropriate classification scheme. Allowing authors to classify their own work also avoids the ongoing cost of employing an expert to classify resources added to the repository (Sinclair & Cardew-Hall, 2008). Tagging systems can be used to improve the searching process, detect spam, increase system popularity, improve personal organization as well as introduce new features of social communication and possibilities for data mining.

Social tagging has recently received wide adoption by various Web 2.0 sites. A tagging system allows users to associate metadata or keywords (tags) to items (Marlow, Naaman, Boyd, & Davis, 2006; Santos-Neto, Condon, Andrade, Iamnitchi, & Ripeanu, 2009). Such tagging features are commonly found in web-based content sharing systems (e.g., Flickr), social bookmarking systems (e.g., del.icio.us, CiteULike) and online social networks (e.g., Facebook). In these systems users generally publish new items, annotate them with tags, and browse and search content via a website. The assignment of a tag to an item is generally referred to as a tag assignment (Santos-Neto et al., 2009).

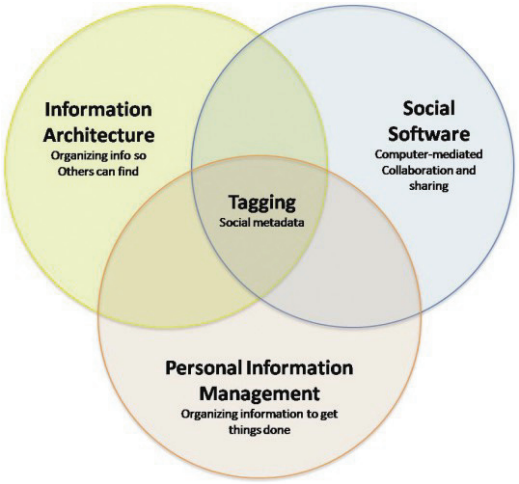

Figure 4.10. Tagging bridges personal information management, social software, and information architecture (Smith, 2008).

Social tagging systems may afford multiple added benefits. For instance, a shared pool of tagged resources enhances the metadata for all users, potentially distributing the workload for metadata creation amongst many contributors (Marlow et al., 2006). Smith argued that tagging bridges three fields, information architecture, social software, and personal information management as shown in Figure 4.10 (Smith, 2008):

Information Architecture: The Information Architecture Institute defines information architecture as *"the structural design of shared information environments"* and *"the art and science of organizing and labeling websites, intranets, online communities, and software to support usability and findability"* (IAI, 2007). In order to achieve the aim to determine how people find and use information across a variety of scenarios, information architects have focused on using controlled vocabularies, search-and-browse systems, and consistent navigation schemes. They are often worked with developing organizational schemes that work for a different populations of users, such as document repositories, company intranets, or large-scale websites.

Social Software: Social software can be defined as applications that people use to communicate, collaborate, and share online. The people who design social software are interested in facilitating group interaction within the system. They often delight in unanticipated uses of a social application.

Personal Information Management: Personal Information Management (PIM) is an activity in which an individual stores his/her personal information items in order to retrieve and use

them later. Such information items include files, emails, web favorites, contacts, and notes. In today's personal computers, the two main ways by which items can be retrieved are through hierarchical navigation and search.

What are the benefits that a user gets when they tag something? On the other side, we can also ask what they get from building a tagging system. To find the answer we can use the value-centered design model from Jess McMullin (McMullin, 2005; Smith, 2008). Value-centered design is based on a simple idea: value derives from balancing the targets of the people who develop the system with the people who use the system as shown in Figure 4.11. In this context, system refers to the tagging system. We might have several goals depending on why we are building a tagging system and who we are doing it for. We might be adding tagging to a website or an intranet, or we might be using it in a consumer web application. In either case, we need to think about the value we will get from it.

According to Smith, people are motivated to tag (as return on experience) because it helps them manage their information. It also gives information management a social component that lets people share ideas, express themselves, and have fun. He stated that organizations that implement tagging can look for seven benefits as return on investment. Some of these are affecting the users of the system such as improved collaboration, increased participation, and enhanced findability. Other benefits are more administrative such as collecting metadata, supplementing current investments in classification, and identifying how people use resources (Smith, 2008).

Figure 4.11. The value of tagging system will come from balancing of the system goals and user goals (Smith, 2008).

Tag Clouds

Tag clouds can be described as visualizations of the tags which are used in a website or other repository of information. In the tag clouds, the visualization is basically the tag words themselves. These tag words, based on tag popularity or importance, are visualized by manipulating visual properties of the words such as font size, color, or weight. Tag clouds are typically presented in alphabetical order, but also different approaches such as random or importance-based tag arrangements have been used.

Tag clouds have become a frequently used interaction technique in the web. The popularity of tag clouds can be explained by their ability to help users quickly get an overview of a certain area. Tag clouds have risen along with the emergence of collaborative tagging, which is now common on social software websites for photosharing (e.g., Flickr), bookmark sharing (e.g., del.icio.us), commerce website (e.g., Amazon as seen in Figure 4.12), and blog searching (e.g., Technorati). Simple keywords called tags on these websites are used to categorize the information on the site, such as the photos or bookmarks. Moreover, tag clouds are frequently used as a method to provide an overview of this human-created metadata. Mostly the tags are hyperlinks. Clicking on a tag will direct users to the resources on the social website that have been tagged with the keyword.

This visualization is different to other forms of information visualization. The tag clouds do not use additional artifacts to represent variables of interest, such as the bars in a bar chart. In its place, tag clouds merge the data variable with the tag word itself. Variables of interest are shown by manipulations to the visual features of the text. The most frequent approach currently used is to map the popularity of a tag to the font size of the word in the cloud. However, many other methods exist, both in terms of possible input variables and visual manipulations (Bateman, Gutwin, & Nacenta, 2008).

Figure 4.12. Tag clouds example from Amazon (Source: http://www.amazon.com/gp/tagging/cloud).

Tag clouds facilitate several user tasks from locating specific items or groups of items depending on the context, to providing an overview and general impression. Rivadeneira and colleagues (Rivadeneira, Gruen, Muller, & Millen, 2007) listed four distinct tasks that can be supported by tag clouds:

Search: Locating a particular term or one that symbolizes a desired concept, frequently as a tool to navigate to underlying content.

Browsing: Using tag clouds as a tool to browse, often without a particular target item or subject in mind.

Impression Formation and Impression Presentation: Using the cloud as a way to get a general idea about a theme. Visually popular items may carry more weight in this initial impression, but other less popular items also serve to enhance thoughts.

Recognition or Matching: Recognizing which of a number of sets of entities or information a tag cloud is likely to represent.

It is of interest to understand how a tag cloud supports a user to compose a story. Tag clouds seem to fit to being used in the authoring tool to support a user to seek a story's information by giving an effective, simple and evolving visual representation. Sinclair and Cardew-Hall studied the usefulness of tag clouds versus search interfaces for different types of tasks and they found that users preferred the search interface for specific information-retrieval tasks. In another hand, tag clouds can provide a helpful visual summary of the content. Moreover, users preferred the tag cloud for more open-ended tasks. They concluded that a tag cloud is not adequate as a replacement for search in information-retrieval tasks. However, a tag cloud could be used to enhance the user's search process. The benefit of the tag cloud interface was summarized by one participant who said, *"The tags [in the tag cloud] invoked ideas immediately in my mind, making access easier"* (Sinclair & Cardew-Hall, 2008). In addition, tag clouds are best used in browsing scenarios where a specific target has not been determined (Bateman et al., 2008). Browsing tags enable the finding of terms that the user may not have known or would not have thought of (Bateman et al., 2008; Mathes, 2004).

Geotagging

Geotagging means adding geographic tags, such as latitude and longitude or place names, to resources. Geotagging can be applied to all kinds of resources. Unlike other tags, geotags require a particular kind of structured metadata–geographic coordinates–to place resources on a map. Those coordinates can be derived from existing tags such as place names, or they can be entered directly by users.

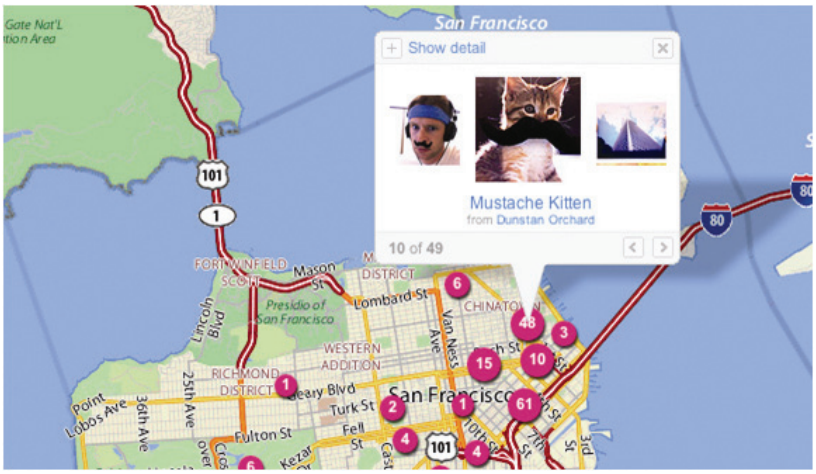

Figure 4.13. Map showing geotagged photos in Flickr (Source: http://www.flickr.com/tour/maps/).

In geotagging, people add coordinates to various media such as photographs, video, websites, to specify the location where the picture or video was taken. Geotagging supports users find a large variety of location-specific information. Recently, geotagging has been used widely by users in collaborative tagging systems (Lee, Won, & McLeod, 2008) and allows mash-ups, web-based applications that mix data and functionality of several web services, such as the Google Maps service. Figure 4.13 shows an example of a geotagging photo page in Flickr.

Google released its APIs for their mapping services in June 2005. The Google Maps API is an open toolkit that allows developers to develop computer programs that communicate directly with the Google Maps system. Google Maps API is used in *Wayang* Authoring system to build groups of authors because with the Google Maps API, the Google Maps can be embedded into the authoring web pages with JavaScript. Specifically, their own overlays can be added to the map, including markers and shadowed "info windows" just like Google Maps (Google, 2005). With ease of usage, high interactivity and good freedom of control over the maps, Google Maps has revolutionized a lot of aspects in mapping systems (Tan & Wong, 2006).

4.3.4. Relevance to the research

From the previous discussion it was found that some components of Web 2.0 applications are appropriate for the development of the authoring tool. Those components are:

- Commenting. This component offers a mode of reflection for the authors in this study context. Besides, the indirect communication between authors and other authors, between authors and readers, and between readers and other readers can be supported.
- Tagging. This component can be used for the system to support children in connecting their stories. A sequence of a story, either linear or non-linear, can be facilitated and practiced.
- Mash-up. This component is very important for the system in order to facilitate children in building collaborative story.
- User-generated content. This component is the main element for the authoring system which gives a space for children to compose their visual story. This feature gives a space for children to change their role from a simple user to a (co-)creator in the virtual and narrative world.
- A way to 'friend' other. This is a service to build communities of a storyteller. The communities can be built based on the location of the storyteller or theme of stories.

For the purpose of this study, it was found that a combination between content sites and people sites is the best solution to help us to answer our question. The content site gives a space for children to explore their creativity by building stories. On other hand, the people site facilitates the building of storyteller communities by connecting the children with several groups of communities.

From the study of existing social software, it has been found that providing an online space for sharing and collaborating on stories is important for the authoring system. Commenting and rating activity are useful to connect authors and readers and will enable interaction between them, as shown in YouTube.

Flickr provides some possibilities for users to tell a story. Related to the study approach a better understanding has been gained from Flickr that a story can be built by giving a list of scenes which are in this context Flickr photos, writing a short description and linking some scenes in a linear or a non-linear structure. In this way, the tagging is looked as a potential system to be used in the authoring tool to facilitate children to learn the story's structures.

I was inspired by the 'notification' service in Facebook to use it in the authoring tool. I expected that children can be supported in building collaborative stories by using this kind of notification approach. Moreover, children will be facilitated to build a sense of community.

A representation of space (map) is used as an organizational method for accessing information in the authoring tool by utilizing geotagging. It is expected that by displaying a storyteller's position in a map, communities of storytellers will be built based on location and encourage users to explore stories based on a storyteller's location on the map. I expected that playing

stories and knowing the position of storyteller's location will support the intercultural understanding capacities of children.

4.4 Summary

This section showed that user experience becomes central in interaction design. User experience is about how a product works outside, where a person comes into contact with it and has to work with it.

Four basic activities are included in the interaction design process: identifying needs and establishing requirements is the first activity, followed by providing alternative designs that fit with those requirements. Those processes are followed by developing interactive versions of the designs so that they can be communicated, and at the end evaluated. The term lifecycle model is used to represent a model that captures a set of activities and how they are related. One of the lifecycle models is ISO 13407, an international standard providing guidance on human-centered design activities throughout the lifecycle of an interactive product. It addresses the planning and management of human-centered design and is concerned with both hardware and software components.

We also discussed that digital technologies can play an important role in education. It is known that digital technologies, if properly designed and supported, can broaden the kindergarten approach as mentioned by Resnick, and is relevant to the Reggio Emilia approach, so that people of all ages can carry on learning in the kindergarten style. During the process, they will grow as creative thinkers.

Experience and community occur within social networking sites in a variety of ways, including connections, participations, and a sense of familiarity. Most social networking sites, such as YouTube, Flickr, and Facebook, allow a great deal of community building and provide avenues to community-focused digital experiences, such as experience of communication and experience of control. Furthermore, social tagging systems, such as geotagging, can help users build a community based on location-specific information.

As a conclusion, it seems that social software can support creative activity because creative activity grows out from the relationship between individuals, their activities, and from the interaction between individuals. Creativity does not happen inside people's minds, but in the interaction between a person's thoughts and a socio-cultural context. Systems that support social creativity must facilitate sharing and play, and their design must consider the effects of repurposing, augmentation and behavior adaptation.

From the exploration on YouTube, Flickr and Facebook it was found that there are many alternative ways to utilize them as a tool for creating/sharing stories in interesting ways which

can be adopted for this study approach. Stories can be told by sharing objects (videos, photos, or notes), giving a short description about the objects or by connecting some objects in linear or non-linear structures using a hypertext or tagging system. Commenting and rating activity are useful to connect authors and readers and will enable interaction between them.

Moreover, YouTube and, even more, Flickr show that storytelling is an important motivation which is needed in a community that extends their basic functionality as a sharing tool to become a storytelling tool.

Chapter 5
Wayang Authoring

This chapter contains the design process of Wayang Authoring and its implementation. Web technology is chosen as the application platform of the authoring tool due to its power and flexibility. The requirements and scenario, the concept and the implementation of the prototype are illustrated in this chapter. The potential of the tagging system as a model to compose a non-linear story is explored.

5.1 Concept and requirement

This section describes the concept of the last version of the *Wayang* Authoring prototype, including the requirements and scenarios, architecture and elements of prototype, as well as functionalities of the prototype.

5.1.1. Requirements and scenario

Understanding the requirements is the first of three fundamental activities in interaction design before producing a design that satisfies those requirements, and then evaluating the design. Therefore, the user requirements of our visual story authoring tool are described in this section.

An authoring tool is a computer program designed to be simple to use when building an application. Supposedly, no programming knowledge is needed; however, usually common sense and an understanding of basic logic are necessary. In this research, the authoring tool is used to create visual stories. This short illustration of *wayang* performance as seen in Figure 5.1 more understanding of this kind of story:

> *Ki Ledjar, a puppeteer, sits down in front of a large screen. Musicians play a traditional song as background music. He starts to tell a story, then picks up a farmer puppet and moves it from left to right, flips it, and moves it back to the center, then sticks it into the soft tissue of a banana tree that has been placed horizontally below the lower edge of the screen. Then he holds up a deer puppet, moves it, manipulates it, and places it in front of the tiger*

puppet. At this moment, the music stops. He narrates and makes the dialogue between the farmer and the deer. When he narrates or during dialogues, the puppets are neatly arranged on the screen, mostly immobile except for an occasional hand movement when a puppet speaks.

Figure 5.1. Wayang Performance by Ki Ledjar Subroto

It can be seen that the puppet movements, narration, and the dialogue happen separately, one after the other. Pictorial moments in the performance are moments or segments during which the puppets are stuck to a banana trunk, and either not moved at all or only have their arms moved when 'they' speak. In these moments, the visual movement stops and the screen becomes more of a picture, and the puppeteer begins the dialog. When the dialogue is over the puppeteer may take the puppets from their resting position and immediately start moving them.

This interplay of the movements and visual-oral dialogue is one of the narrative techniques of *wayang* that is extended by a technique, which Jan Mrázek called *wayang* montage (Mrázek, 2005). The partial representation of a movement, for example, not only gives the impression of continual movement, but also helps create a mental image of what happens in between the parts that are shown.

Wayang Authoring in this research is supposed to be a visual authoring tool to help the user create stories. The usability goals for this system should be efficient, and easy to learn and to remember how to use. This system is expected to fulfill user experience goals such as being

aesthetically pleasing or enjoyable. Working collaboratively across distance can be challenging, so this system should be motivating, and supportive of creative and enhancing sociability.

A question to ask is: 'Who is the user?' The user target groups are children in the age span from 6 to 11. I suppose that the authoring tool can be used by children who are already developing simple sequence-of-events capability in order to support their narrative development. From research, it has been found that typically children in this age range have a set of social/emotional, moral, psychological, and environmental concerns, such as strengthening their capacity for imaging, remembering, problem solving, logical reasoning, and critical thinking; they become more reflective – that is, better able to talk, access, and reflect upon their own feelings and thoughts, and to explain themselves in complex ways; using language effectively in a wide variety of situation, communicate easily; and gain the ability to write and understand text (Shore, 2008).

A group of children who prepared a shadow puppet performance at *Rockwinkel* School Bremen was observed in order to extract requirements and to gain an understanding of how non-Indonesian children work with *wayang* figures. The head of the project was Jochen Zülch who has worked for nearly twenty years with *wayang kulit* and *gamelan* (Mrázek, 2005) in schools with children aged from 6 to 13. The basis for his work is the concept of reform pedagogic from Célestin Freinet and also his experiences in Indonesian culture. During the preparation of the performance, I asked a boy to tell a story. Imagine a 7-year-old child sitting in front of you telling a story spontaneously.

> *Tom has an idea to tell a story about a friendship between an elephant and a monkey. He starts by selecting a figure of an elephant from a collection of puppets. He moves the elephant from right to the left, flips it around, and moves it again to the center and holds it with his left hand. Then he selects another puppet, a monkey, and holds it with his right hand. He moves the monkey on top of the elephant and then has it jump it in front of the elephant and to its right. He flips the monkey around, so the elephant and the monkey are now standing face-to-face. He then creates dialogues between them. After a short time they decide to go and find a banana tree in the jungle together. After the dialogues Tom flips the monkey around and moves it from the stage, and the elephant then follows.*

From the second illustration, activities can be identified that are needed to produce a story, namely selecting actors, moving and manipulating them, and creating dialogues.

a. Selecting actors
In this workshop, the figures are grouped into some collections such as animal figures, human figures and background figures. Children select a puppet from a collection and hold it by their hand or stick it to something behind the screen. From this observation, it has been found that some containers should be provided for figures in our system. Users can select a figure and put it onto the stage by dragging the figure.

b. Moving and manipulating figures
A puppet is moved by hand. It can be moved in all directions such as left, right, up, down or diagonally. Some parts of the puppet can be moved. Children can also flip and rotate the figure. For the tool, it has been observed that users need features to move a figure on the stage and to manipulate some properties of the figure, such as flipping and rotating the figure.

c. Creating dialogues
During the workshop, it has been monitored that children liked to add dialogue to their stories. The puppets were held or stuck in position when the dialogues appeared. It was very rare that dialogue was given while the puppets were being moved. It also has to be considered providing in the authoring tool a function to add dialogue to the story. The dialogue will be shown by a text in a rounded rectangular callout.

These basic activities are used to design this authoring tool. Use cases (Jacobson & Ng, 2004) will be used to show the interaction between the user or the actor and a software system (Sharp, Preece, & Rogers, 2007).

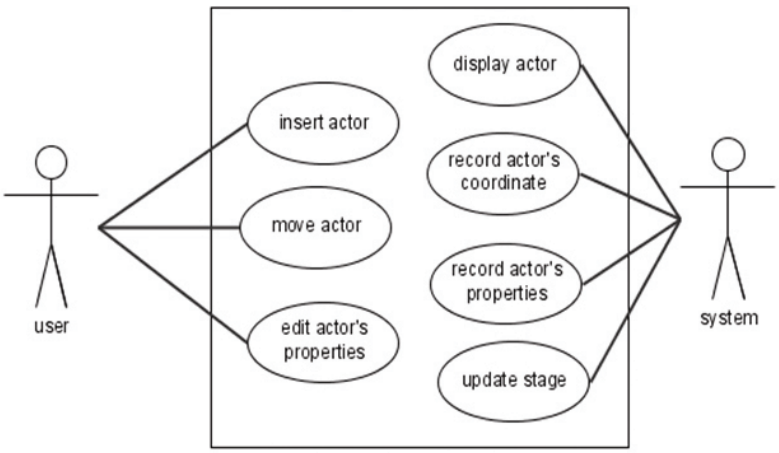

Figure 5.2. Use-case diagram for creating a story.

Figure 5.2 shows the use-case diagram for creating a story. The sequence of the dialogues between user and system for creating a story using *Wayang* Authoring is:

1. The system displays a stage and actor collections.
2. The user selects an actor from the containers.
3. The user chooses an actor and drags it onto the stage.
4. The system displays the actor and starts to record a story.
5. The user moves the actor around the stage.
6. The system records the actor's coordinates.
7. The user manipulates the actor's properties.
8. The system updates the stage and records the actor's properties

We now return to the preparation of shadow puppet performance at *Rockwinkel* School. A short story from Tom inspired two children to create other stories.

> *After Tom had told his story, Jack and Regina came up to us. They had some ideas after having heard Tom's story. Jack said that before Tom's story, he wanted to create a story about the elephant and the tiger and explain how the elephant with the monkey met. However, Regina had a different idea. She preferred to continue Tom's story first, showing how the elephant and the monkey go to the jungle, what they find and whom they meet, and then put Jack's story at the end. Tom, Jack, and Regina discussed the sequence of their stories.*

The result of their discussion is not important in this case, but how they built the story is more interesting. They built a long story and a story's plot from three short stories. Each of them contributes to the story. It has been found from this case that the authoring tool should support this way of developing a story from some stories. This feature is expected to help children learn about story structure, using questions such as these: What will happen if we change the sequence of a story? Is the meaning of the story changed? This feature also provides a space for them to work collaboratively.

The sequence of the dialogues between user and system for creating a story from some stories is like this:

1. The system displays a list of available stories.
2. The user selects stories from the list and moves them to a container.
3. The system displays the list.
4. The user arranges the sequence of the stories.
5. The system updates the list.

Figure 5.3 shows the use-case diagram for creating a story from some available stories.

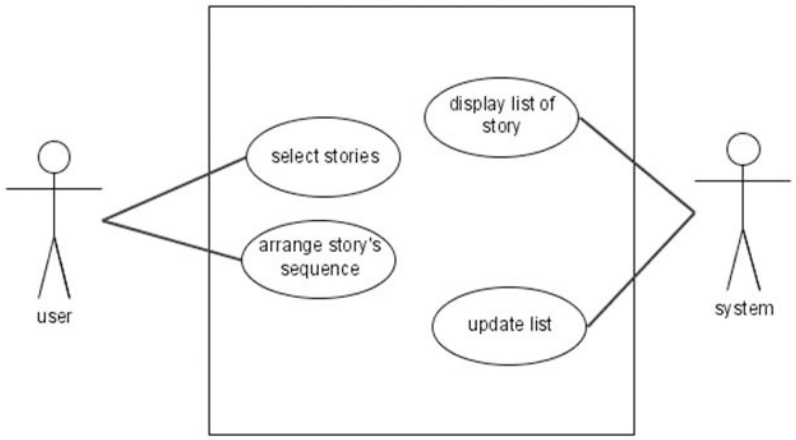

Figure 5.3. Use-case diagram for creating a story from some available stories.

Figure 5.4 shows a use-case diagram for playing a story. Playing a story is an important feature of this tool. Using this tool a user can use any idea from the available stories and, most importantly, users can reflect on and rethink their story. The sequence of the dialogues between user and system for playing a story is:

1. The system displays a list of stories.
2. The user selects a story.
3. The system loads and plays the story.

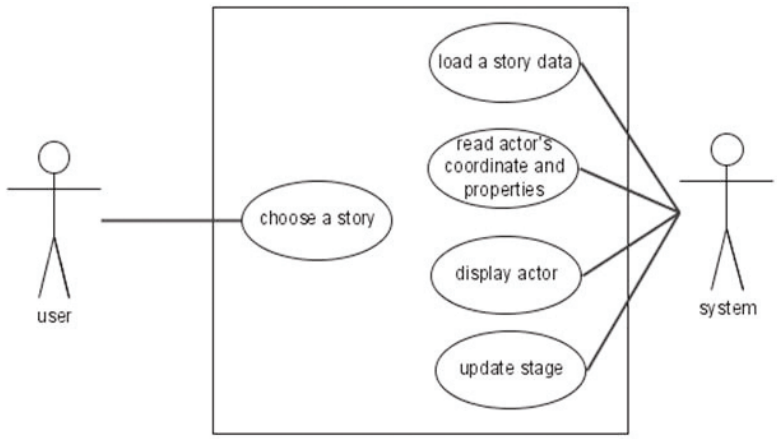

Figure 5.4. Use-case diagram for playing a story.

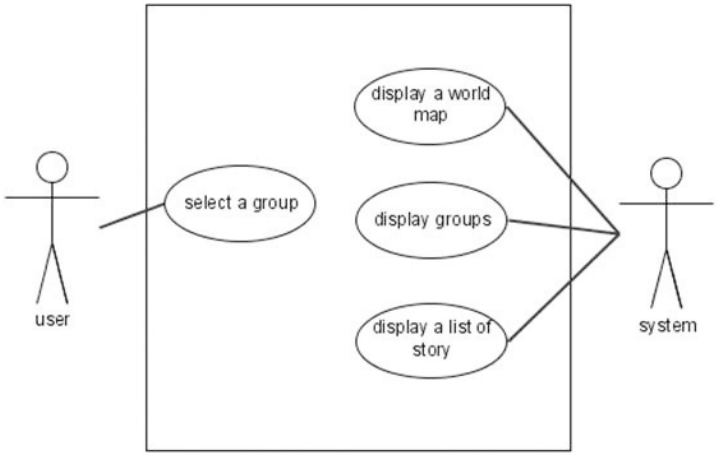

Figure 5.5. Use-case diagram for finding a storyteller.

In order to build a community of young storytellers this tool provides a feature that displays a world map and groups of the storyteller based on location. The user can search for friends and their stories as well. The sequence of the dialogues between user and system for finding a storyteller is:

1. The system displays a map and location of groups.
2. The user selects a group location.
3. The system shows the storytellers' names within that group.
4. The user selects a storyteller's name from the list.
5. The system displays a list of stories of the storyteller.

Figure 5.5 shows the use-case diagram for finding groups of a storyteller.

This authoring tool is designed to also give another experience: the experience of control as already mentioned in section 4.3 about social software. With this tool, it is supposed to be easy to control how the user shares or unshares a story. The user can modify the properties of the story, delete, upload, or download it. Some features are adopted from three social networking sites, which are explored in Chapter 4. The main functionalities to manage objects are share/unshare objects, upload/download objects, delete objects and modify objects' properties. Figure 5.6 shows a use-case diagram for managing stories and the sequence of the dialogues between user and system is:

1. The system shows options.
2. The user selects an option to share or unshare a story.
3. The system shares or unshares the story.

4. The user selects an option to delete a story.
5. The system deletes the story.
6. The user selects an option to modify a story's properties.
7. The system displays the story's properties.
8. The user modifies the story's properties.
9. The system updates the story's properties.
10. The user selects an option to upload a story.
11. The system prompts for the file name.
12. The user inputs the file name.
13. The system uploads the file and updates the list of stories.
14. The user selects an option to download a story.
15. The system prompts the location where the story will be saved.
16. The user enters the location.
17. The system saves the story's file at that location.

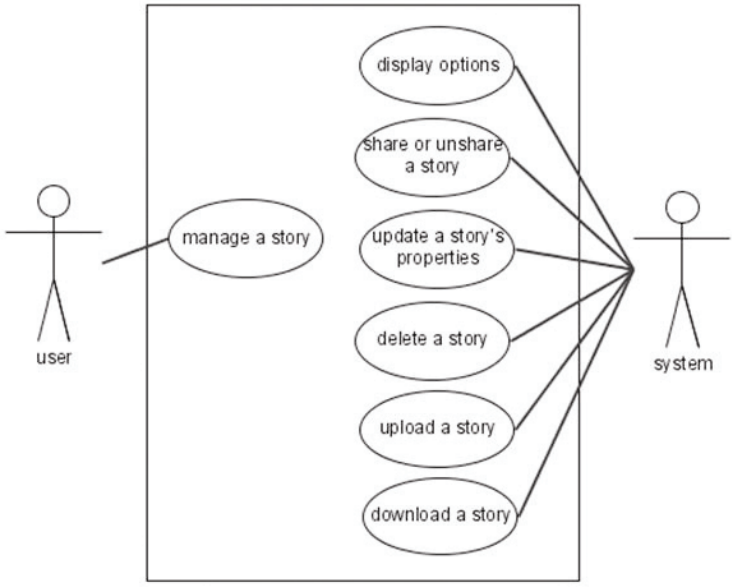

Figure 5.6. Use-case diagram for managing stories.

5.1.2. Architecture of prototype

The basic architecture of *Wayang* Authoring is shown in Figure 5.7. The user interacts with the system using a web-based Graphical User Interface (GUI). The Story Manager is responsible for maintaining functionalities related to story creation, story performance, and other functions such as commenting and ranking a story, sharing, and communications between clients and

server. All the data relating to stories and users will be stored in a database and maintained on a server.

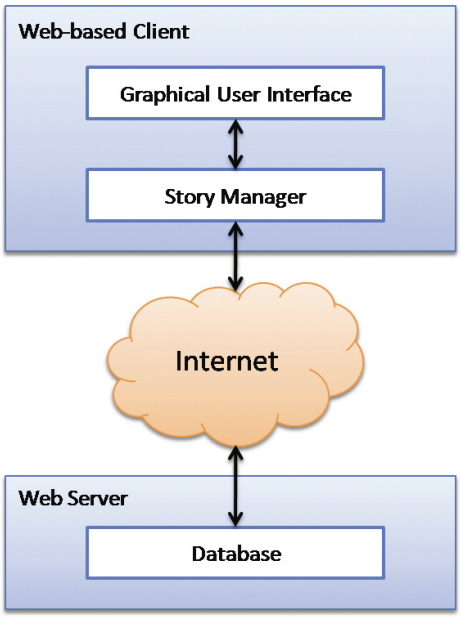

Figure 5.7. Architecture of *Wayang* Authoring Prototype

5.1.3. Elements of prototype

As I learned from sections 4.2.1 and 4.2.2 that learning and creative process is a spiral process of imagine, create, play, share, and reflect and from section 4.4 that social software can support creative activity, the prototype design consists of three elements: the imagination-building element, the creative working element, and the social interaction element as seen in Figure 5.8.

With the imagination-building element children can obtain ideas or inspiration from the tutorial or from stories that already exist, which have been stored and shared by other users. This element is expected to support children in building their imagination. The creative acting element usually enables the children as members of the *Wayang* Authoring community to compose a story and save, replay and perform it. This element is projected to give the children an avenue to express their imagination through these stories. Moreover, they can reflect on and play with their creation. Then in the social interaction element, the children can share their stories, give comments and rank other children's stories. This process is designed to

support children to find friends and to connect with friends in the context of this social network. This element is designed to provide the children with the chance to experience the community building, to experience its communication, and to experience how to control their story building.

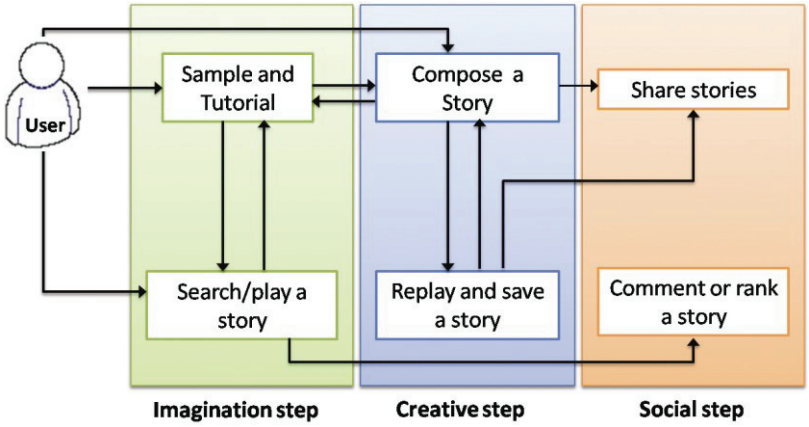

Figure 5.8. Basic elements of *Wayang* Authoring are composed from three components: the imagination step, creative step, and social step.

5.1.4. Models of a story's structure

One of the research goals is to support children to learn and to understand the story's structure. In this study, the story's structure is the sequence of the story, namely a linear story and non-linear story as illustrated in Chapter 3. In order to achieve this goal, three options or levels for composing a story are designed:

Single story

In this option, children will compose a single story. This story will not be linked to other stories. A story has some properties, e.g., a title, a description, and actors who are involved in the story.

Linear Story

At this level, a whole story will be composed from a few single stories. One single story will be connected to another single story in a linear sequence. The composing process is illustrated in Figure 5.9.

Non-linear story

At this level, a whole story will be composed from a few single stories as a linear story but the sequence can be non-linear. The basic idea of the composing model is shown in Figure 5.10.

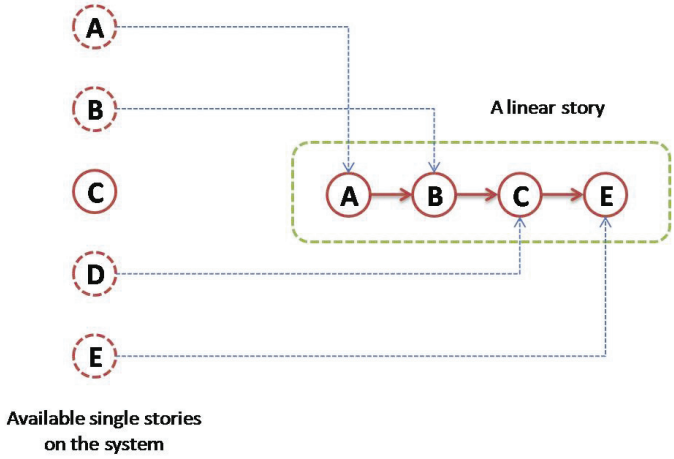

Figure 5.9. Illustration of the composing process of a linear story

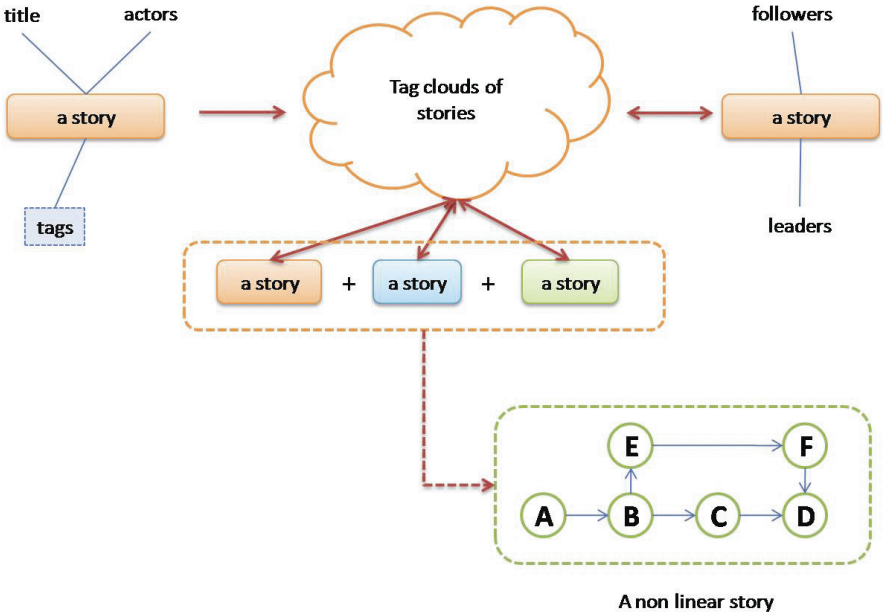

Figure 5.10. Illustration of the model of a non-linear story

Traditional storyteller from *wayang* background combines a story pattern of his repertoire according to the association which is giving by the audiences. In addition, from the workshop it has been observed that children were also like to add an association to a figure in order to make meaning to them. There was found that it is needed providing a feature to connect a story to other stories. And from the exploration in Chapter 4 it has been found that in Web 2.0 applications tagging systems play a role in connecting information.

The idea behind this model is tagging system as described in section 4.3.3. Using tagging, we can manage our information. Users apply tags to resources such as a web page or photos. In this study, the context of the resources is single stories. I look at tags are a potential way of connecting a story to other stories.

Each single story has some properties such as a title, a list of actors, a short description, and the story's author. A function to add tags to a single story is designed. The tags' vocabulary can be chosen from a library or typed by the user in a free form. Users connect a single story to another single story by tagging a single story which will be followed. A single story which is tagged by other stories will have two new properties. The first property is called *follower*. This term is borrowed from Twitter, a social networking and microblogging. In this context the *follower* contains the stories' title which follows a story. The second property is called *leader* which contains the title of a story from a story that followed. As an example, a single story A is connected to a single story B and a single story C is connected also to B as illustrated in Figure 5.11. In this case, the single story B has two followers which are the single story A and C. The leader of a single story A and C is the single story B.

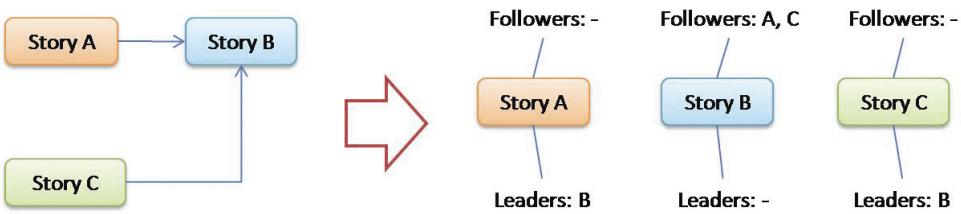

Figure 5.11. Illustration of the properties of a single story.

Using this method we can compose a non-linear story. If a story has more than one leader it means that at that point a story branch will be created. Each branch will follow a certain path. At this point, the readers have the option to choose a particular path to continue the story. For example above, a single story B has two leaders (a single story C and E) and a follower (a single

story A). The single story C has one leader (a single story D) and one follower (the story B). The single story F has one leader (the single story D) and one follower (the story E). This means that the single story D has two followers (a single story C and F). The reader at point B will have an opportunity to continue the story through story E or through story C. This process is illustrated in Figure 5.12.

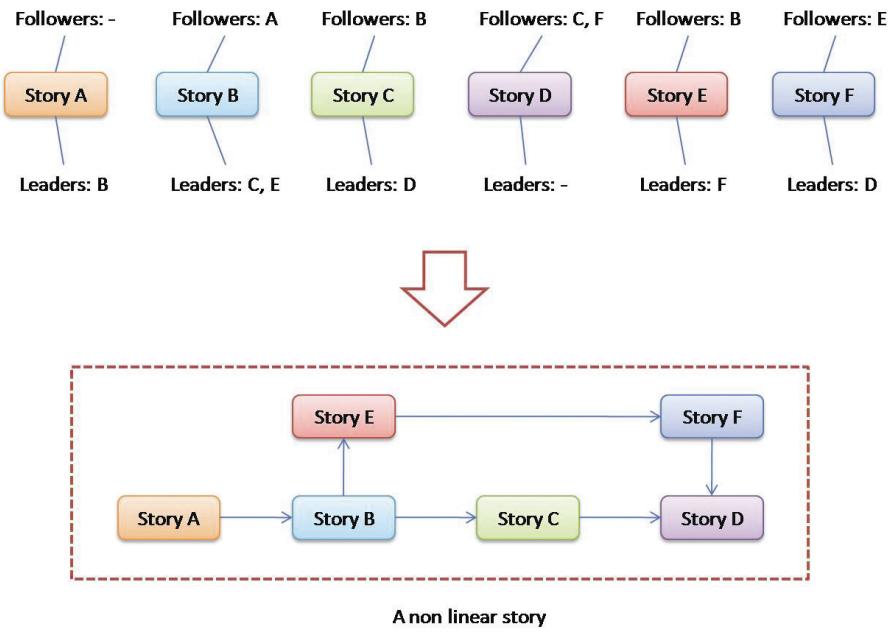

Figure 5.12. Illustration of a non-linear story.

Figure 5.13 illustrates the implementation model of *'Followers'* and *'Leaders'* and shows an example of a user plays the story from a particular story, e.g., Julian-1 story. If a story has more than one leader, at that point an option will appear to ask the user to decide which story will be played then.

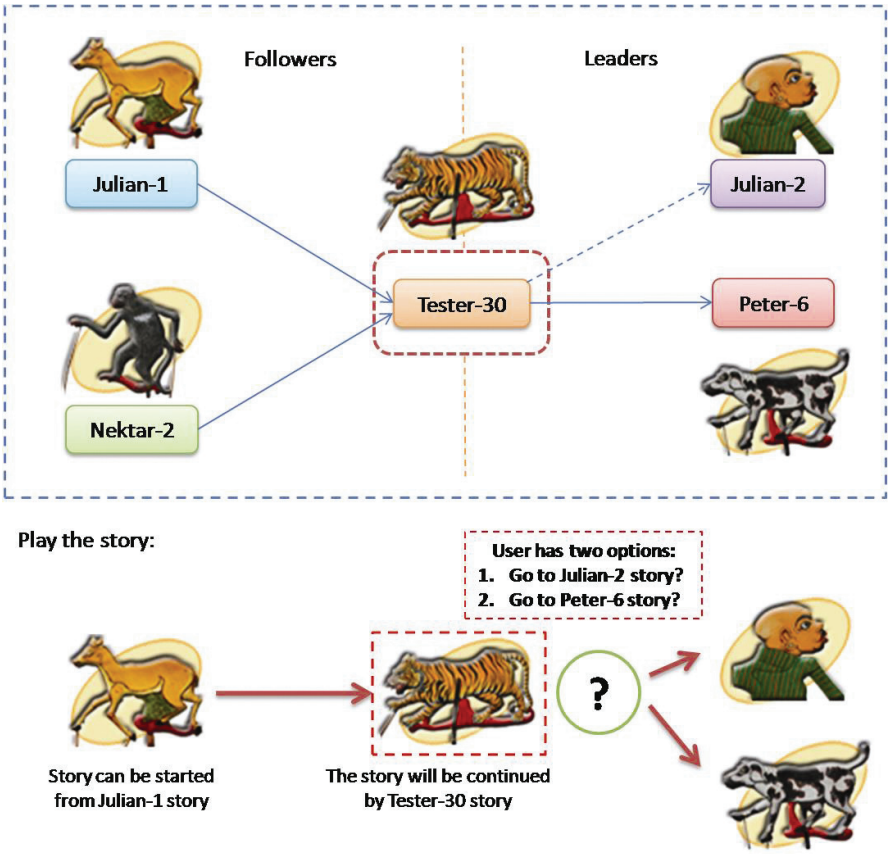

Figure 5.13. Illustration of connections between stories.

5.1.5. Interface design

User interface design is not a "one size fits all" process. Every system has its own considerations and be connected with design goals. There are three central models in the visual design and conceptual of user interfaces: *implementation-centric*, *metaphoric*, and *idiomatic* (Cooper, Reimann, & Cronin, 2007).

In this research, two interface paradigms are combined: metaphoric interfaces and idiomatic interfaces. Metaphoric interfaces are used in order to support children to learn, understand, and have experiences with other cultures, in this case the *wayang* culture. Idiomatic interfaces are used to support children's learning processes and support media literacy for children, so they have competences to be able to interpret and interact with a range of sources of information and cultural forms.

Metaphoric interfaces

Metaphoric interfaces depend on intuitive relations that users make between the visual clues in an interface and its functions. Intuition happens by inference, where we see relations between different subjects and learn from these similarities, while not being disturbed by their differences (Cooper et al., 2007). Therefore, we understanding the meaning of the metaphoric controls in an interface because we psychologically relate them with other things we have already known.

A visual metaphor is a picture used to symbolize the purpose or attribute of things. The use of metaphor can be helpful when it fits well with a situation, but it is not a panacea and is not guaranteed to add value.

One major pitfall to which metaphors can lead us is the *global metaphor*, which is a metaphor that is intended to encompass an entire application. The "desktop" concept is an example of a global metaphor. The global metaphor becomes confusing when reality begins to diverge from the metaphor. Consider carefully the desktop metaphor. It can be seen how it deviates from reality immediately. The trash can is a good metaphor for the deletion function, but trash cans are normally not placed on the top of a desk.

Metaphors also rely on relations perceived in the same ways by both the user and the designer. If the designer does not have a similar cultural background to the user, it is easy for metaphors to fail. There can be significant misunderstandings, even in the same or similar cultures (Cooper et al., 2007).

Three metaphors are drawn for the interface design of the authoring tool from *wayang* tradition. First, the user will use two-dimensional puppets on a white screen as the stage to create a story. The second metaphor is related to the narrative style of *wayang* performance. As described in Chapter 2, two main parts of *wayang* performance are visual movement moments and pictorial moments. The puppet movements, the narration, and the dialogue happen separately, one after the other. The dialogue text in our authoring tool will appear when the puppets are not being moved. The complete story is a combination of the visual movements of the puppets and the puppets' dialogues. The last metaphor is the use of color and black/white modes of the figures. The color mode is used when the user acts as the storyteller or *dalang*. If the users choose the black/white mode they act as the audience of *wayang* performance that sees the shadow of the puppets on the white screen.

Idiomatic interfaces

An idiomatic user interfaces solves the problems of the preceding two interface types by focusing on the learning of simple, non-metaphorical visual and behavioral idioms to complete goals and tasks, not on intuition of function or technical knowledge. Using this paradigm, we

depend on the natural ability of humans to learn easily and quickly as long as we do not force them to understand how and why (Cooper et al., 2007).

Most visual elements of the graphical interfaces are actually visual idioms (Cooper et al., 2007). Windows, close boxes, screen-splitter, drop downs, and title bars are things we understand idiomatically rather than intuit metaphorically. For example, a scroll bar, is not a metaphor for anything in the physical world. It is a completely new construct, so far it performs an obvious function; its operation is easily mastered, and users can easily remember how it works. It is the visual aspect of the scroll bar that allows it to be learned so quickly. Users use it with visual clues rather than remembering the keys for page up, page down, lineup, line down, etc.

Wayang Authoring tool adopts some visual idioms elements such as window, title bars, pop-up menu, context menu, and drop downs. It is expected that children will not have difficulties using the authoring tool, in particular, when they are already familiar with these kinds of idioms from other web or desktop applications.

As already described in section 2.2, the space of *wayang* performance is dominated by the large screen in lavishly decorated frame, with two long rows of puppets arranged symmetrically to the sides of the central part of the screen where the puppeteer arranges or moves the puppets that act in the play; this metaphor is used to design a general visual layout of the prototype interface as seen in Figure 5.14. A dominant large space at the center is used to place the main functionalities of the application.

A grid is created to ensure uniformity of design through a master layout that is used as a template for creating layout variations of *Wayang* Authoring as seen in Figure 5.15. Not every layout will use every part of the grid (Garret, 2002) – in fact, most layouts will probably only use a few – but every element's placement on the grid should be uniform and consistent.

Another important aspect of a user interface is that it should be aesthetically pleasing. It is possible for a user interface to be easy to use, intuitive, efficient and still not be terribly nice to look at. While aesthetics does not directly impact the effectiveness of a user interface, users will be happier and, therefore, more productive if they are presented with an attractive user interface. And this is why this design followed the aesthetic practice of the traditional *wayang* storyteller. Several discussions with some experts of *wayang* tradition and visual designers have been conducted to gain knowledge what kind of aesthetics aspects should be implemented on the prototype.

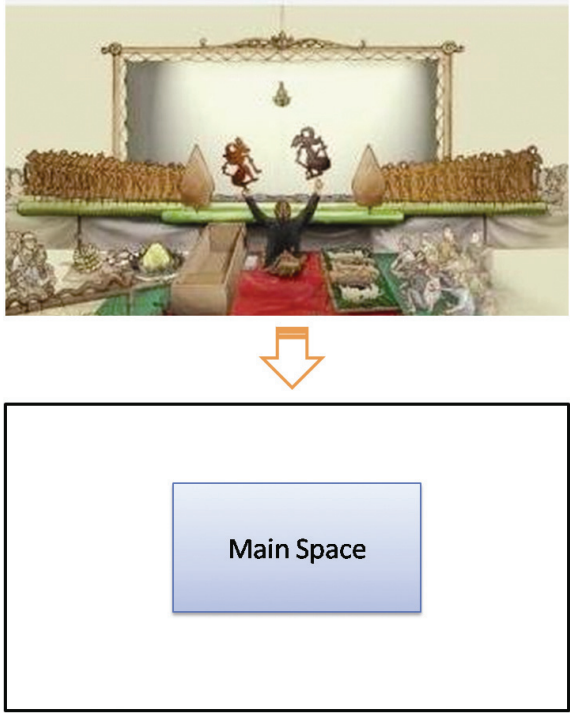

Figure 5.14. Basic layout of *Wayang* Authoring's visual design.

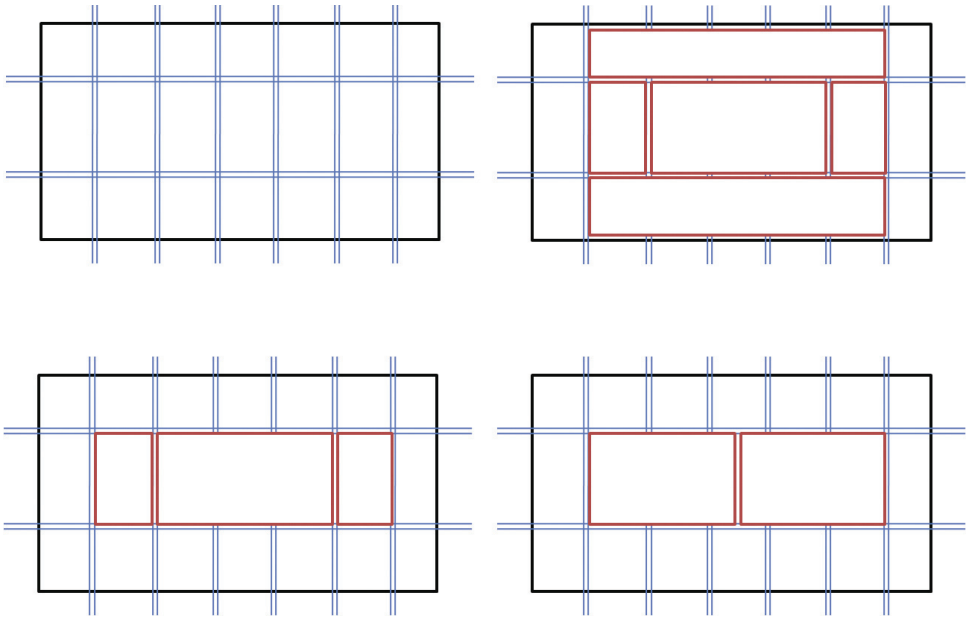

Figure 5.15. Layout variations of *Wayang* Authoring's visual design based on a grid layout to ensure uniformity of design.

5.2 Technology

This section explains the reason why the web is chosen as the platform of *Wayang* Authoring. Some technologies which are contributing to the development of the authoring tool are described.

5.2.1. Web browser as an application platform

The extensive adoption of the World Wide Web has principally changed the setting of software development. The web has become the *de facto* deployment environment for the latest software systems and applications in the past few years. In the new age of web-based software, applications exist on the web as services. They consist of code, data and other resources that can be placed anywhere in the world. Additionally, it is not needed to install or upgrade it manually. Ideally, applications should facilitate user collaboration, such as allowing numerous users to interact and share the same data and applications over the internet (Antero Taivalsaari, 2008).

The World Wide Web has sustained a number of evolutionary stages. In the beginning, web pages were looking as simple textual documents, such as the main page of Google's search engine, with restricted user-interaction capabilities based on hyperlinks. Hyperlink is used as navigation between pages. Each time users clicked on a link, a new web page will be loaded from the web server.

Form-based data entry and graphics support were then added. Step by step, with the introduction of DHTML (Dynamic HTML) which is the combination of HTML, the JavaScript scripting language, Cascading Style Sheets (CSS)(Lie & Bos, 2005), and the Document Object Model (DOM) (W3C, 2005). The potential to build a more interactive web page with integrated support for advanced animation and graphics was increased. Several plug-in components were then introduced, such as Flash, RealPlayer and Shockwave. These plug-in enable the development of visually rich web pages with interactive multimedia content. At the top, the evolution of web pages has evolved from classic, simple web pages with just text and static images to animated multimedia web pages with plug-ins to *Rich Internet Applications* (RIA) (Antero Taivalsaari, 2008).

The *Wayang* Authoring tool is designed to support children in creating visual stories using simple animation of puppets. A web application is needed to be provided which is responsive and has the capabilities of the functionalities close to a desktop application.

Rich Internet Applications (RIAs) offer this web application solution. Rich Internet Applications (RIAs) are web applications that provide the responsiveness, "rich" features and functionality

approaching that of desktop applications (P. J. Deitel & H. M. Deitel, 2008). Macromedia describes RIAs as integrating the inexpensive deployment of web applications, multimedia communication and the broad reach and the power user interface capability as well as the better interactivity experience of desktop software applications (Duhl, 2003). This supports the development of an application which gives a more responsive, effective, and intuitive user experience. Particularly, the power of the desktop is in providing quick interface response times without page refresh, an interactive user interface for formatting and validation, the capability to work online and offline and common user interface operations such as drag-and-drop. These features are important for the authoring tool. Through providing these features, the process of creating stories is expected to become faster as there is no longer the time loss that was incurred from the communication processes between the client and the server. Furthermore, the best of the web includes features such as instant deployment, the use of advanced download for retrieving data and content, cross-platform accessibility, the magazine-like style of web pages and leveraging broadly adopted internet standards.

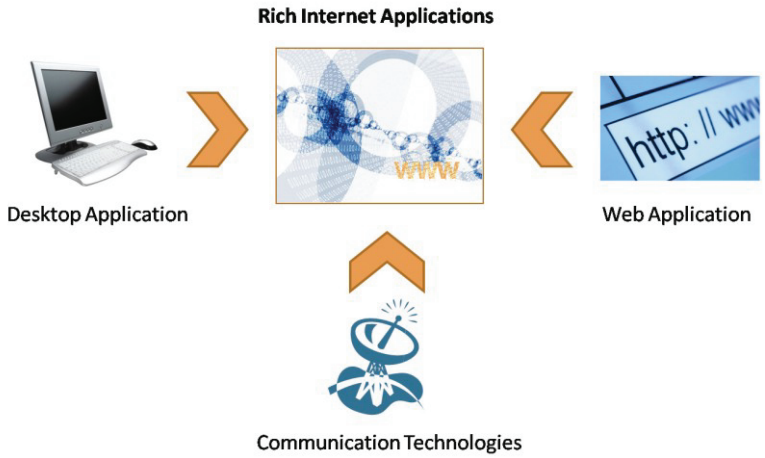

Figure 5.16. Rich Internet Applications combine the best of the desktop applications, web applications, and communication technologies (Duhl, 2003)

Rich Internet Applications (RIAs) combine the best of the desktop applications, web applications, and communication technologies as seen in Figure 5.16. This means that in an RIA the client is able to do more than simply render pages. It enables the *Wayang* Authoring tool to perform computations, retrieve and send data asynchronously from the user's requests in the background. Moreover, they can redraw sections of the screen, use audio and video in a closely joined manner, and so forth. It is not dependent on the server or back end it is connected to. All computational functions regarding story building will be done in the client browser, and the server maintains the data of stories and users.

5.2.2. Technologies for web application development

This section looks at some of the platforms and technologies, which are contributing to development of rich experience for the application users in the following.

Adobe Integrated Runtime (AIR)

AIR is a web application platform which built around Adobe's previous web technologies (Freedman, Peters, Modien, Lucyk, & Manning, 2009), including Flash, the ActionScript scripting language (Moock, 2007), and the Flex Builder development environment. ActionScript, which is a programming language that can be looked at as a variant or an extension of JavaScript and is primarily used to write AIR applications. For application execution, Adobe AIR at present needs a runtime or plug-in component (Antero Taivalsaari, 2008).

Microsoft Silverlight

Microsoft Silverlight (Microsoft, 2009) is Microsoft's reaction to Adobe AIR and other web application development technologies. Microsoft Silverlight is a web-based subset of the Windows Presentation Foundation (WPF), which enables Flash-style web applications to be created using similar APIs to those in .NET applications which are written for Microsoft Windows. This system is built around Microsoft's XAML (eXtensible Application Markup Language) and JavaScript. It has been strongly integrated with Microsoft's Visual Studio development environment. Like many other technologies, Silverlight at this time needs a separate plug-in for application execution in a web browser.

Ajax

Jesse James Garrett introduced the term Ajax (Asynchronous JavaScript and XML) when he was presenting the previously unnamed technology to a client. The technologies of Ajax (XHTML, JavaScript, CSS, DOM and XML) have all existed for many years (P. J. Deitel & H. M. Deitel, 2008). Ajax can be seen as a logical extension of Dynamic HTML (DHTML), by adding asynchronous HTTP networking and XML protocols. It enables the asynchronous updating process of web page in the background. Compared to the two previous and other web application development technologies, the main strength of Ajax is that Ajax utilizes only such technologies that already exist in commercial web browsers today. Thus, for application execution Ajax requires no plug-ins or any other additional components (Antero Taivalsaari, 2008).

As already described in section 4.3 that social software can support the creative activities, web technology is a good choice to implement such kind of prototype for this research. This web application requires no installation or manual upgrades and can be located anywhere. The interface of the authoring tool should be responsive, so the user has the feeling that changes

are instantaneous. Waiting time and traffic to and from the server should be reduced. Another thing is if a page section encounters an error, other sections are not affected (if not logically linked) and the data already entered by the user is not lost. From the explanation of the web technologies and the requirements of the authoring tool, Ajax technology is chosen to be used to support and the development of our system because Ajax can make the application richer and more user-friendly. Moreover, Ajax needs no plug-ins or any other additional components for application execution.

5.3 Prototypical implementation

The prototype is implemented by utilizing the most important recent feature of the web, which is the ability to run scripts on a client through JavaScript. This is combined with the ability to access and to modify client-side Document Object Models (DOM) (W3C, 2004) of the browser, and the ability to add asynchronous background requests at the web. The next section describes the main features of the prototype.

5.3.1. Composing a single story

This feature is the main function of this tool. The web-based GUI of this "composing a story" is shown in Figure 5.17. Three main parts of the page are a stage where a user creates a story by putting and moving figures on it; three containers, which contain available figures; and a panel button.

Figure 5.17. Screenshot of *Wayang* Authoring's prototype for composing a story.

Recording process will be automatically started at the moment the user puts a figure on the stage. This tool allows users to record the movements of the figures. The user can define the movement of a figure using the dragging capability of that figure. The direction and speed of the movement are automatically recorded, so that the user can record all movements very easily without defining a time line. A start/end point of the object's movement can be fixed.

Figure 5.18. Pop-up panel and context menu to manipulate a figure's properties.

Properties of the figures such as dialogue text, sound, or rotation can be manipulated using a context menu or a pop-up panel property which appears if the user clicks on the figure as seen in Figure 5.18. On the pop-up panel the user recognizes the function of the buttons from a small overview window. A short animation will appear in it when the user moves the mouse over the button. The pop-up panel is added because most of the users who participated in a workshop to evaluate this tool did not recognize that they could display the context menu with a right-click.

The story can be played or replayed using the *play* button on the buttons panel. During the *playing* mode the user can activate *black and white* or *color* mode. If the user activates *black and white* mode, the story will be displayed in black and white. This feature is intended to give a feeling of shadow puppet performances.

5.3.2. Individual and collaborative stories

With the *Wayang* Authoring tool, the user can create an individual and also a collaborative story. The feature "individual and collaborative stories" enables different individual, perhaps partial stories (that are in the "shared" mode) to be combined into a single whole story in a linear sequence. The user can also change the sequence of a story to create different meanings. By this way, the children can learn about 'story structure'. Story structure as a topic of education fosters the ability to detect a meaning by reading. This function is illustrated in Figure 5.19.

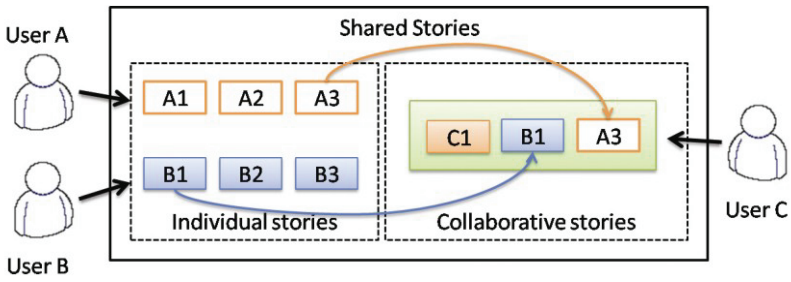

Figure 5.19. Individual and collaborative stories. This tool provides two possibilities to compose a story. A story can be composed as a single story or from several single stories.

Figure 5.20. Individual and collaborative stories interface.

According to Jan Mrázek (2005), through ordering the partial representation should be related together so that an action or a story can be built up – as the creator knows what is important

to know and how things fit together. Children will learn to produce and understand causal and temporal-structured plots that are organized around a variety of themes and involve certain characters. Furthermore, they also develop the necessary skills to recognize whether or not a plot makes sense.

The implementation of this concept can be seen in Figure 5.20. All stories in the *shared* mode are listed on the left-hand side. The user can also list the stories based on author or actor. The container on the right-hand side is used to manage a story's sequence, which is composed from several stories. The user should select a story from the left and move it to the right container using the drag-and-drop function. To arrange the sequence of the story on the right container, the user can drag and drop a story up and down. The story sequence is played by clicking the play button.

5.3.3. Composing a non-linear story

The *Wayang* Authoring tool provides a feature to compose a non-linear story. As described in section 5.14, this feature utilizes a tagging system. Users choose a story from the story tag cloud instead of using a search tool. The story's information such as the story's title, the actors, and the story's description will be displayed in the information window. Followers and leaders of that story will also be listed to provide the user information as to whether that story is followed by other stories or follows other stories itself. To connect this story to another story, users use the tag tool. Users choose one or more story tags from a list and this story will then be connected with other stories. The interface of this feature is displayed in Figure 5.21.

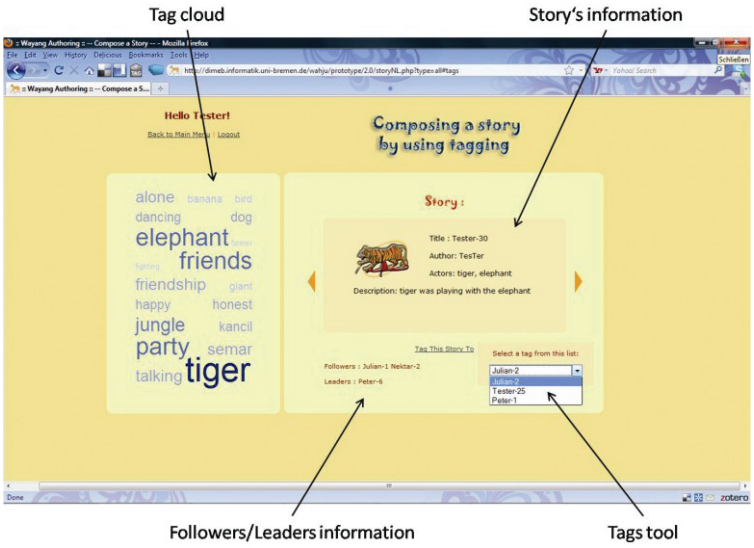

Figure 5.21. Non-linear stories interface.

The result of the tagging process can be seen in Figure 5.22. Each story which has more than one leader will have a story branch.

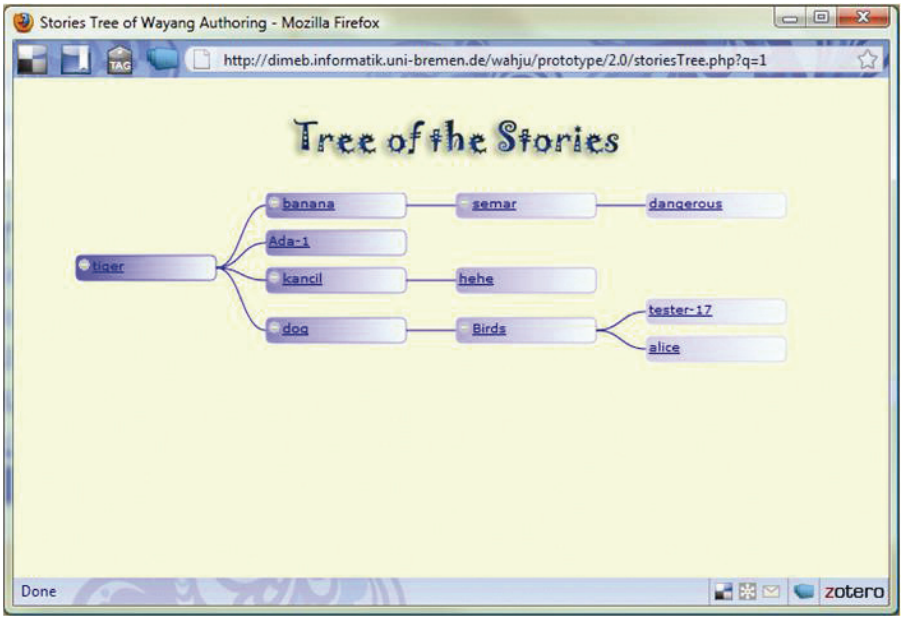

Figure 5.22. Non-linear stories.

5.3.4. Playing stories

The user can play a story by choosing it from a list of stories as seen in Figure 5.23. An item in the list contains information about the story's title, author, date, and main actors. As a default all stories will be displayed sorted by date. But this tool provides features to list stories based on author or actor. The user can also search for stories based on a combination of title, actor, and author. Color or black-and-white mode can be selected when a story is played as seen in Figure 5.24.

Figure 5.23. List of all available stories.

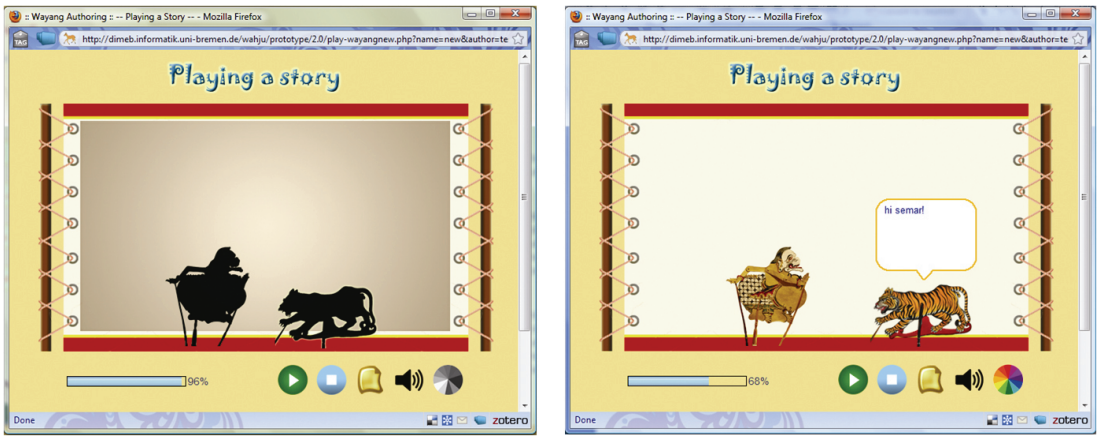

Figure 5.24. Color and black/white mode during playing a story.

5.3.5. Rating and commenting

Each story, which is displayed on the list, has information added about its rating and how many times it has been viewed. This tool provides rating and commenting features. The rating feature allows users to rate the story on a 1-5 scale. Another option that can be used is the commenting feature. Users can leave comments to share their opinion about the story as seen in Figure 5.25. This feature is designed to enable communication between the author and the

audience or between the authors themselves in order to support the user to have experiences in communication.

This feature is designed based on the observation of the workshop. The children were motivated to publish a new story after receiving comments from friends or their teacher. Communication between them provided new ideas for the author and also for the audience. I believe that this communication can be supported by this feature in the authoring tool. In the virtual world, this kind of indirect communication is already a part of social software and Web 2.0 applications as described in Chapter 4.

Figure 5.25. Rating and commenting feature.

Figure 5.26. Managing stories feature.

5.3.6. Managing stories

This feature enables users to manage their stories and provide experience with control. They can share their stories or decide not to share them, delete stories, download stories, and edit story properties using a panel button as shown in Figure 5.26.

- Share/Unshare a story
  By clicking the share/unshare button the user can publish/unpublish a story. If the button appears without a red cross it means the story can be seen by all users.
- Delete a story
  If the user clicks this button, the story will be deleted from the list.
- Download a story
  In this study, we also developed a desktop version of the authoring tool. Users can download the story files and play them on the desktop application. The story file is saved in .xml format.
- Edit a story's properties
  This feature facilitates users to edit the title, actors or description of a story.

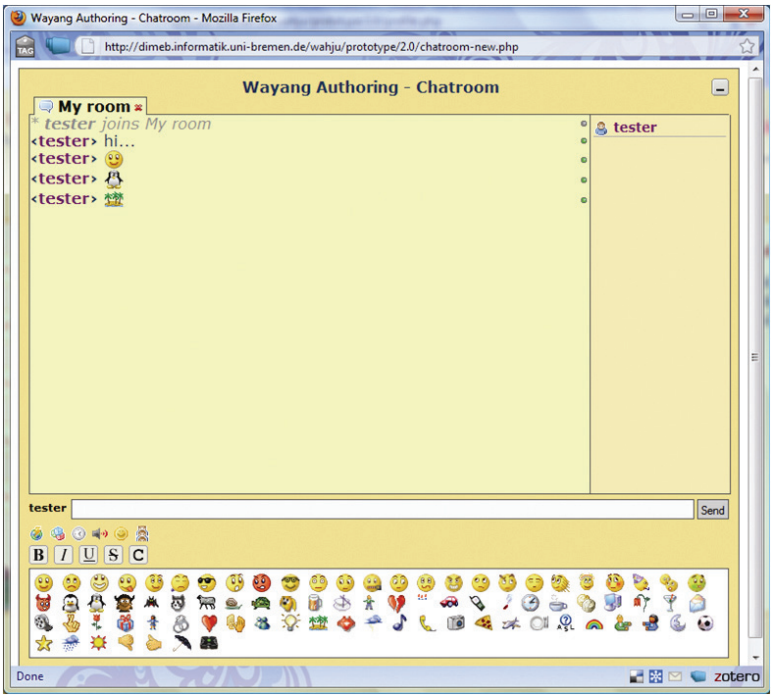

Figure 5.27. *Wayang* Authoring Chat Room.

5.3.7. Communications

Text talks in online chat environments have grown into an interesting style of communication. They are remarkably similar to face-to-face dialogue in some ways. In other ways, they are actually unique. They just contain typed words. There are no facial expressions, nobody language, no changes in voice, very little or no visual/spatial environment as a context of meaning.

The *Wayang* Authoring tool provides also a chat room as seen in Figure 5.27. This feature enables synchronous communication and allows users to work collaboratively at many different locations.

5.3.8. Organizing story in a visual symbolic way

A functionality to show or play a story using symbols and story lines is implemented. Position or distance between actors can be identified from the story line. Each actor will be symbolized as a colored line. Activities of the actors, such as dialogue, flipping, changing mood, etc., are shown using small symbols.

This functionality is shown in Figure 5.28. In this story, an elephant comes onto the stage in a happy mood, indicated by a green circle. But a tiger then appears that is in a bad mood, indicated by a black circle. The tiger and the elephant start a dialogue, symbolized by a bubble symbol. A triangle symbol indicates that the actors have turned back (flip) from their current position. At the end, the tiger becomes happy; the black circle on the red line is changed into a green circle and then the tiger rolls away, symbolized by a circular arrow.

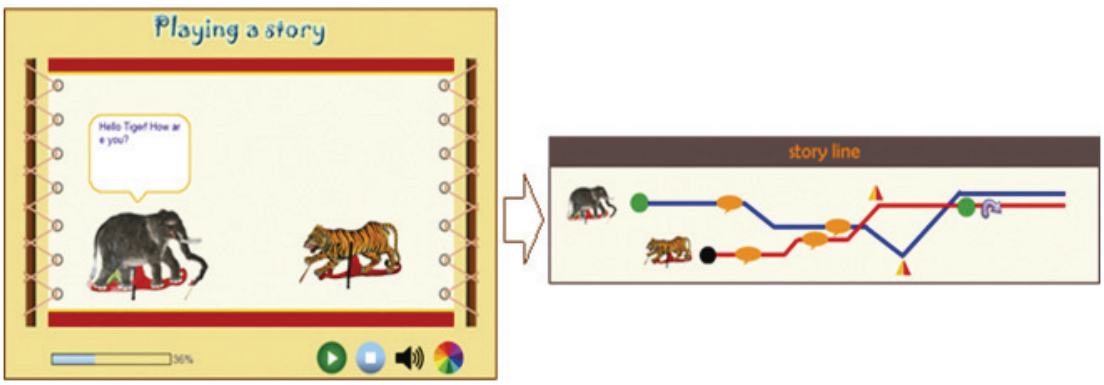

Figure 5.28. A story in a visual symbolic presentation.

This story line model is expected to help children to enhance their imagination and creativity because to symbolize is an act of construction and a very important act of thinking. Language and script make up the basic symbol set of our culture. In order to progress in mental processes the subjects are supposed to translate experiences into symbolic representations. Symbolization is, in this view, the basis of invention and creation of ideas. Symbols are not only surrogates of the objects of this world; they are also a vehicle that helps to picture and understand real objects.

The idea of this feature comes from the philosophy of *wayang* itself. The representation of *wayang* characters is the symbol and simulation of real *wayang* objects. In order to gain an understanding of a *wayang* character, we need to know the meaning of color and the carved pattern on the *wayang* object, and the gesture of the figure. In this context, the story's actions are symbolized. As described in Chapter 2, two main parts of *wayang* stories are movements and dialogues, which happen separately. Figures 5.29 and 5.30 illustrate the translation of the object's movement along a line. If a character moves from the left to the right of the stage or vice versa as shown in Figure 5.29, then the straight line slopes in an upward or downward direction as seen in Figure 5.30. A higher slope value indicates a faster movement. These movements' translation is combined with the symbolization of the figures' properties such as the figures' mood, the object's orientation, and the actor's dialogues. With this model, children are expected to gain an understanding of a *wayang* story's structure.

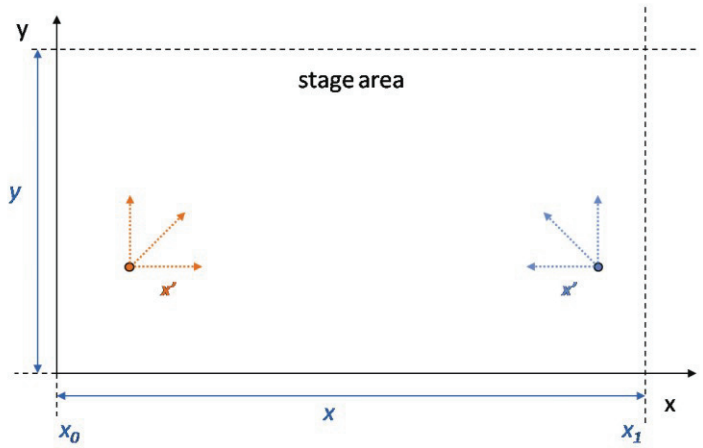

Figure 5.29. An illustration of objects' coordinates on the stage

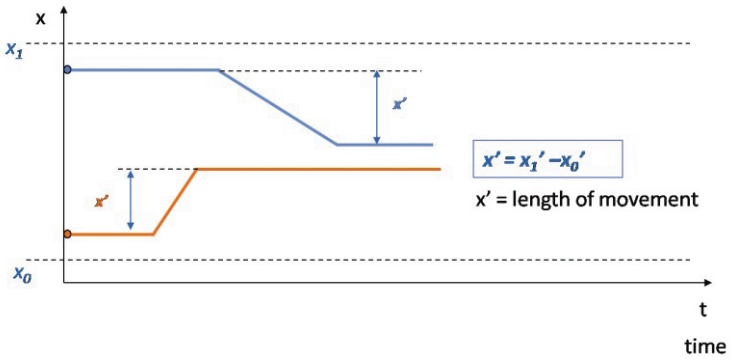

Figure 5.30. A representation of objects' movements by lines

Narrative activities in general and storytelling in particular help children's symbolic imagination development, make available a place to exercise it and prepare the way for abstract thought development and deeper mental processes (Nicolopoulou, 1997).

This is related to *wayang* tradition, as a long-established living art form, *wayang* has a set of symbolic shapes that can be used as a medium to express oneself and to evoke fantasy and imagery, to communicate with the own inner world and with others.

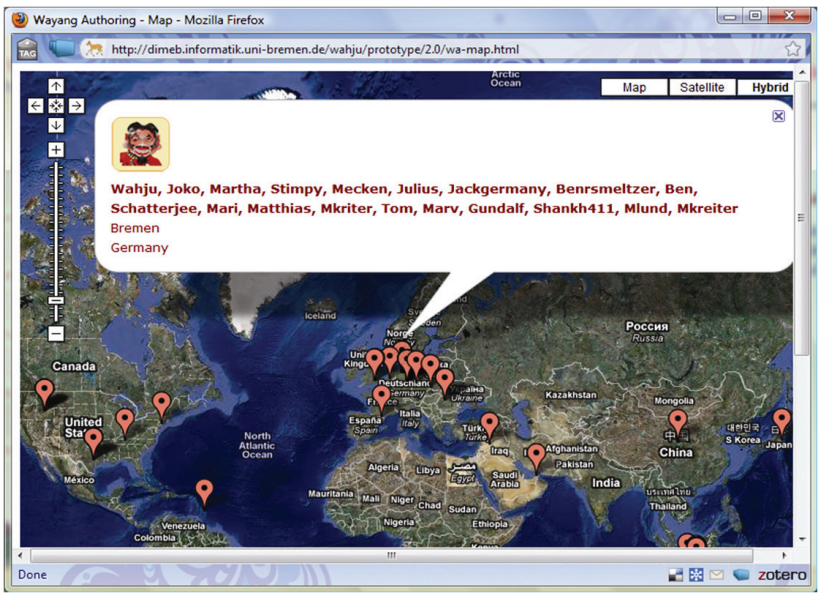

Figure 5.31. Author grouping based on location

5.3.9. Connecting authors

An additional tool's feature should enhance the cooperation and exchange of *wayang* story authors. In a mash-up, as already mentioned in section 4.3.3 Google map is used to visualize the authors according to their location on the globe as seen in Figure 5.31. A profile can be added and also connected to the authors easily. This feature is expected to give an opportunity to build a trans-cultural community. The coordinate information–latitude and longitude values which uniquely reference a point on the world– is automatically detected by the system based on the IP address of the user.

5.3.10. XML structure

XML (W3C, n.d.) has become a very popular format for marking up all kinds of data, from web content to data used by applications. XML can be easily sent across a network and is a cross-platform, and we can use XML in any programming language, which we can write a parser for. Furthermore, it can be simply transformed from one vocabulary to another (Williams, 2000).

XML is chosen to support compatibility with another authoring tool, which is called *Wayang Composing*, an authoring tool which runs on a PC as a desktop application as seen in Figure 5.32. *Wayang Composing* was developed to support users who do not have an internet connection. The features of this tool are similar to the *Wayang* Authoring tool except the sharing story online and displaying storyteller groups features. However, users can still share their stories using the upload facility of the *Wayang* Authoring tool as long as they have an account for it. Furthermore, they can download stories from the *Wayang* Authoring tool and play them using the *Wayang Composing* tool.

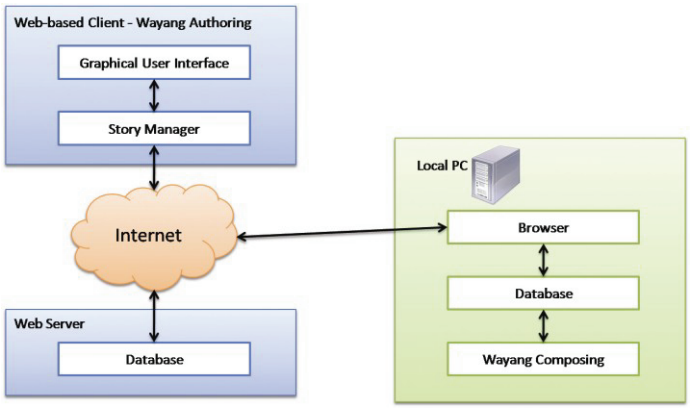

Figure 5.32. Stories exchange.

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<story>

     <info>
          <author> Author </author>
          <title> Title </title>
          <actors>FigureA,FigureB</actors>
          <date>dd/mm/yyyy</date>
          <description> Text </description>
     </info>

     <scenes title="Title Scenes" sound="default no sound">
          <scene number="1" time="0" isFigure="true" flip="false"
           sound="false" dialog="false" rotationL="false"
          rotationR="false">
               <actor>FigureA</actor>
               <pos-x> x </pos-x>
               <pos-y> y </pos-y>
               <text-dialog> Text </text-dialog>
          </scene>
     </scenes>

</story>
```

Figure 5.33. XML structure of the story's file.

In the *Wayang* Authoring tool, XML format is used in this system to record a story's data. The structure of the XML is shown in Figure 5.33. Two major elements of the XML file are the *info* element and the *scenes* element. The *info* element contains information such as the author's name, story's title, main actors, date of the story, and a short description of the story. The *scenes'* element contains information about the story itself. All of an actor's movements will be recorded in the *scene* element, including coordinates, dialogue text, and other properties such as sound, flip status, and rotate status.

5.4 Summary

Prototyping and scenarios are used throughout the design process to test out ideas for feasibility and user acceptance. The researcher worked with a group of children and the teacher who prepared a shadow puppet performance at *Rockwinkel* School Bremen in order to extract requirements and to gain understanding of how non-Indonesian children work with *wayang* figures.

The main features of this prototype are composing stories, playing stories, managing stories such as sharing or unsharing stories, rating and commenting on stories, and grouping the authors based on the authors' location. A model for building non-linear stories is designed as described in section 5.1.4 by utilizing a tagging system. It has been found that the tagging

system is appropriate for the authoring tool. In order to support children in gaining an understanding of the structure of a *wayang* story in a symbolic way, a functionality to show or play a story using signs and story lines is proposed as illustrated in section 5.3.8.

Web technology is a good choice to implement *Wayang* Authoring prototype research because this web application requires no installation or manual upgrades and can be located anywhere. Ajax technology is used to support interaction between user and system because Ajax can make the application richer and more user-friendly. This prototype is implemented by utilizing the most important recent feature of the web, namely the ability to run scripts on a client through JavaScript.

Chapter 6
Evaluation

Wayang Authoring has been implemented in order to show how an authoring tool can support creative storytelling and self-expression, and simultaneously contribute to the field of storytelling as an interaction design for children in its relevance to the understanding of story structure, to build a young storyteller community in a virtual world and to support intercultural empathy as well. This chapter discusses the evaluation process and the findings from the development process of our system.

6.1 Questions for the evaluation

Several questions are prepared to guide the evaluation process and are expected to contribute to answering the research questions at the end. These questions are divided into four parts, as follows:

- First part: user interface and interaction qualities
    - Is the functionality of the system working properly and easy to use?
    - Are the children enjoying the story creating process using the tool?
    - Is the interaction model of the tool enabling the story creation?
- Second part: composing stories
    - Does the authoring tool enable children to compose a story and foster the creativity and self-expression?
    - Are the children motivated to create a story by using the tool?
- Third part: structuring stories
    - Does the tool enable children to structure a story's sequence?
    - Do the children understand the differences between the linear and the non-linear story?
- Fourth Part: intercultural aspect
    - Do the children accept and comfortable to use figures from another culture to create a story?
    - Are the *wayang* figures evoking curiosity about the culture behind the artifacts?

6.2 Methods

In order to answer the evaluation questions, the evaluation has been conducted by using several methods.

- Usability Testing
  Once a user has been attracted to the website's homepage and has been persuaded to stay, the next step begins. In most cases, finding the products, service or information the user needs drives navigation. Usability problems can break user interaction at this stage; careful design is very important for this reason. Therefore, usability testing has been carried out for our authoring tool.

  For this research the heuristic walkthrough (Sears, 1997) had been used for the usability testing. This technique provides more structure than heuristic evaluation (Nielsen, 1997) but less than cognitive walkthrough (Wharton, Rieman, Lewis, & Polson, 1994). Evaluators were guided by a prioritized list of user tasks, a list of usability heuristics, and a list of though-focusing questions. The goal of this evaluation was to test the functionality of the tool as to whether the system works properly and is easy to use. In order to make children comfortable and get the most out of the sessions the usability testing has been conducted with respect to the guidelines of usability testing for children (Hanna, Risden, & Alexander, 1997; Markopoulos & Bekker, 2003).

- Focus groups
  In order to gain an understanding of how children feel and think about our authoring tool, the focus group (Krueger & Casey, 2000) method has been used. The group discussion was conducted with three different groups of children.

- Interview
  Interviews have been held with experts, teachers, and children. The interviews were conducted using semi-structured questions. The interviews with children were aimed at finding information about their personal motivation and experiences in creating stories with or without the authoring tool. From the interviews, feedback and important information regarding the development of the tool have been obtained from the experts and the teachers.

- Document analysis
  The XML story documents are analyzed to extract several components of the story such as actors, dialogues and character properties. The result is used to analyze the complexity of a story.

- Observation
  Observations have been conducted with teachers and experts about how children made a story using the authoring tool. These observations were aimed at collecting information regarding children's behavior in creating stories and their interaction with the system.

- Comparison
  In order to find out the different processes of creating stories with or without the authoring tool, a comparison has been made between children who prepare a real *wayang* performance and children who compose stories using the authoring tool.

Table 6.1 shows the summary of the main activities of evaluation which are implementing those methods. For a deeper focus, the selected activities with different aspects in terms of problem and result will be discussed in the following sections.

Table 6.1. Summary of the workshops and expert interviews

Activities[1]	Description
WS-1	**Purpose:** After the basic structure had been developed the handling of the figures on the stage was analyzed. This was done by evaluating the using of *wayang* figures to create a story and testing the design layout of the interface for creating a story. **Participants:** one child, one researcher, one observer. **Location**: dimeb, University of Bremen, Germany. **Methods:** Observing the child creating a story using the tool. Conducting an interview with the child concerning the experiences with using the tool. Documented with a video camera. **Result:** The child is able to create a story. He likes the tool because it is easy to use and has interesting figures. Concerning the layout he suggested giving more space to put the figures on the stage.

[1]WS stands for Workshop, EI stands for Expert Interview

Activities[1]	Description
WS-2	**Purpose:** Evaluating the properties of the figures to get more details for the further implementation. **Participants:** one child, one researcher, one observer. **Location**: dimeb, University of Bremen, Germany. **Methods:** Observing the child manipulating the properties of the figures. Conducting an interview with the child concerning the experiences with using the tool. **Result:** The child can manipulate the figure's properties to create a story. He likes the tool because it is easy to use. However, he suggested adding more figures to the system and giving information about the figure to gain knowledge about it.
WS-3	**Purpose:** Evaluating the interaction between the user and the system in creating a story process. **Participants:** two children, one researcher, one observer. **Location**: dimeb University of Bremen, Germany. **Methods:** Observing the children creating a story using the tool. Conducting interviews with the children concerning the experiences using the tool. **Result:** The children are enabled to create a story and enjoy using the tool. However, they suggested adding more backgrounds to the system and providing pop-up help on some buttons to guide them.
WS-4	**Purpose:** Evaluating the new interface for creating a story. **Participants:** two students, one researcher, one observer. **Location**: dimeb University of Bremen, Germany. **Methods:** Observing the process of creating a story. **Result:** The new interface is easier to use.

Activities[1]	Description
WS-5	**Purpose:** Evaluating the tool's functionalities to create a story, to manage a story and to comment a story and the using of the tool in a classroom. **Participants:** eight children, two researchers, one teacher, three research students. **Location**: The International School of Bremen (ISB), Bremen, Germany. **Methods:** Giving several structured tasks to children to create a story, to manage a story, and to comment a story. Observing the process of creating, managing and commenting a story. Conducting interviews with the children and the teacher, and holding a group discussion concerning their experiences in using the tool. Documented with a video camera. **Result:** The children are able to create a story, manage a story, and comment on a story. Several usability problems were uncovered, such as difficulty in activating a context menu and a mismatch of the figures' coordinates. The teacher found that the tool can be used in some lessons.
EI-1	**Purpose:** Discussing and evaluating the purpose of the authoring tool in museum context. **Location**: Leiden Museum, the Netherlands. **Result:** It is found an opportunity to use the authoring tool to introducing *wayang* tradition combining with the presentation of real *wayang* puppets.
EI-2	**Purpose:** Discussing and evaluating the interaction model of the authoring tool. **Location**: University of Bremen, Germany. **Result:** There is a need to reduce the steps for creating a story in order to force the children to create a story immediately. The recording process should be started automatically.
EI-3	**Purpose:** Discussing and evaluating the interface design the authoring tool. **Location**: University of Applied Sciences Bremen, Germany. **Result:** There is a need to refine the interfaces' layout.

Activities[1]	Description
WS-6	**Purpose:** Evaluating the revised tool's functionalities and the interface's layout, and a new functionality to build a linear story's sequence. **Participants:** two students, one researcher, one observer. **Location**: dimeb, University of Bremen, Germany. **Methods:** Observing the students use the functionalities based on a structured task. **Result:** The functionalities are working well. The linear story's sequence can be created and stored.
WS-7	**Purpose:** Evaluating the tool's functionalities to create a linear story's sequence. **Participants:** eight children, two researchers, one teacher, three research students. **Location**: The International School of Bremen (ISB), Bremen, Germany. **Methods:** Giving several structured tasks to children to create a story sequence, play and save it. Observing the process of creating a linear story sequence. Conducting interviews with the children and the teacher, and holding a group discussion concerning their experiences in using this functionality. Documented with a video camera. **Result:** The children are able to create a linear story sequence by using the tool. It is found that the children preferred to one story as a whole instead of composing it from several small scenes.

Activities[1]	Description
WS-8	**Purpose:** Evaluating the using of the tool for a *wayang* story performance. **Participants:** twelve children, one researcher, two teacher. **Location**: Kassel, Germany. **Methods:** Observing the process of creating a story and a linear sequence. Conducting interviews with the children and the teacher, and holding a group discussion concerning their experiences in using the tool. Documented with a video camera. **Result:** The children are able to create stories and a linear story sequence by using the tool and enjoying using it. The teacher found that the tool is helpful to support creative writing and can be used for a performance rehearsal. It was found that an additional library of traditional story from Indonesia could be helpful to support generating ideas.
EI-4	**Purpose:** Discussing and evaluating the functionality to structure a story. **Location**: University of Arts Bremen, Germany **Result:** A structure of a story can be built from the actors and the story itself. A non-linear story should be supported by the authoring tool.
WS-9	**Purpose:** Evaluating the tool's functionalities to build a non-linear story sequence. **Participants:** two children, one researcher. **Location**: Bremen, Germany. **Methods:** Observing the students use the functionalities based on a structured task. **Result:** The functionalities are working well. The non-linear story sequence can be created and stored.

Activities[1]	Description
EI-5	**Purpose:** Discussing and evaluating the using of the authoring tool in classroom and in intercultural context. **Location**: Bremen, Germany. **Result:** The expert found that the authoring tool could possibly be used for creative writing teaching in a classroom. Moreover, the tool is good for young people to learn the complex tradition of shadow theater. He suggested providing an option to combine the available figures with the figures from different cultures.

6.3 Usability interface testing

In this evaluation, a combination of methods has been used, such as usability testing, observation, interview and focus group in order to find the answers to the first and the second questions of the first part of evaluation questions. The interview, observation and focus group methods were used to gather information regarding the children's experiences and their enjoyment of using the tool. Several workshops were held to evaluate the functionalities of the authoring tool.

In this section, the main usability testing in the fifth (WS-5), seventh workshop (WS-7), and the ninth (WS-9) are described. The WS-5 and WS-7 were performed with 8 children around 10 years old, one girl and seven boys, with different cultural backgrounds and one teacher at the International School of Bremen (ISB), Germany as can be seen in Figure 6.1. This evaluation was conducted at a computer laboratory where each child used one computer.

The evaluation team consisted of 6 persons. Two researchers were responsible for the workshop scenario and together with the teacher were involved in observing and discussing experiences in story building and enjoyment of using the tool with the children in a discussion group. The teacher was very committed and involved in this evaluation and during his lessons touched on various topics that were related to this activity. He motivated the pupils to work together with the team. Three research students focused on the technical part and the documentation. All the activities in this evaluation were documented using a video camera.

The WS-9 was done with two students in order to facilitate a more intensive discussion during the workshop. This workshop was focused on the non-linear story's structure that will be explained later on.

Procedure

Some tasks were given to the children to create a story using the *Wayang* Authoring tool. All these children were already familiar with computers and internet applications; therefore, it was not necessary to give them an introduction to how to use a web browser. Whereas, some detailed instructions focused on how the participants should accomplish a task with *Wayang* Authoring were given.

Detail instructions were designed to guide them to accomplish the task (see Appendix A and B). The aim of this assessment was to test the usability of the prototype's functionalities and user interfaces. This section describes the usability testing of the five main functionalities, such as create a story and manage a story, comment on a story, and create a story's structure.

Figure 6.1. The evaluation at the International School of Bremen.

- **Create a story**

The target for this evaluation was a short story to be created by the children using the prototype. The focus of the evaluation was not on the content or meaning of the stories but on the usability of the functionalities and the user interfaces of the tool. The story only used two actors in what should be a short animation. Table 6.2 shows the summary of the structured tasks of creating a story.

From the observation, it is found that in the first step all the children could put two actors onto the stage using the click-and-drag function. Problems started in the third step when they had to flip the actors. They were confused because they did not find any menu or button to flip the actors, until one child managed to do it by using a double-click. He screamed: *"Yes, I did! I found the way how to flip the figures! Just use a double-click!"*. The other children followed his method to flip the actors. Problem was solved, but then appeared another problem. They could not add the dialogues. Actually, this function can be found from a context menu, and they should right-click on the actor to display it. After the function of the context menu was explained, they could add the dialogues then. Finally, they finished creating a short story and played it.

Table 6.2. Summary of the structured tasks of creating a story

Goal	Children successful to create and replay a short story with two actors. The actors should be short animated.
Assumption	The user is already registered on the system
Steps	1. Select two actors and put them onto the center of the stage. 2. Move one actor to the left and the other to the right until they reach the edge of the stage. 3. Flip the actors. 4. Move the actors back to the center of the stage. 5. Insert dialogue for the actors. 6. Delete one actor. 7. Play the story.

The main problem with this task is that users had difficulty finding the menu or the button to do a particular function. The context menu by using a right-click is not a good choice for children. This problem caused the creative process to create a story to be obstructed because the children became confused and frustrated. To solve this problem, a pop-up panel was implemented on the prototype version 2.0 which shows some buttons for several functions. This pop-up panel will appear automatically when users click on the figure and then disappear when users start to move the actors.

It was found a mismatch of the coordinates of the figures. The object's position during the creating process was different to the puppet's position when the story was played. The stack order of the figures was not working properly. From the group discussion, the children reported that the size of the stage was too small. They preferred to have a bigger space to accommodate more puppets for their story.

It was observed that some children had a difficulty when they wanted to delete a figure by dragging it to a box. They put the object outside the stage, which means that the actor is not deleted. We discovered that the position of the box was too far from the stage.

- **Manage a story**

The second task is to evaluate the functionality of managing stories (see Appendix A-2). Table 6.3 summarizes the structured tasks of managing stories.

Table 6.3. Summary of the structured tasks of managing stories

Goal	Children successful in share and unshare a story, delete a story, and edit a story's properties such as the title or the story's description.
Assumption	The user is already registered on the system and has four stories.
Steps	1. Choose the menu for managing stories. 2. Unshare two stories. 3. Share a story which is already unshared. 4. Delete a story. 5. Change the title of a story.

In this task, the problem was the children did not really understand the share/unshare function. They saw that the button was changed, but they did not recognize what had exactly happened to their story. A demonstration about share/unshare function was showed to them to give them more understanding about that.

- **Comment a story**

The next task is to evaluate the communication function by using the rating and commenting utility and by using the chat room function. In this task, as can be seen in Appendix A-3, they did not have any problems leaving a comment or rating a story.

- **Structure a story's sequence**

Workshops WS-7 and WS-9 were focused on the functionality to structure a story's sequence. The children were asked to create a whole story from some story units that are existing on the tool in WS-7. Six stories have been prepared in the system. The children should build a long story by combining the available short stories in a linear sequence. This assignment can be

seen in more detail in Appendix B-2. Table 6.4 shows the summary of the structured task of creating a linear structure.

Table 6.4. Summary of the structured tasks of creating a linear structure

Goal	Children successful to structure a story in a linear sequence from random scenes with authoring tool.
Assumption	The scenes are available on the system. User is not familiar with the story. The user is already registered to the system.
Steps	1. Choose the menu for creating a story list. 2. Drag and drop stories from left container to the right container. 3. Play the story list. 4. Save the story list. 5. Rearrange the list.

They all succeeded to create the whole story, because the prototype provides an easy interface. Children can select a story from a list and drag it to another container. Then they can arrange and rearrange the sequence of the whole story as described in section 5.3.2. The functionality to create a linear structure can be used easily by the children.

The WS-9 was focused on the non-linear story's structure. Children were asked to tag a single story to another single story in order to make a connection between them as shown in Figure 6.2. The detailed task for this test can be seen in Appendix B-3. Table 6.5 shows the summary of the structured task of creating a non-linear structure.

Table 6.5. Summary of the structured tasks of creating a non-linear structure

Goal	Children successful to structure a story in a non-linear sequence from random scenes by using the tagging system.
Assumption	The scenes are available on the system. User is not familiar with the story. The user is already registered to the system.
Steps	1. Choose the menu for composing a non-linear story. 2. Select a story with a title 'Tester-30'. 3. Connect the story with another story by using the tag function. 4. Play the story list. 5. Add other stories in the list. 6. Play the story list.

From this test, it was found that the children could use the *'Tag this story to'* function to select another story, which will follow. They can tag a story to several other stories. Each time they

tagged it to another single story the *'Leaders'* information is successfully updated to inform them that this story has a new connection to other stories. The non-linear story structure can be built by the authoring tool.

Figure 6.2. Making a connection between stories by using tags.

Result

From the usability testing, it was found that the main functionalities of *Wayang* Authoring as seen in Table 6.6 are working properly and easy to use. The children had no difficulties in using the prototype even without any needed guidance. They enjoyed using this tool and could compose a story, play it and share it as well. However, there were still some usability problems to be fixed and handled as listed in Table 6.7. The issue priority is defined based on the influence of the issue to the process of creating a story.

Table 6.6. The main functionalities of *Wayang* Authoring

No	Main Function	Detailed functionality
1	Creating a story	• Drag and drop a figure • Flip a figure • Rotate a figure • Delete a figure • Insert a dialogue • Save a story • Play a story

No	Main Function	Detailed functionality
2	Managing a story	• Share a story • Unshare a story • Delete a story • Edit the story's title • Edit the story's title • List stories based on the title or the author
3	Commenting and ranking	• Give a rank • Submit a comment • Show the comments and the rank
4	Structuring a story's sequence	• Drag and drop a story • Rearrange a sequence • Add a *'Leader'* and *'Follower'* tag • Remove a tag • Save the story list • Play the story list

Table 6.7. Usability issues

Issue#	Issue Priority	Issue	Recommendation
1	High	A function to rotate a figure is sometimes not working properly	Fix the function
2	High	Children were difficult to specify the stack order of an actor	Provide an easier mechanism
3	Medium	Children always used the same actors	Make the actor collections more informative
4	Medium	Box to store or delete actors is too far from the stage	Move the box closer to the stage
5	Low	Size of some buttons is too small	Change the button size

Interaction between children and the authoring system

In this section the interaction between children and the authoring system are evaluated in order to answer the last question of the first part of the evaluation questions. Several methods have been used such as observation, interview, and document analysis.

An interactive authoring system is a system-based agent. There are at least two agents who do the actions. An agent is *'one who initiates and performs actions'* (Laurel, 1993, p.4). The user who performs actions is an agent and another agent is the system which carries out any

actions in response to the user. If one action is accomplished those agents can continue to the next actions. The sequence of those actions can be drawn as shown in Figure 6.3 and follows Freytag's dramatic pyramid as described in section 3.3.1.

Figure 6.3 illustrates a series of dialogues between the user and the system. The user is symbolized by an orange circle. The system is represented by a green circle, and the state is marked by a square. On the first state, the user enters to the system or a part of it. Based on the possibilities from the system, the user makes a decision and will go to the next state. In that state, the system gives the response. This response leads the user to make another decision and reach another state. This process happens repeatedly until the resolution phase has been reached. Complex dialogues and decisions can occur in the climax phase.

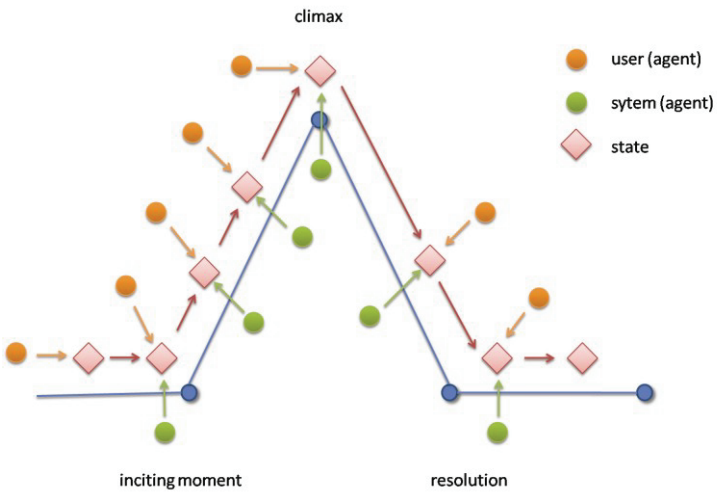

Figure 6.3. Agents' actions and Frytag's dramatic pyramid

One feature of *Wayang* Authoring can be used as the case in this context. In section 5.3.1, how the user composes a single story has been described. When the user enters to this feature, she/he comes to the first state and has several options, such as searching for any actor from actors' containers or put an actor to the stage. If the user decides to put an actor onto the stage, a new state is created. The system offers other possibilities to the user in this state. The next decision or action from the user leads her/him to the new state and this process is repeated until the user decides to finish her/his story.

It is defined in this feature that the dramatic actions start from when the user observes and browses through actors. The inciting moment begins when the user puts an actor onto the stage. The user then causes the level of action to rise and achieves the climax phase when

she/he moves or manipulates the figures. When the user decides to play her/his story, it means that she/he has arrived at the resolution phase.

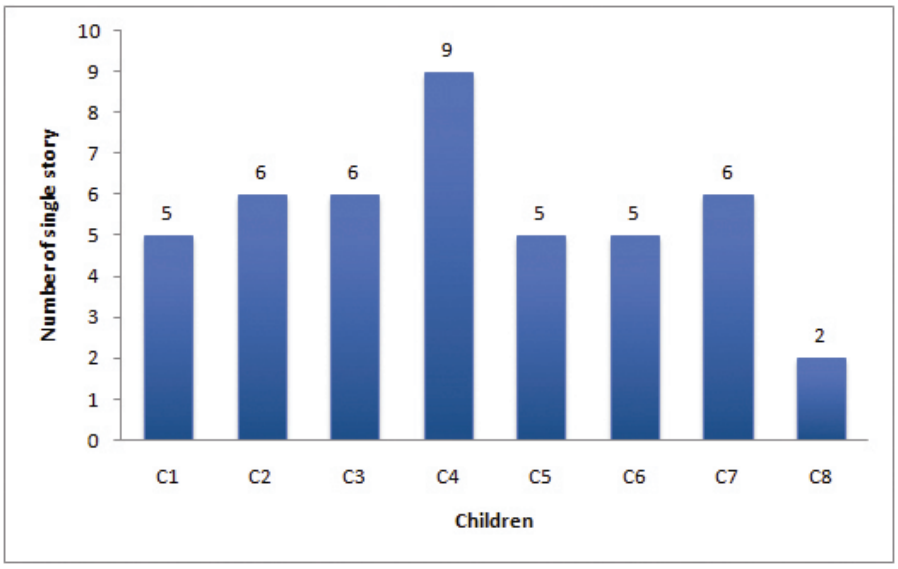

Figure 6.4. A number of single stories were produced per child during the workshop.

During workshop WS-5 as described in section 6.3 the children produced several single stories as shown in Figure 6.4. From the chart in Figure 6.4 can be observed the average number of single stories that can be produced by a child is five stories. Two interesting pieces of data have been found. Child (C4) produced nine stories (above the average), and child (C8) produced two stories (below the average). To get more information about this, a talk has been held to the two children separately. They were asked what their impressions were of our authoring tool. Both answered that they liked and enjoyed using the tool. It was need to be explored more in order to get the answer as to why there was such a large difference in the amount of stories produced. From the exploration, it was found that the child who produced nine stories is used to telling stories at home, but the other child rarely tells stories, so he needs support in developing an idea to tell or create a story including when using our tool.

Furthermore, the analysis of the story files were conducted in order to find out some information in their stories, such as how many actors they used, whether they built dialogues between the actors, and did they manipulate the figures' properties. They used at least two actors and combined several figures. The variation of figures and story themes is much greater than in the previous *wayang* performance workshop. This study did not explore the meaning

of the stories. Figure 6.5 shows the results of the examination. The average number of actors, dialogues and other figures' properties (e.g., rotation, flip), which appeared in the children's stories are counted. It can be obtained one particularly interesting result from the chart: a child (C8), who created two stories made six dialogues in average in his stories. In discussion with the teacher, it was informed that he is normally a quiet child in class. He has difficulties focusing on the subjects in the class and rarely talks with others. During the workshop, the teacher and the researcher observed him, and it was found out that the child was very engaged and focused on creating stories. He expressed his ideas by moving the figures, creating dialogues, and changing the actors' properties.

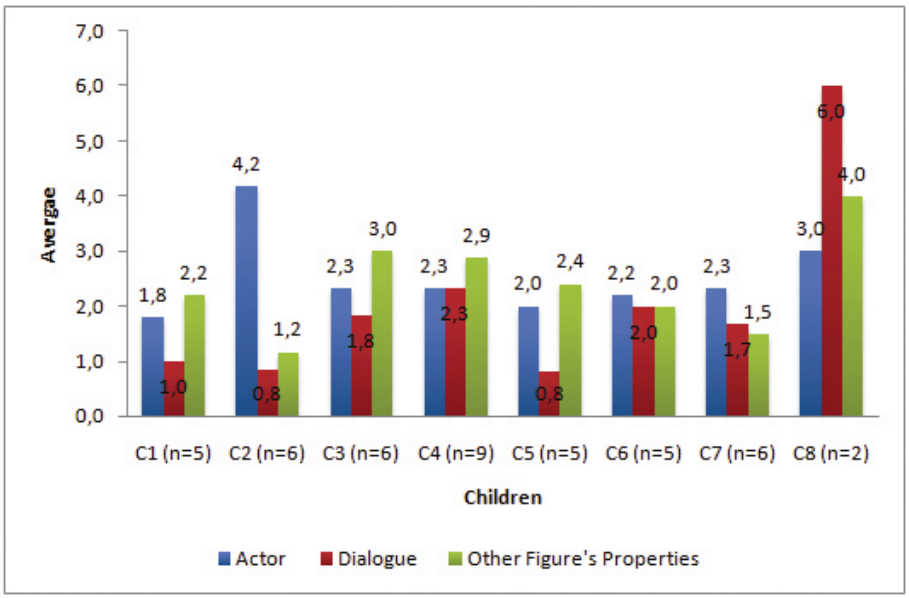

Figure 6.5. The average number of story's components of the children during the workshop.

From the observation and analysis of the story files, we came to the result that the authoring tool enables the child to act out dialogues with the system. The authoring tool provides features that lead the child to accomplish the task to create a story. The dialogue with the system started from the selection of the actors. The intensive dialogues with the system happened when the child made a lot of manipulations of the figure's properties and made many dialogues between the actors in his story. It means that the interaction between children and the system which follows the dramatic schema fosters the engagement of the user with the system and leads the user to accomplish the task.

6.4 Ability to compose a story

This section discusses facts about how the children build a story. This discussion is important for analyzing whether a part of the goal, which provides an authoring tool that supports creative storytelling and self-expression has been reached. Several methods have been used such as observation, interviews, and focus group in order to answer the second part of the evaluation questions. The process of composing a story by using our prototype with the real story preparation for a *wayang* performance is compared.

Firstly, it was found in the *wayang* performance workshop with physical puppets that children were encouraged to build a story from their imagination. They started to build their story from their imagination from when they started to hold a puppet. They started a relationship with the puppet. Then they communicated with others to share their imaginative ideas in order to arrange and develop the story. Through the communication of ideas, children can be put into an imaginative context and through their physical actions may gain new meanings. From this imaginative activity children learned to manage complex contexts, take different roles and views and act in fictive situations as well. Furthermore, the child by using real puppets or digital puppets in *Wayang* Authoring gains experience in learning to act with the use of symbols instead of just using objects. The framework also demands opportunities to set and bargain with the rules and the adapted activity asks for self-monitoring of one's own behaviors and to cooperate with others. Altogether, it can be best described that in tasks that involved the children in role-playing and fiction-playing can be used as an effective exercise to help children discover imagination, concepts, models, ideas and meanings and to act with them as if they were objects (Vygotsky, 1962). Furthermore, the teacher believes that through these tasks, abstract thinking will be enhanced and language skills will be fostered.

The following example shows how stories of others can foster the child's own imagination. A girl in the workshop had already published a story, and two other boys recognized it and then played it. A boy said: *''Aha, you have created a story about a monkey and an elephant! I have another story about them. Hmmm… wait a second!''.* Then he published a story with a monkey and an elephant as the main actors. Another boy also created another story with the same characters, but he preferred to continue the story of the girl. From this case, it can be assumed that new stories, new views on stories, and new topics can activate experiences, previous actions and demands for further reflection. It was observed that after the children played other children's stories, they started to prepare and create a new story. This gives the impression that this tool can promote children to become creative storytellers themselves. Children take existing materials as an inspiration tool, imagine what they themselves want to tell, create a story based on their own ideas, play with their creations, share their stories and creations with others, and even reflect on their experiences at the end.

In discussions with the teacher and from the analysis of the story files, it was found that the tool supports the children's self-expression. The expression can be noticed in different forms

and anchors, as it can be seen in the movements of the object, the dialogues between actors, the collections of objects without movement as a pictorial moment, or in commenting on a story. This repertoire of the possible accesses is an important part of the mental, cognitive and social development of a child. This study refer to Loris Malaguzzi who proclaimed in the poem *"One hundred"* that each child has the potential of a huge range of expressions or expressive styles which have to be fostered (Cadwell, 2003). In the reflection with an expert, it was gained an understanding that one basic aspect of playing with puppets is that every puppet can become something else in the child's imagination just like every object can become another object in the imagination or as a representation of something that is not available physically. A stick can become a horse, and a puppet can possibly become a representation of a specific character or a person or even a role. From the project with the drama teacher, it was observed that most of the children could activate and personificate a puppet in their imagination. Furthermore, in our workshop, we observed that through the spontaneous movement of a figure on the virtual stage, the child activates this picture in his imagination. It was found this indication during the workshop while they composed a story. Some children said aloud some sentences such as:

> *"… ooh my funny dog.."*
>
> *"… a small dog like my dog.."*
>
> *"… this my brave tiger, he is really brave like me.. isn't it.. (laughing).."*
>
> *"… hmmm yes.. I want to be like this elephant.. he is so strong….and ….. so (hmmm) friendly…"*.

These examples show the children gave hints that they did the imagination activation when they select or move a digital puppet.

During a longer-term school project about Indonesian shadow theater (WS-8), it was got the chance to evaluate and comment for a longer period on how the drama teacher developed a performance with the *wayang* figures' performance and how additionally several tests using the prototype with pupils and the drama teacher could be performed. The practical work with real *wayang* puppets evaluated with a video camera and interviews. The teacher left the pupils to explore the *wayang* figures. Each pupil decided to be one figure and to imagine how this figure life and how it feels by writing a letter to another figure. Then the pupils played out a small improvisation with some chosen figures. Generally, from the observation with the teacher, the pupils chose two figures. For a second round, a conflict between two characters, namely, between the civet cat and the duck was established by telling the beginning of an Indonesian story. Each pupil was asked to act out the conflict and to find out a solution for this conflict through several improvisations with the *wayang* figures. They worked in small teams. One team performed and the other had to write on a sheet of paper what they performed.

After several rounds of discussing the paper sheets in a time line of an overall story and finally, through this procedure, a storybook was written. According to the teacher, the improvisation had been a re-enactment of the conflicts that the pupils had experienced or seen in the classroom.

This finding showed a positive effect on the class communication. However, in general, it was difficult to build the protocol of the performances and the pupils did not act as freely as with their ideas. And sequencing the stories took a lot of time. After this step, there was a chance to test the tool with a small group of children and with the drama teacher separately. The leading question here was to find out if and how our tool could foster the creativity needed in approach for a *wayang* story. The pupils and the teacher liked the tool. The pupils reported that they felt freer to try out and to do improvisation. They could change the story's sequence instantly and easy to add a new scene on it. The teacher assumed that the process from the collection of little stories to build to an overall story could be supported, leaving more energy left to put the storybook on the *wayang* stage. This is very important because the teacher had often noticed in other projects that the teacher created a proposal story from the small stories and frequently the protocol of the improvisational performances became imprecise, so that it to regain the motivation of the children to put the story on stage. From this workshop and the feedback from the drama teacher, it was found that it could be helpful in the tool to add a library of small starting scenes from Indonesian stories that imply some conflicts or a mystery that support the improvisation needed to create the story.

A discussion has been held with the children who are members of the *gamelan kancil* group. They found that this tool was very useful for them to prepare and develop a story for real performances. They could discuss their story virtually and reflect on it before performing it. But they found that this tool should be improved, so that they could still feel like they were holding a real puppet because with the real puppet it is much easier to make and control a gesture and create effects through the puppet's movement. This finding is similar to other discussions with the children who were not familiar with *wayang* puppets. They did not understand that a part of the real puppet can be moved to create some effects such as gestures. A real *wayang* puppet usually has one or two moveable arms, with one stick attached to the hand of each moveable arm, but the puppet as a whole can also be moved to express the movements of other parts of the body. The arm movements give a sign that the puppet *'speaks'* and expresses a certain meaning. A combination of movements between the puppet's arms and body creates a complex gesture. This property of real *wayang* puppets cannot and is not supposed to be handled by *Wayang* Authoring. A further research can be done into this in order to find a specific medium and methods, which are appropriate for children to learn to use these kinds of gestures in this type of setting.

From the discussion in this section, it was found that *Wayang* Authoring tool can be used to support creative storytelling and self-expression of children. A list of attractive figures and

stories from other children can inspire children to compose a story. These are the advantages of the digital tool. Brief information about the figure is immediately presented to the children when they point to the figure. This kind of explanation of a figure is not easy to provide in traditional *wayang* storytelling. A *dalang* or an expert is needed to explain the character of the figures. However, it is needed to add a library of small starting scenes from Indonesian stories that imply some conflicts or a mystery that supports the improvisation. This library could be helpful to evoke imagination and ideas to create a story. This is another advantage of the digital authoring tool. A list of stories related to a specific actor or a story's library can be easily added to and retrieved from the database. Moreover, stories from other children evoke the motivation the children to create a new story.

6.5 Story structure

This section discusses how our authoring tool can support story structure understanding for children in order to answer the third part of the evaluation question.

A story can be viewed as an ensemble of story units and a story unit in this study is a single story. Therefore, story structure in this context is a relation schema between single stories. As described in section 3.3, every story has a structure that can be visualized as a process. Linear stories have linear processes and non-linear stories have non-linear processes. This study does not want to find which structure is good for children, because narrative structures are not universal: children stories are cultural products and their form differs from culture to culture. A good story for one storytelling tradition is not necessarily a good story for another (Vygotsky, 1986). This research wants to ponder the potential of our authoring tool to support the understanding of a story for children.

Workshop WS-7 focused on the structure of stories. The children were provided with four parts (scenes) of a shortened Indonesian story to be arranged. Those scenes are 'duck gets hurt by a dog' (A), 'dog eats cadaver' (B), 'the revenge' (C), and 'the party' (D). The assignment and the story's description can be seen in Appendix B-1. They discussed and arranged some logical sequences of that story reasonably. Some of them added a bridging part that enabled them to create either a story with a completely different meaning or in an order that was in a random sequence before. It seems that they followed an unconscious comprehension of story structures that enabled them to arrange or complete the unconnected and separate parts of the story according to a certain narrative logic. In this case, they built a linear story. It was identified from their explanation of how they did the story arrangement. An example is the following quote from a young boy.

> *.. first of all the story will **start** with 'the party' (D) because …… **then** 'the revenge' (C) … **and then** 'dog eats cadaver' (B) … **then** 'duck gets hurt by a dog' (A)… **and then** because the duck gets hurt by the dog, so…*

We can see that the sequence of the story becomes linear and follows a strictly defined procedural path – one after another as illustrated in section 3.3.2.

In the next step they were asked to build a linear story sequence from some existing story units in the authoring tool. They all succeeded in building a linear sequence. The problem occurred when they had to create an entire story from a scratch. Some of them had problems structuring the story along some small units when composing the story. They preferred to compose one story as a whole instead of arranging it from several smaller units. The challenge for the system is to make the structure of stories more explicit by adding a kind of storyboard panel.

Non-linear story is other structure which is important to be understood even for young children especially when they use hypermedia such as web applications. A characteristic of hypermedia is non-linearity structure, which allows us to navigate through an information space using associative linking. The user action determines a pathway through the material. Similarly, hypertext fictions are about the journey as much as they are about the narrative that waits to be pieced together.

The *Wayang* Authoring tool provides a feature for children to build a non-linear story from story units that are existing on the system by using a tagging system. A model for building a non-linear story has been designed as described in section 5.1.4. This section describes the potential of the model to support non-linear story understanding for children, whether tagging can support children in composing a non-linear story.

After they completed the task as described in Appendix B-3, the children were interviewed in order to explore their understanding of story structure and what they had gained from the tagging system in context story structure. It was found some interesting results from the interviews. Two children asked what the meaning of *'Followers'* and *'Leaders'* is. They also asked why the information in *'Leaders'* is only changed when they have tagged a story to another story. To answer the questions an illustration was provided to show them the effect of a tag on the story's sequence. If a story has more than one leader, at that point an option will appear to ask the user to decide which story will then be played.

There were indications that they understood the effect of tags on a story. Two boys reflected and interpreted their understanding in a different way. These are examples of their quotes:

> *"… it looks like a sign on the street.. I saw the arrows on the street.. [hmm].. yes, left and right.."*

> *"… I saw an option in a game.. I have to choose something.. but… I didn't tag anything… "*

Even though they did not explicitly mention the story's branching, indications can be seen that they understand that a path is not always a straight (linear) path.

This study focuses on the relation schema between single stories. This research does not go deep into the evaluation of the meaning of the whole story in a different schema. From the discussion in this subchapter it is found indications that the authoring tool can be used to help children to have experiences in story structure. They connected some stories either in a linear or a non-linear sequence using the tagging system. However, the system should be improved by adding clearer information and online help related to tagging as a story connector. Indications were found that they understand the differences between a linear and a non-linear sequence.

In discussion with the drama teachers, they said that by using the tool the children can be trained as a story composers who have the opportunity to think about possible story combinations. The tagging system can help children to construct meaning in a playful way. This non-linear story object visualizes a possible ways to create a story that evokes curiosity to explore different and diverse combination of stories.

6.6 Intercultural aspect

This section describes the evaluation which is related with the fourth part of the evaluation questions related to the intercultural aspect.

The concept of *Wayang* Authoring has been designed as a reference to the traditional *wayang* theater. Putting the specifications of *wayang* on a screen was meant to translate the aesthetic language of one media into the possibilities and the restrictions of another media. Of course *Wayang* Authoring can, but it should not replace the rich tradition of *wayang*; instead it can foster the understanding, especially of the users who have diverse cultural backgrounds other than the Indonesian. For the aim to convey the aesthetic practice of one culture for children with another cultural background, several discussions have been held with the teachers and the experts from a museum who have had long-term experience in teaching Indonesian *gamelan* music to children with a non-Indonesian background. One of these patterns that they employ uses the interlocking of notes of two players but seems rather difficult for children with a European background. Each of the two players is given a paper with his or her specific part represented by a number that represents a note which is marked on the instrument. It takes time for the two players to recognize the pattern. This process can be done by trying to perform the musical pattern which works only in a certain way.

In a similar way, an attempt has been made to organize this approach to the visual language of *wayang*. The *wayang* figures are images that can be allocated to an animal or a person. However, they are also signs with a specific cultural meaning. The way a figure is represented enables or fosters certain focuses of the imaginations more than others. For example, the faces are generally embodied and are more pronounced, thus the facial expressions are stronger. By playing with these images, the children become aware of this visual language and try out other expressions than the already known ones. The challenge now will be to extend these aspects, for example, through a library of story parts from Indonesian stories, so that during a longer period of play, a child can experiment with these story patterns either by combining them with their own parts or by using them as a starting point of his or her own story.

The puppet images in the tool are taken from the iconic tradition of *wayang*. Because of the difference of cultural codes, the appearance of the puppets of mother and father, for example, look different to western presentations of mother and father. In *wayang* tradition a specific gesture describes a particular meaning of a character. With *Wayang* Authoring children easily detected what symbols should represent mother, father and child. During the workshop, some children tried to imitate a gesture or position of the arms or legs. They also asked some questions:

> *“…. why his legs.. like this… ?“ (he showed his legs position)*
>
> *“….what is the meaning with this….? (imitated a puppet’s arm position) and this…? (imitated another position)“*

These indications show that tool has a potential to evoke the children to understand different cultural codes.

In a group discussion after the workshop, a boy from Turkey reported that he had seen a similar puppet theater in Istanbul. That is the shadow puppet Karagöz, and the famous figure is Havicat. Another boy from India said that he had seen similar images when he was in India. He described to the group in which aspects the Indian characters are different and how they had been used. A girl from Italy talked about the traditional style of Italian string puppets. This indicated that our tool can also be used to evocate discussion and expression of different cultural experiences among the group of children.

Since the prototype was published in July 2008, 78 users from 15 countries have been registered on the system. Mostly they come from Germany (29 users) and Indonesia (18 users), and 264 stories have been recorded. The user distribution based on country can be seen in Figure 6.6. The system automatically collects information about a user’s country of origin during the registration process. The system identified a user’s location based on their IP address and converted it to coordinates location (latitude, longitude). By using the Google

Maps API, we embedded Google Maps site into the authoring tool. The system groups users based on the coordinates location, e.g., a user group from Bremen as seen on Figure 5.31.

The goal to provide this feature is to offer a stage, where all participants of the community are visualized on a globe. Initially, this stage was showed to some children. They seem to understand this feature through giving comments such as "*oh, now we can see our friends on the globe*". This visualization can be used to support the curiosity to try to communicate with children from other cultures, and that the focus on the visual storytelling would simplify this, and at the end they will build a community of young storytellers.

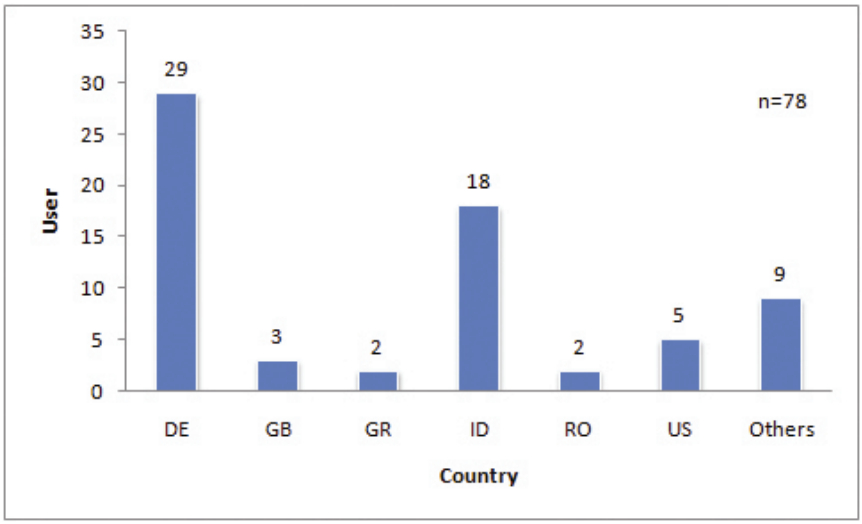

Figure 6.6. The user distribution based on country.

From Figure 6.10 it is found that the authoring tool which is designed from a traditional art from Indonesia can be accepted and used worldwide. It can be concluded that the aesthetic appearance of the figures evokes the curiosity of the culture and fosters a discussion and expression of different cultural experiences. The different looks of characters from another culture are acceptable to children for creating stories. Playing with the virtual figures, children can become involved in a playful manner using the expressive language of another culture. In this way, intercultural understanding means to adapt expressive patterns of another culture and to become experienced in the other existing ways of viewing things, feeling them and the other thinking patterns as well.

It can be concluded that the children accept and are comfortable in using the figures from another culture to create a story. Besides that, it is found that the *wayang* figures evoke curiosity about the culture behind the artifacts.

6.7 Summary

In this chapter, the *Wayang* Authoring system is evaluated in order to show that the tool can support creative storytelling and self-expression, the understanding of story structure, and intercultural empathy as well.

Based on the workshop and the evaluation processes, it has been found that the *Wayang* Authoring tool can support creative storytelling and self-expression. Children take existing materials as an inspiration tool, imagine what they themselves want to tell, create a story based on their own ideas, play with their creations, share their stories and creations with others, and reflect on their experiences at the end. However, this study cannot offer empirical evidence for reflection experiences. From the observation and discussion with the children and teachers, some hints were found that indicate the children have this experience during using the tool.

This digital authoring tool has several advantages in comparison to the traditional *wayang* storytelling. The digital tool facilitates children to explore the figure's character information by themselves. The children are able to share their stories broadly, and they have an opportunity to communicate their ideas with others in a world wide scope. A list of stories related to a specific actor or story library, which can be used to evoke imagination and ideas to create a story, can be easily added to and retrieved from the database. The children have two roles when using the digital tool. They act as the 'writers' and, at the same time, as the 'readers' as well. Moreover, this digital tool enables children to reflect on their stories by playing and re-playing, and by reading comments of their stories. The time process of imagine-create-play-share-reflect from Resnick as described in section 4.2.2 can be shortened.

There were indications from the evaluation that the children understood with the effect of tags on a story were found. Moreover, they can use the tagging system to learn story structure. They could connect stories in order to build linear and non-linear structure of the story by adding a tag to a story. If a story has more than one *'Leader'*, it means that the story has a branch to other story paths, and a non-linear story structure is built. The tagging system in the authoring tool has a good potential to be used to support them to have experiences in story structure. The children can learn to structure and re-structure a story's sequence by using the digital tool. This is very useful for the preparation of a real *wayang* performance.

The handling of cultural artifacts helps support the ability to understand different cultural codes, and there were indications from the workshop and discussion with experts that it also supports the children's curiosity to learn more about the culture lying behind these artifacts. This would in turn enhance the intercultural empathy between children.

Chapter 7
Conclusion

In this chapter, the answers to the research questions of this study are presented. The design process and the evaluation process of Wayang Authoring in the previous chapter contributed to obtaining answers to those questions. At the end of this chapter, the contribution and the future works are described.

7.1 Discussion

The findings were described in the previous section. This section brings together reflections on the evaluation and theoretical framework in order to provide a comprehensive understanding of authoring media in the context of storytelling for children. Furthermore, the research questions are answered.

As mentioned in the first chapter, the research questions are:

- Which interaction design of an authoring media is appropriate to support children's creative storytelling and self-expression?
- Which kind of visual interactive web-based tool can support children to collaborate on a story and understand story structure?
- Do children change the process of creating stories in different media?

In the following section, the questions are answered starting from the last question.

Do children change the process of creating stories in different media?

In section 3.1, the concept of transmedia storytelling from Jenkins has been described. This concept stresses that each medium has special advantages in the process of telling a story. The differences in performance across the various media, due to each medium having its own distinct structure, affect the meanings of the stories being told and also how they are shaped and shared. This understanding leads us to the question of the process of creating stories in different media.

As explained in Chapter 2 and Chapter 3, in general every story has three parts: a beginning, middle and end. In Chapter 2 a story has been defined as a composition of several events or

actions, which follow a particular sequence as a storyline to increase a tension and achieve a final resolution in order to convey a meaning. This means that the process of creating a story consists of events of introducing the actors, events of presenting the conflicts, and events of producing the resolution.

In this study, the process of developing a story by using real *wayang* puppets and by using *Wayang* Authoring has been analyzed. Before the authoring media has been designed, I worked with a puppeteer to gain knowledge on how to develop a story for a *wayang* performance as described in section 2.2.2. I also worked with a group of children who prepared a shadow puppet performance at *Rockwinkel* School, Bremen and with the head of the *wayang* project Jochen Zülch. This observation is important in order to have an understanding of how they use a traditional art form from another culture in their own context. The finding is that this group used *wayang* as part of the exercises in creative writing. They are not only using stories from the original tradition, but also modifying or developing a new story from a part of the traditional story. They choose actors of the story and imagine the lives of the figures. In the next step, the teacher gave a conflict, and children propose a solution. From the observation of the workshops with children to evaluate the authoring tool, it was found that the children followed a similar process to create a story. As described in section 6.5, children chose digital puppets from the library, and they built imagination on the figures. Then they started to compose a story.

It can be concluded that there are no significant differences in the process of composing a story when using either the traditional puppets or the authoring media. However, it was found that children had different experiences. Experiences in the body movements and *wayang* puppet's gestures are prominent in composing a story using the real puppets. Children can learn much easier to make and control a gesture and give effects on the puppet's movement. The combination of movements between the puppet's arms and body creates a complex gesture. This property of real *wayang* puppets cannot and is not supposed to be handled by *Wayang* Authoring. In other ways, *Wayang* Authoring gives experiences of reflection as described in section 6.5. This digital tool enables children to reflect on their stories by playing and re-playing, and by reading comments of their stories. Reflection is a critical part of the creative process as mentioned in sections 4.2.1 and 4.2.2. *Wayang* Authoring supports reflection on the creation of an artifact (Reggio Emilia approach) and important reflection on the ideas that guided the design, or strategies for refining and improving the design (Kindergarten approach to learning from Resnick). Children can reflect on the story or on the process of creating the story.

Which kind of visual interactive web-based tool can support children to collaborate on a story and understand story structure?

In the fourth chapter, it has been described that social software can support a creative activity, because the innovative activity grows out from the relationship between individuals, their actions, and from the interaction between individuals. Creativity does not happen inside people's minds, but rather in the interaction between a socio-cultural context and a person's thoughts. Systems that intended to support social creativity should facilitate sharing and play, and their design should consider the effects of re-purposing, enrichment and behavior adaptation.

Wayang Authoring is designed and implemented as a type of social software for children, but focused more on creative production (Peppler & Kafai, 2007). Peppler and Kafai argued that creative production prepares youths to participate in the technical, social and political aspects of the new convergence culture by providing youths with skills, tools and knowledge necessary to engage in the evolving media landscape. It has been found from the evaluation that by using *Wayang* Authoring children can express their creativity by producing visual stories and sharing them. They can compose the story individually or collaboratively. The evaluation in section 6.5 shows that a list of attractive figures and stories from other children can inspire children to compose a story. The expression can be noticed in different forms and anchors, as can be seen in the movements of the object, the dialogues between actors, the collections of objects without movement as a pictorial moment, or in commenting on a story. Children take existing materials as an inspiration tool, imagine what they themselves want to tell, create a story based on their own ideas, play with their creations, share their stories and creations with others, and reflect on their experiences at the end.

Wayang Authoring serves all three kinds of a participatory culture from Jenkins as described in section 4.3.1:

1. **Affiliation**– through creating a user profile and joining a group centered on its favorite character.
2. **Expression**– through creating a new story with the authoring tool and rating and commenting on other children's stories.
3. **Collaboration** – through composing a collaborative story and connecting one story to others.

Collaboration is one aspect of the participatory culture that this study explored. The power of a tagging system is investigated to support this kind of collaboration by connecting stories using tags. Another aspect is how to support the understanding of story structure by using a tagging system.

As mentioned in section 4.3.3 that one feature of Web 2.0 technology appropriate for supporting story creation is tagging. *Wayang* Authoring tool provides a feature to enable children to compose a collaborative story through tagging technology. Moreover, they can learn to structure and re-structure a story's sequence. In Chapter 3, it has been described ten geometric structure variations of stories from Samsel and Wimberly. This study focuses on the linear and non-linear such as branching and multilinear structure.

A model of a tagging system to compose a non-linear story is proposed as illustrated in section 5.1.4. This model facilitates children to make a branch on a story by adding a tag to it. If a story has more than one *'leader'* tags it means that at that point a story branch will be created. Each branch will follow a certain path. At this point, the readers have an option to choose a certain path to continue the story. From workshops and evaluation, as described in section 6.5, it was found indications that the children have an understanding of linear and non-linear stories after doing the tagging process. By this feature, children gained experiences in control a story's structure. They connected some stories by using the tagging system. They could decide if a story will follow a certain story. They trained as a story composer by structuring a story sequence. Moreover, they put their creative product in the context of the entire story as a part of the storyteller community. This will help children gain experiences in the intertextuality concept as explained in section 3.2.

From the findings and discussion it can be concluded that the social software concept supports children to do story collaboration and to understand a story's sequence. The authoring tool should facilitate children to structure and re-structure the story's sequence in a playful way.

Which interaction design of an authoring media is appropriate to support children's creative storytelling and self-expression?

In order to answer this central question of this study, I want to look again at the concept of storytelling, the structure of a dramatic work and the interaction design. In the following, I analyze the connection between them and use *Wayang* Authoring system as the case study.

It was defined in Chapter 2 that storytelling is a performance of a story with an interactive act between storyteller and audience, which at the same time encourages the audience's active imagination. This means that in storytelling communication and engagement between storyteller and audience will take place. The plot is one significant aspect of a story in order to build this kind of engagement. Aristotle in his book 'Poetic' wrote that there are six important elements of drama: plot, character, thought, diction, song, and spectacle. However, he mentioned that "*The Plot, then, is the first principle, and, as it were, the soul of a tragedy: Character holds the second place*" (Aristotle, 2008). Therefore, he said that every story must

have a beginning, middle and end. The emotion of the audience will rise and fall as it follows the plot and actions of the characters.

From the understanding of the interaction design, as discussed in Chapter 4, one issue of the interaction design is concentrating on the dialogue that takes place between people products & services and its effect. This means that on the interactive products also have characters and the plot of dialogues between them. The emotion of the user during the interaction with the system is dependent on the plot or the scenario of the system. Through the dialogues, the system will tell a kind of story to the user and in the process build a kind of engagement of the user. If we as designers, had a better understanding of how stories are crafted and brought to life in a performance tradition, we would have a better understanding of how to design kinds of engagement in the interactive products. I refer this understanding to the statement by Brenda Laurel in her book 'Computers as Theater' as follows *'Well-designed system-based agents can contribute to dramatic engagement, elicit empathy, and influence the actions and emotional responses of human agents involved in the same activity'* (Laurel, 1993, p. 146).

From the evaluation in section 6.4, it was found that a child is engaged to compose a story by using this feature. The engagement in this context can be understood as *"the state of mind that we must attain in order to enjoy a representation of an action"* (Laurel, 1993, p.113). The child spent more time than the others in order to express his idea and enjoyed the process. The chart in Figure 6.4 shows that he made a lot of dialogues and manipulation of the figures' properties. It shows that he did many dialogues with the system to define movements or properties of the objects. The dialogues led him to accomplish the task by following the dramatic schema.

The design that considers the dramatic flow can support the experience in exploration. This experience is needed for children to support creativity in composing a story. One example is the exploration of actors. Before they start to compose a story they search for a certain actor and explore what they can do with the actor such as change orientation or rotate the actor. The pop-up window to manipulate the figure's properties, as illustrated in section 6.3, facilitates the user to communicate with the system before she/he decides an action. During the exploration, the system should give a proper response to the children's activity. If children can communicate with the system and carry out their activity with fun and enjoyment, they will be more engaged with the system. This situation will give them an interactive experience.

It can be concluded that interaction design of an authoring media which is appropriate to support children's creative storytelling and self-expression should:

- be designed by considering the dramatic flow of a story. The communication between user and system should be facilitated in order to help the user make a decision to go to the next state, and to lead the user to accomplish the task.
- have a simple, understandable, and consistent functions and interfaces.

- provide experiences in reflection, control, and exploration for children while performing narrative tasks, such as structuring the sequence of a story and creating a story by expressing their fantasy in form of text, images, or movements.

7.2 Contribution

This section reflects on the study to emphasize the contribution it has made. The major contributions are in the *wayang* culture and in the field of web technology on storytelling.

The contribution of this study to the *wayang* culture is enabling children, who have not had any experience with *wayang*, to learn *wayang* patterns, *wayang* aesthetic and *wayang* performance in a playful approach. Furthermore, the system can be used to enhance the real experiences in *wayang* storytelling by facilitating the story building and story exchange. A repository of stories which is composed by user from around the world enriches the repertoire of *wayang* storytellers.

Tagging systems can be used to improve the searching process, detect spam, increase system popularity, improve personal organization as well as introduce new features of social communication and possibilities for data mining. In this thesis, a model of tagging system to connect internet resources (e.g., image, video, and story) is proposed in order to build a linear or non-linear sequence structure. Users connect a resource to another resource by tagging the resource which will be followed.

A different performance and process of the stories and how the meanings of stories are created and shared depend on the structure of each medium. The stories we have read, heard and seen in a single medium have not lacked effect, but combining several media gives a completely new experience as Jenkins mentioned about transmedia as described in section 3.1. In this study, an exploration has been made of how a story is developed and performed in a given medium in comparison to other media. In this case, the web is used as a medium to revive traditional storytelling using puppets.

It has been shown that the web and the web community as a medium offers different experiences in developing and performing stories. When children use the web-based authoring media, they put themselves into the process of developing stories. When they are connecting stories, they connect and immerse with other children as well. They have to act and play by themselves or with others, within the stories in order to experience the narratives. Tagging model in this study is not only to share web resources in a web-based sharing platform. By using the tagging model to build a story sequence the children occupy two roles. They act as the ‘writers’ when they write or create a story. In the same time, they act as the ‘readers’ as well. They ‘read’ the language of the (hyper)media. By transforming understanding of the

(hyper)media's language into an active and critical process, they can gain an understanding of the narrative's structure. Furthermore, they train to have the skills to interact, to share their ideas and to collaborate constructively. This is making them possible to participate in today's media-driven culture.

Children grow up in a world that is defined by a huge amount of commercial media products such as PC games, movies, television and diverse formats of advertisements. These products provide a story based on entertainment and information, which is ready to be consumed. Fostering children's own creative activities and to make them become authors of their own stories is not easy, especially in concurrence to commercial virtual worlds and movies. This study obtained evidence that the authoring tool could evoke enough motivation for children to stay for a longer time actively creating their own story. In interviews, no one compared the tool to commercial tools. It happened that some children drew a comparison with stories they had heard or read or to traditional puppets or, and this happened quite often, to picture books. For this it can be concluded that the aesthetic coupled with the interactive functions support children to explore virtual and narrative worlds. This virtual creative production tool gives a space for young people to change their role from a simple user to a (co-)creator.

7.3 Future works

This thesis offered a view of the role of digital media in the field of storytelling. This study focused on the interaction design of authoring media which is appropriate to support children's creative storytelling and self-expression. From the findings it has been found some future directions to continue this study.

This study discovered a potential of tagging technology to support children's understanding of story's structure; however, it is more focused on the sequence schema of story units. Research into the content of a story related to the schema could be of interest in the future. This study found that the children preferred to make a big story rather than split it into several small stories. Could it be that something was making it difficult for them to create stories from others' units? Perhaps it is a question of ownership? Or was it that the units did not fit clearly into their structure? It would be interesting to investigate whether providing more structure helps, or causes more problems.

Wayang Authoring provides a space for children to collaborate and communicate with other children to develop stories. Further research can be done to look deeper into the effect of the virtual collaboration and communication on the quality of children's narrative development and narrative performance.

Developing a system in a medium based on a system from other medium is a challenge. This is not a process of imitating other media–copying one medium onto another. As explained in previous chapter, this study does not want to imitate the real *wayang* performance onto the virtual performance using the web because a process of copying/imitating can produce a result in a design that is worse than the original. As Martin and Stolterman stated, that *"..Creates computer imaginative interactions. Computer imaginative (CI) software exploits the strengths of the medium for particular purposes (e.g., instruction, productivity, organization, entertainment).."* (Siegel & Stolterman, 2009, p.8). This concept is close to the concept of transmedia storytelling from Jenkins which describes how stories can be told throughout various media so that the benefits of best performance of each medium can be obtained (Jenkins, 2007). For further research it could be interesting in a cross-media experiences context to explore stories in order to expand our notions of what stories are and what stories can be.

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Appendix A-1

The structured tasks of creating a story

Goal	Children to successfully create and replay a short story with two actors. The actors should be shown in a short animation.
Assumption	User is already registered on the system.
Task 1	**Go to the page for composing a single story.**
	Steps: 1. Login to the system. 2. Go to **Compose Story -> Single Story.**
	Chose two actors for your story.
	Steps: 1. Move your cursor to the figure to get information about it. 2. Click or place the cursor on the triangle button to see other figures. 3. Place your cursor on the figure, click your mouse and drag it to the stage.
Task 3	**Make a simple animation and add a dialog.**
	Steps: 1. Drag and drop one actor to the left and the other to the right until they reach the edge of the stage. 2. Flip the actors. 3. Use the Flip function to flip the figure. 4. Move the actors back to the center of the stage. 5. Insert dialogue for the actors. 6. Use the Insert Dialog option to add the text. 7. Delete one actor. 8. Use the Delete function or move the figure to the wooden box.

Task 4	**Play your story.**
	Step: Click the Play button to play or re-play the story

Appendix A-2

The structured tasks of managing stories

Goal	Children to successfully share and unshare a story, delete a story, and edit a story's properties such as the title or the story's description.
Assumption	User is already registered on the system and has four stories.
Task 1	**Go to the page for managing a story.**
	Steps: 1. Login to the system. 2. Go to the **Manage Stories.**
Task 2	**Un-share two stories.**
	Steps: 1. Move your cursor to the **Publish/Unpublish** button on the right of the story's title which will be unshared. 2. Click the button and observe the button's image.
Task 3	**Share a story which is already unshared.**
	Steps: 1. Move your cursor to the **Publish/Unpublish** button on the right of the story's title which will be shared. 2. Click the button and observe the button's image.
Task 4	**Delete a story.**
	Step: 1. Click the Delete button on the right of the story's title which will be deleted.

Task 5	**Change the title of a story.**
	Steps: 1. Click the Edit button on the right of the story's title which will be edited. 2. Click the Edit button. 3. Change the story's title. 4. Click the Save button.

Appendix A-3

The structured tasks of commenting stories

Goal	Children to successfully comment on and rate a story.
Assumption	User is already registered and several stories are available on the system.
Task 1	**Go to the page for commenting and rating a story.**
	Steps: 1. Login to the system. 2. Go to the **Play a story.** 3. Click the Rating link and comment on the story below the story's title which will be rated and commented on.
Task 2	**Give a comment and a rating for the story.**
	Steps: 1. Click one of the rating options. 2. Write your comments in the comments box. 3. Click the Rate button

Appendix B-1

The structured tasks of structuring a story without the authoring tool

Goal	Children to successfully structure a story from random scenes without the authoring tool.
Assumption	User is not familiar with the story. The story is adopted from a traditional story from Indonesia.
Task 1	**Read four scenes.**
Task 2	**Create a story by arranging the four scenes.**
Task 3	**Rearrange the scenes and add another scene to it.**

Scene 1: The duck gets hurt by the dog

Once upon a time, a duck went to a small river in the jungle. It was late morning and as usual he wanted to eat his breakfast. For him, this meant small worms and little insects that he finds in the slime near the riverbank. A dog watched him do this and made fun of the duck. He told all the other animals that the duck was a dirty animal that ate slime. However, he, the dog, only ate good things! The duck felt hurt listening to this. The *kancil* (this is a deer) heard this and talked to the duck. He said, ”You should go to the river very early in the morning, then you will see what the dog really eats!”

Scene 2: The dog eats a rotting carcass

Early the next morning just before sunrise, the duck hid behind a big bush near the river. As usual, the dog came and stared digging near the riverside. Suddenly, he had a foul a rotting carcass in his muzzle. With pleasure, he devoured the rotting carcass. After seeing this, duck

laughed loudly. The dog became scared but after a few second she asked with a sweet voice, “Oh dear duck who told you that I have my meal at this time?”. The duck answered, “The *kancil* told me”. The dog got really angry and wanted to satisfy his desire for revenge. However, the *kancil* was hiding behind some other bushes and had seen everything.

Scene 3: The revenge

During the night, the dog crept up to the place where the *kancil* usually sleeps. From a distance, he saw something that had to be the sleeping *kancil*. He very quickly jumped to towards it, and using all his power he tried to bite the *kancil* on the head. But the *kancil* was not there! There was a stone instead and the dog broke its teeth. The *kancil* saw this because he was again hiding behind a group of trees.

Scene 4: The party

The *kancil* invited all of the animals to a party. Because everybody went to the party the dog went also. However, he could not eat anything because he did not want anyone to know what had happened. After a while, the *kancil* started telling some jokes, and the dog forgot to keep his mouth closed. The moment he laughed, everybody knew his secret.

Appendix B-2

The structured tasks of structuring a story with the authoring tool

Goal	Children to successfully structure a story in a linear sequence from random scenes with the authoring tool.
Assumption	The scenes are available on the system. User is not familiar with the story. The user is already registered to the system.
Task 1	**Go to the page for composing a storylist.**
	Steps: 1. Login to the system. 2. Go to **Compose Story ->A list of stories.**
Task 2	**Create a story list from the available stories.**
	Steps: 1. Drag and drop a story from the left container to the right container. 2. Repeat step 1 four times.
Task 3	**Save and play the storylist.**
	Steps: 1. Click the Save button. 2. Click the Play button.
Task 4	**Rearrange the storylist.**
	Steps: 1. Drag and drop a story to above or below another story. 2. Repeat step 1 several times. 3. Save and play the storylist.

Appendix B-3

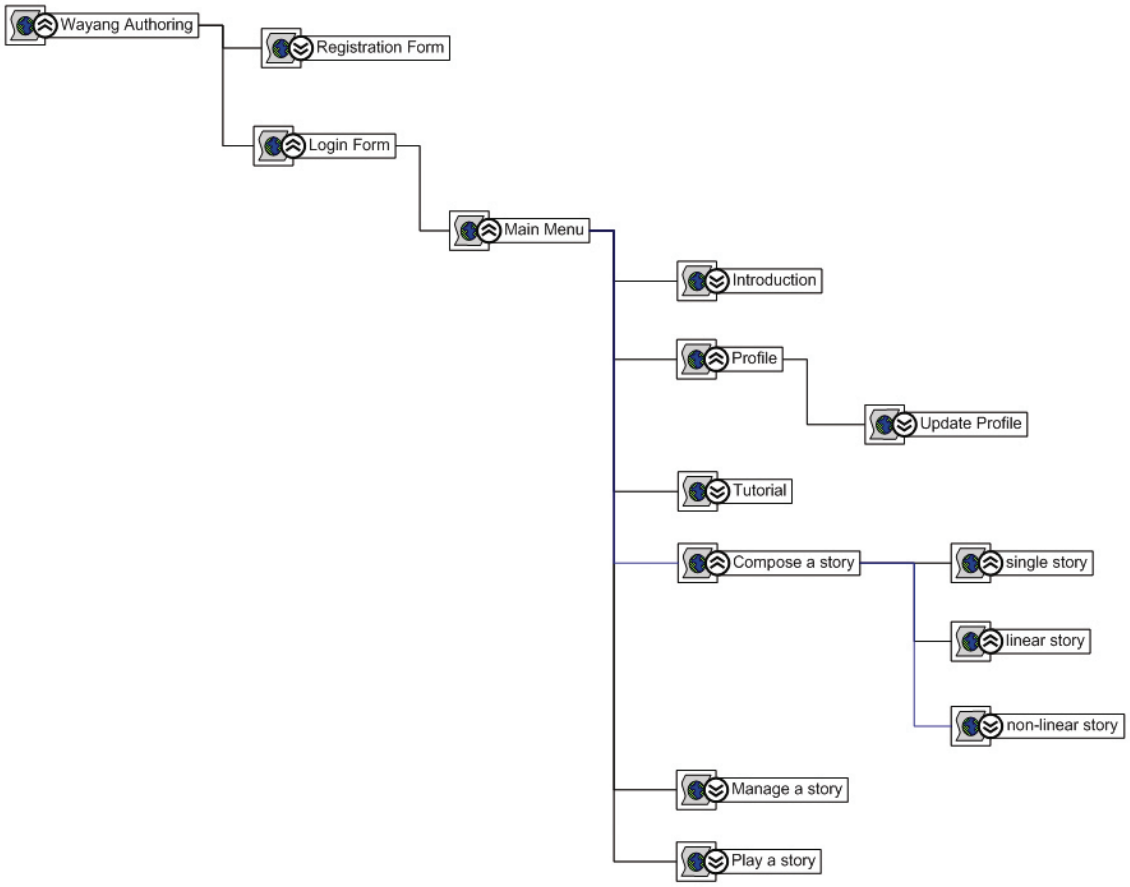
The structured tasks of structuring a story by using tagging model

Goal	Children to successfully structure a story in a non-linear sequence from random scenes by using the tagging system.
Assumption	The scenes are available on the system. User is not familiar with the story. The user is already registered to the system.
Task 1	**Go to the page for composing a story by using tagging.**
	Steps: 1. Login to the system. 2. Go to **Compose Story ->Non-linear story.**
Task 2	**Create a story sequence from the available stories.**
	Steps: 1. Select a story with a title **'Tester-30'**. 2. Click the link **Tag this story to**. 3. Chose a story title. 4. Observe the text **Leader** and **Follower**.
Task 3	**Add another story to the sequence.**
	Steps: 1. Click one story's title in the **Leader** list. 2. Click the link **Tag this story to**. 3. Chose a story title. 4. Observe the text **Leader** and **Follower**. 5. Repeat this task twice.
Task 4	**Play the story.**
	Steps: 1. Click the Play button.

Appendix C-1

The structure and screen shots of *Wayang* Authoring

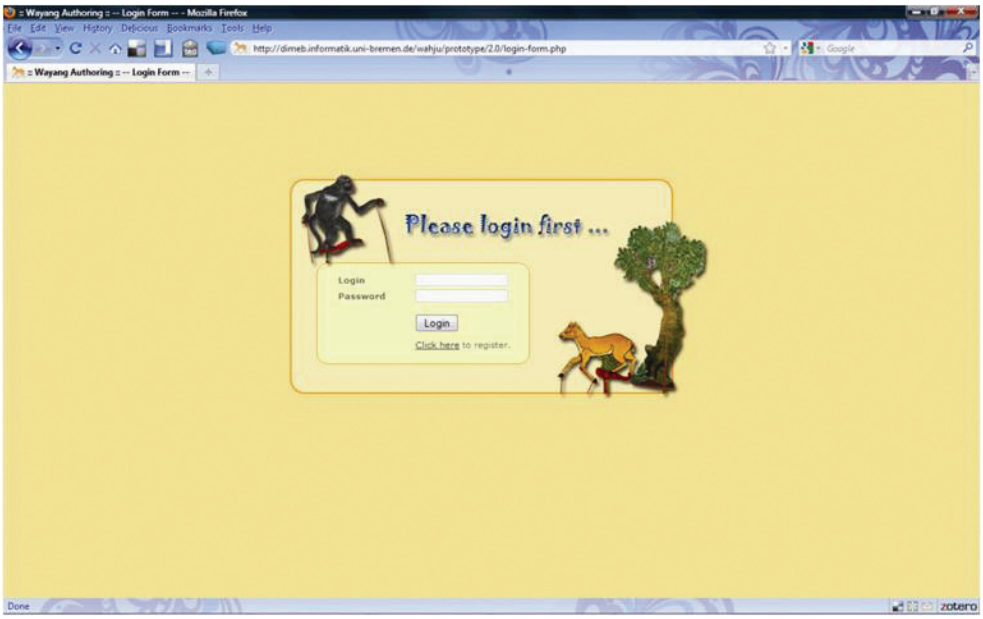
- **Site's structure**



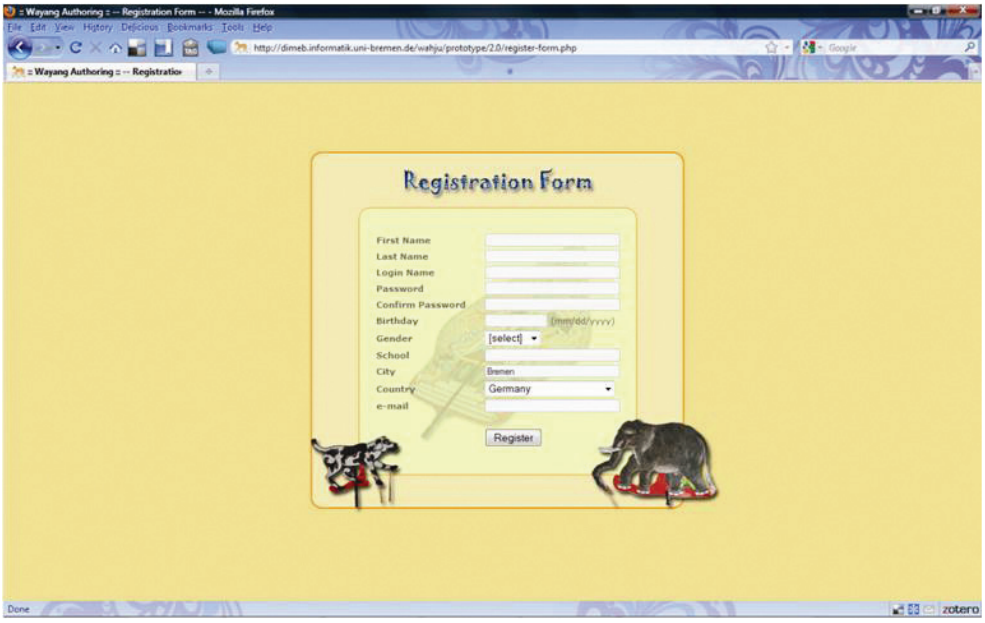
- **Site's screen shots**

  – Front page

  – Login Form

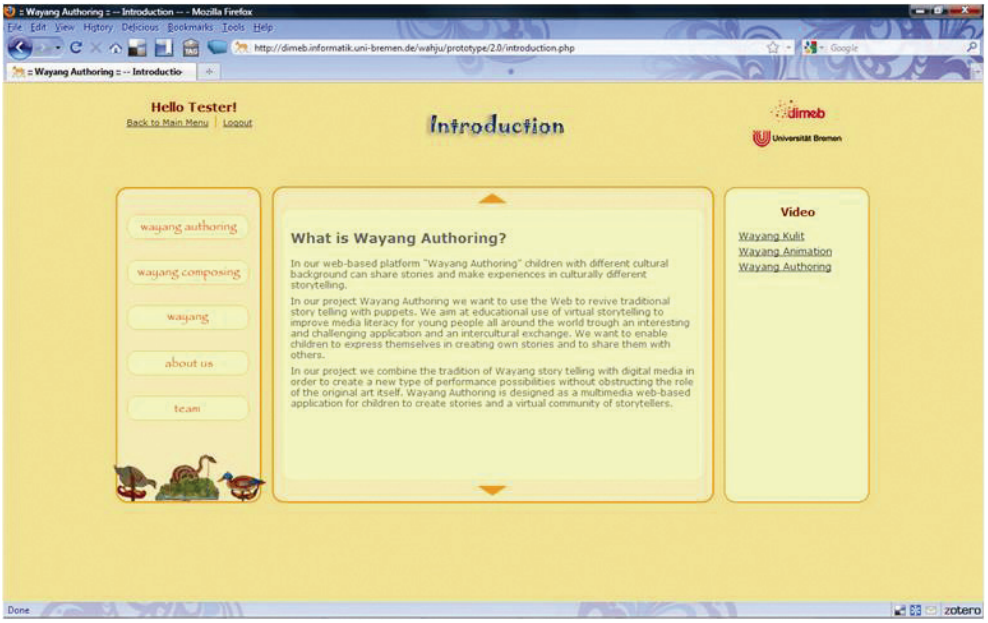


– Registration Form

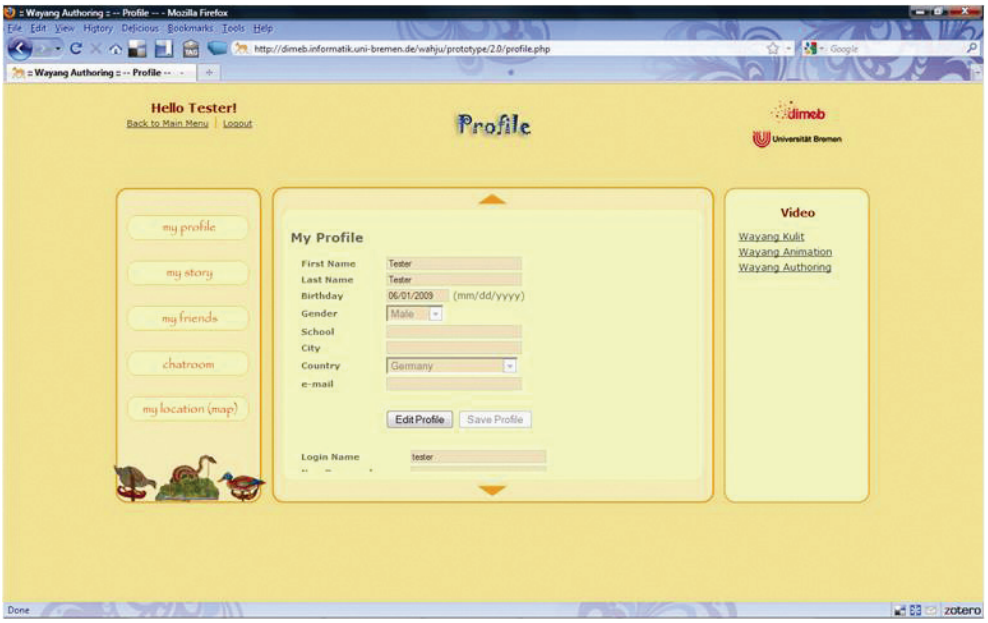


– Main menu page

– Introduction page



– Profile page



– Update profile page

– Tutorial page

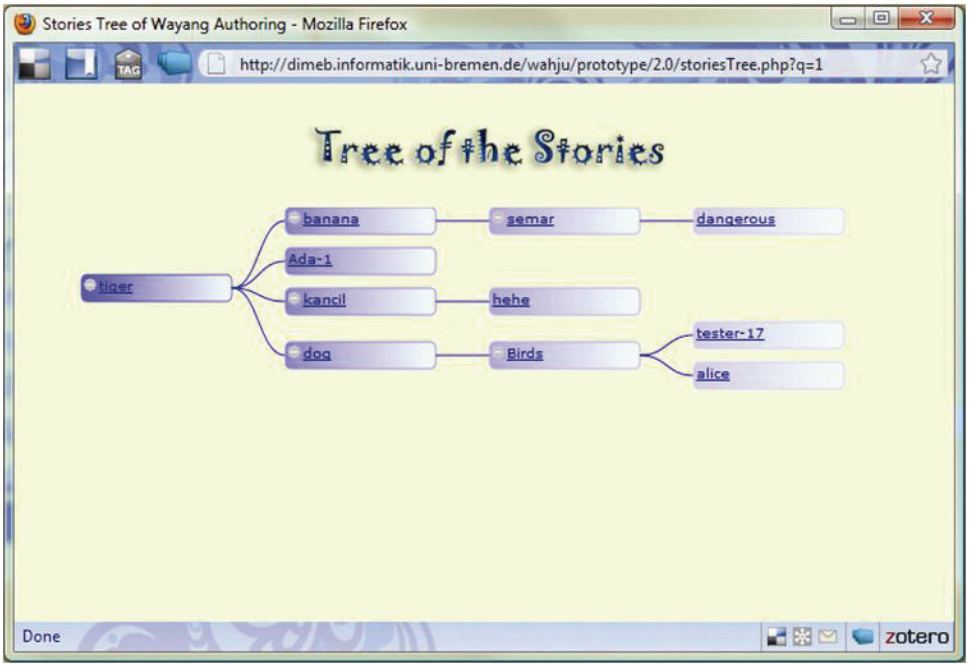
– Compose a story page

– Compose a single story page

– Compose a linear (storylist) page

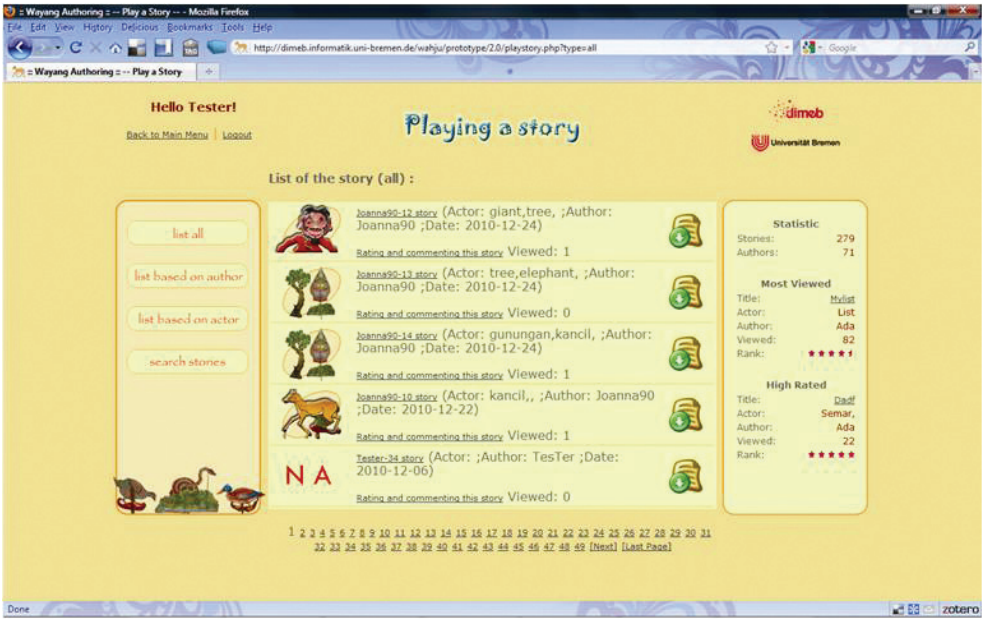
– Compose a non-linear story page

– Tree diagram of a non-linear story page



– Manage a story page

– Play a story page



Black and white mode

Color mode


:: Wayang Authoring :: -- Playing a Story --- Mozilla Firefox
http://dimeb.informatik.uni-bremen.de/wahju/prototype/2.0/play-wayangnew.php?name=test
Playing a story
100%
story line
Done
zotero

Appendix C-2

The list of functionalities of *Wayang* Authoring

Functionality	User Action	Result
Page: Registration		
Check availability of 'Login Name'.	User types the login name in the 'Login Name' field.	System will inform the user if the login name already exists.
Check password confirmation.	User types again the password in the 'Confirm Password' field.	System will inform the user if the confirmation entry does not match.
Automatically detect the city.	Nothing	System shows the city of the user based on the IP address.
Automatically detect the country.	Nothing	System shows the country of the user based on the IP address.
Check the required fields for the registration process.	User clicks 'Register' button.	System will show a message if the required field(s) is/are empty.
Register.	User clicks 'Register' button.	System stores the data in the database.
Page: Login		
Check the combination between 'Login Name' and 'Password'.	User clicks the 'Login' button after filling the login name and the password.	The main menu page will appear if the login process is successful.
Page: Main Menu		
Logout from the system.	User clicks the 'Logout' link.	The login page will appear.
Show information about each menu item.	User moves the cursor over the menu button.	System shows the information of the selected menu on the right container.
Select menu.	User clicks the 'Menu' button.	System will show the new page based on the chosen menu.
Page: Introduction		
Logout from the system.	User clicks the 'Logout' link.	The login page will appear.
Return to the main menu.	User clicks the 'Back to main menu' link.	The main menu page will appear.

Functionality	User Action	Result
Show the information.	User clicks the menu option button.	The information will be shown in the center container.
Page: Tutorial		
Logout from the system.	User clicks the 'Logout' link.	The login page will appear.
Return to the main menu.	User clicks the 'Back to main menu' link.	The main menu page will appear.
Show the tutorial.	User clicks the menu option button.	The information will be shown on the center container.
Page: Profile		
Logout from the system.	User clicks the 'Logout' link.	The login page will appear.
Return to the main menu.	User clicks the 'Back to main menu' link.	The main menu page will appear.
Show the user's profile.	User clicks the 'my profile' button.	The user's profile will be shown in the center container.
Edit the user's profile.	User clicks the 'Edit profile' button.	The fields and the 'Save Profile' button will be enabled.
Save the user's profile.	User clicks the 'Save Profile' button.	The fields and the 'Save Profile' button will be disabled.
Change the user's password.	User clicks the 'Change password' button.	The password fields and the 'Save Password' button will be enabled.
Save the user's password.	User clicks the 'Save password' button.	The password fields and the 'Save Password' button will be disabled.
Change the user's profile photo.	User clicks the 'Change photo' button.	The 'Save Photo' button will be enabled.
Save the user's profile photo.	User clicks the 'Save photo' button.	The profile's photo will be updated and the 'Save Photo' will be disabled.
Chat with others.	User clicks the 'Chatroom' button.	The chatroom will be shown and activated.
Show friends' locations on a map.	User clicks the 'My location (map)' button.	The map and the friend list based on the city will be shown.
Page: Compose Story		
Compose a single story.	User clicks the 'Single Story' option.	The page for composing a single story will appear.
Compose a linear story (storylist).	User clicks the 'List of Story' option.	The page for composing a storylist (a linear structure) will appear.

Functionality	User Action	Result
Compose a non-linear story.	User clicks the 'Non-linear Story' option.	The page for composing a non-linear story structure will appear.
Page: Composing a single story		
Logout from the system.	User clicks the 'Logout' link.	The login page will appear.
Back to the main menu.	User clicks the 'Back to main menu' link.	The main menu page will appear.
Browse figures.	User moves the cursor on the triangle button or clicks this button.	The collections of figures will be shown.
Select a figure and put it on the stage.	User clicks on a figure, drags and drops it onto the stage.	A copy of the figure will be put onto the stage.
Move a figure on the stage.	User clicks on the figure and drags it.	The figure's position will be updated.
Flip a figure on the stage.	User clicks the figure to activate the pop-up menu. Select the 'Flip' button.	The figure will be transposed on the vertical axis.
Rotate a figure on the stage.	User clicks the figure to activate the pop-up menu. Select the 'Rotate' button.	The figure will be rotated.
Insert text ontoa figure on the stage.	User clicks the figure to activate the pop-up menu. Select the 'Insert text' button.	The pop-up window to type the text will appear.
Delete a figure.	User clicks the figure to activate the pop-up menu. Select the 'Delete' button. Or drag the figure to the wooden box.	The figure will disappear from the stage.
Clear the stage.	User clicks the 'Clear the stage' button under the stage.	The stage will be empty.
Start the recording process.	User put a figure to the stage when the stage is empty.	The recording process will be started automatically.
Stop the recording process.	User clicks the 'Play' or 'Stop' button.	The recording process will be stopped and the story will be played.
Play and replay a story.	User clicks the 'Play' button.	The story will be played.
Change the color mode when user plays the story.	User clicks the 'Change Color B/W' button.	The figure will be changed to either in color or black and white.
Show the story's description.	User clicks the 'Story's description' button'.	The story's description window will be shown.

Functionality	User Action	Result
Edit the story's description.	User clicks the 'Story's Description' button, then clicks the 'Edit' button.	The pop-up window in which to write the story's description will be shown.
Switch on/off the figure's sound.	User clicks the 'Sound' button.	The figure's sound will be switched on/off.
Page: Composing a storylist		
Logout from the system.	User clicks the 'Logout' link.	The login page will appear.
Back to the main menu.	User clicks the 'Back to main menu' link.	The main menu page will appear.
Show all the stories.	User clicks the 'List all' button.	The entire story will be listed and sorted by date in the middle container.
Show the stories based on the author.	User clicks the 'List based on the author' button. Then selects an author from the list.	The stories based on the selected author will be listed and sorted by date in the middle container.
Show the stories based on the actor.	User clicks the 'List based on the actor' button. Then selects an actor from the list.	The stories based on the selected actor will be listed and sorted by date in the middle container.
Select an available story and put it on the list.	User clicks a story from a list in the middle container and drags it to the 'My story' container.	The story will be listed in the right container.
Remove a story from the 'My story' container.	User clicks the story and drags it to the middle container.	The story will be deleted from the right container.
Change the story's sequence in the 'My story' container.	User clicks a story in the 'My story' container and drags it up or down.	The story will be moved and put above or below another story.
Play the storylist.	User clicks the 'Play' button.	The storylist will be played starting from the first story on the list and followed by the next story sequentially.
Save the storylist.	User clicks the 'Save' button. Then types the storylist's name.	The storylist will be stored in the database.
Page: Composing a story by using tagging		
Logout from the system.	User clicks the 'Logout' link.	The login page will appear.
Back to the main menu.	User clicks the 'Back to main menu' link.	The main menu page will appear.
Select a story.	User clicks an actor in the tag cloud. Then chooses a story from the list.	The story's properties will be displayed.

Functionality	User Action	Result
Connect a story to another story.	User clicks the 'Tag this story to' link. Then chooses a story from the link.	A tag will be added to the story. The information on the 'Leaders' property will be updated.
Remove a tag from a story.	User clicks on the story's title on the 'Leaders' property and clicks the 'Delete' button.	The tag will be removed from the story. The information on the 'Leaders' property will be updated.
Page: Play a story		
Logout from the system.	User clicks the 'Logout' link.	The login page will appear.
Back to main menu.	User clicks the 'Back to main menu' link.	The main menu page will appear.
Show all the stories.	User clicks the 'List all' button.	The entire story will be listed and sorted by date.
Show the stories based on the author.	User clicks the 'List based on the author' button. Then selects an author from the list.	The stories based on the selected author will be listed and sorted by date.
Show the stories based on the actor.	User clicks the 'List based on the actor' button. Then selects an actor from the list.	The stories based on the selected actor will be listed and sorted by date.
Search a story.	User clicks the 'Search a story' button. Then types the title and/or selects the author and/or selects the actor.	The stories based on the selection criteria will be listed and sorted by date.
Play a story.	User clicks the story's icon or the story's title link.	The story will be played.
Change the color mode when the user plays the story.	User plays a story. Then clicks 'Change Color B/W' button.	The figure will be changed to either in color or black and white.
Show the story's description.	User plays a story. Then clicks 'Story's description' button.	The story's description window will be shown.
Give a comment and a rating for a story.	User clicks the link 'Rating and commenting this story'. Then the user selects the rate and types the comment and clicks the 'Rate' button.	The rating and comment will be stored in the database and the list of the stories will be updated.
Page: Managing Stories		
Logout from the system.	User clicks the 'Logout' link.	The login page will appear.
Back to the main menu.	User clicks the 'Back to main menu' link.	The main menu page will appear.

Functionality	User Action	Result
Show all the user's stories.	User clicks the 'List all' button.	The entire story will be listed and sorted by date.
Show the user's stories which are published.	User clicks the 'List published stories' button.	The user's stories which are published will be listed and sorted by date.
Show the user's stories which are unpublished.	User clicks the 'List unpublished stories' button.	The user's stories which are unpublished will be listed and sorted by date.
Publish/unpublish a story.	User clicks the 'Publish/unpublish' button.	The 'Publish/unpublish' button will be changed.
Delete a story.	User clicks the 'Delete' button.	The story will be deleted and the list will be updated.
Download a story.	User clicks the 'Download' button.	The story will be downloaded in an XML file.
Edit a story's properties.	User clicks the 'Edit' button.	The pop-up window to update the story's properties will be shown.
Upload a story.	User clicks the 'Upload stories' button. Then selects the story's name and clicks 'Upload' button.	The story's file will be uploaded to the server and the story list will be updated.

Appendix C-3

The example of a single story

One single story is written by author to show, how the data of the story in XML format is stored. The first part of the XML file contains information about the author, the story's title, the story's actors, the story's date, and the description of the story. The next parts store information of the actor's properties including coordinates value, dialogues, and status of sound, flip or rotation.

- The screen shot

- The XML file

```
<story>
   <info>
       <author>tester</author>
       <title>tester-34</title>
       <actors>elephant, tiger<actors/>
       <date>06/01/2011</date>
       <description>no description</description>
   </info>

   <scenes title="tester-34" sound="default no sound">
       <scene number="1" time="1" isFigure="true" flip="false" sound="true"
       dialog="false" rotationL="false" rotationR="false">
```

```
   <actor>elephant</actor>
   <pos-x>81</pos-x>
   <pos-y>169</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="2" time="2" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>81</pos-x>
   <pos-y>169</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="3" time="3" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>81</pos-x>
   <pos-y>170</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="4" time="4" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>96</pos-x>
   <pos-y>175</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="5" time="5" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>100</pos-x>
   <pos-y>176</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="6" time="6" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>101</pos-x>
   <pos-y>177</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="7" time="7" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>102</pos-x>
   <pos-y>177</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="8" time="8" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>104</pos-x>
   <pos-y>177</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="9" time="9" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>105</pos-x>
   <pos-y>177</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="10" time="10" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>107</pos-x>
   <pos-y>177</pos-y>
   <text-dialog> </text-dialog>
</scene>
```

```
<scene number="11" time="11" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>109</pos-x>
   <pos-y>177</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="12" time="12" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>111</pos-x>
   <pos-y>177</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="13" time="13" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>114</pos-x>
   <pos-y>177</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="14" time="14" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>117</pos-x>
   <pos-y>177</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="15" time="15" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>117</pos-x>
   <pos-y>178</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="16" time="16" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>118</pos-x>
   <pos-y>178</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="17" time="17" isFigure="true" flip="false" sound="true"
dialog="true" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>118</pos-x>
   <pos-y>178</pos-y>
   <text-dialog>hiiii</text-dialog>
</scene>
<scene number="18" time="18" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>118</pos-x>
   <pos-y>177</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="19" time="19" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>117</pos-x>
   <pos-y>176</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="20" time="20" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>116</pos-x>
   <pos-y>176</pos-y>
   <text-dialog> </text-dialog>
```

```
</scene>
<scene number="21" time="21" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>113</pos-x>
   <pos-y>175</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="22" time="22" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>109</pos-x>
   <pos-y>175</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="23" time="23" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>104</pos-x>
   <pos-y>174</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="24" time="24" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>102</pos-x>
   <pos-y>174</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="25" time="25" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>99</pos-x>
   <pos-y>174</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="26" time="26" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>97</pos-x>
   <pos-y>175</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="27" time="27" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>96</pos-x>
   <pos-y>176</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="28" time="28" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>94</pos-x>
   <pos-y>178</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="29" time="29" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>93</pos-x>
   <pos-y>179</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="30" time="30" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>elephant</actor>
   <pos-x>91</pos-x>
   <pos-y>180</pos-y>
```

```
   <text-dialog> </text-dialog>
</scene>
<scene number="31" time="31" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>tiger</actor>
   <pos-x>390</pos-x>
   <pos-y>190</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="32" time="32" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>tiger</actor>
   <pos-x>390</pos-x>
   <pos-y>190</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="33" time="33" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>tiger</actor>
   <pos-x>390</pos-x>
   <pos-y>190</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="34" time="34" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>tiger</actor>
   <pos-x>389</pos-x>
   <pos-y>190</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="35" time="35" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>tiger</actor>
   <pos-x>360</pos-x>
   <pos-y>208</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="36" time="36" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>tiger</actor>
   <pos-x>357</pos-x>
   <pos-y>208</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="37" time="37" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>tiger</actor>
   <pos-x>355</pos-x>
   <pos-y>208</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="38" time="38" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>tiger</actor>
   <pos-x>354</pos-x>
   <pos-y>208</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="39" time="39" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>tiger</actor>
   <pos-x>352</pos-x>
   <pos-y>206</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="40" time="40" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>tiger</actor>
   <pos-x>351</pos-x>
```

```
   <pos-y>203</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="41" time="41" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>tiger</actor>
   <pos-x>347</pos-x>
   <pos-y>200</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="42" time="42" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>tiger</actor>
   <pos-x>343</pos-x>
   <pos-y>197</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="43" time="43" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>tiger</actor>
   <pos-x>342</pos-x>
   <pos-y>196</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="44" time="44" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>tiger</actor>
   <pos-x>341</pos-x>
   <pos-y>196</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="45" time="45" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>tiger</actor>
   <pos-x>340</pos-x>
   <pos-y>197</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="46" time="46" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>tiger</actor>
   <pos-x>339</pos-x>
   <pos-y>199</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="47" time="47" isFigure="true" flip="false" sound="true"
dialog="true" rotationL="false" rotationR="false">
   <actor>tiger</actor>
   <pos-x>339</pos-x>
   <pos-y>199</pos-y>
   <text-dialog>hiiii........</text-dialog>
</scene>
<scene number="48" time="48" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>tiger</actor>
   <pos-x>339</pos-x>
   <pos-y>198</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="49" time="49" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>tiger</actor>
   <pos-x>342</pos-x>
   <pos-y>198</pos-y>
   <text-dialog> </text-dialog>
</scene>
<scene number="50" time="50" isFigure="true" flip="false" sound="true"
dialog="false" rotationL="false" rotationR="false">
   <actor>tiger</actor>
```

```
            <pos-x>349</pos-x>
            <pos-y>197</pos-y>
            <text-dialog> </text-dialog>
         </scene>
         <scene number="51" time="51" isFigure="true" flip="false" sound="true"
         dialog="false" rotationL="false" rotationR="false">
            <actor>tiger</actor>
            <pos-x>355</pos-x>
            <pos-y>197</pos-y>
            <text-dialog> </text-dialog>
         </scene>
         <scene number="52" time="52" isFigure="true" flip="false" sound="true"
         dialog="false" rotationL="false" rotationR="false">
            <actor>tiger</actor>
            <pos-x>359</pos-x>
            <pos-y>197</pos-y>
            <text-dialog> </text-dialog>
         </scene>
         <scene number="53" time="53" isFigure="true" flip="false" sound="true"
         dialog="false" rotationL="false" rotationR="false">
            <actor>tiger</actor>
            <pos-x>363</pos-x>
            <pos-y>198</pos-y>
            <text-dialog> </text-dialog>
         </scene>
         <scene number="54" time="54" isFigure="true" flip="false" sound="true"
         dialog="false" rotationL="false" rotationR="false">
            <actor>tiger</actor>
            <pos-x>368</pos-x>
            <pos-y>201</pos-y>
            <text-dialog> </text-dialog>
         </scene>
         <scene number="55" time="55" isFigure="true" flip="false" sound="true"
         dialog="false" rotationL="false" rotationR="false">
            <actor>tiger</actor>
            <pos-x>370</pos-x>
            <pos-y>203</pos-y>
            <text-dialog> </text-dialog>
         </scene>
         <scene number="56" time="56" isFigure="true" flip="false" sound="true"
         dialog="false" rotationL="false" rotationR="false">
            <actor>tiger</actor>
            <pos-x>371</pos-x>
            <pos-y>203</pos-y>
            <text-dialog> </text-dialog>
         </scene>
         <scene number="57" time="57" isFigure="true" flip="false" sound="true"
         dialog="false" rotationL="false" rotationR="false">
            <actor>tiger</actor>
            <pos-x>374</pos-x>
            <pos-y>203</pos-y>
            <text-dialog> </text-dialog>
         </scene>
      </scenes>
   </story>
```

Appendix C-4

The selected source codes of *Wayang* Authoring

- The main Javascript libraries for *Wayang* Auhoring

  - `scriptaculous.js`
    - script.aculo.us is a JavaScript library that built on the Prototype JavaScript Framework and providing dynamic visual effects and user interface elements via the Document Object Model (DOM).
    - Source: `http://script.aculo.us/`

  - `prototype.js`
    - Prototype is a JavaScript Framework that aims to support the development of dynamic web applications in easy way.
    - Source: `http://prototypejs.org/`

  - `proto.menu.0.6.js`
    - Proto.Menu is a lightweight and simple prototype-based solution for context menu functionality on a web page.
    - Source: `http://kangax.github.com/proto.menu/`

  - `ECOTree.js`
    - ECOTree is a JavaScript component which renders a tree on the screen using VML (Vector Markup Language) in Internet Explorer 6+ or the `<canvas>` element in Firefox 1.5+.
    - Source: `http://www.codeproject.com/KB/scripting/graphic_javascript_tree.aspx?fid=354100&fr=1&df=90&mpp=25&noise=3&sort=Position&view=Quick#xx0xx`

- Source code for creating draggable figure, recording the movement and figure's properties

```
new Draggable(newimg.id, {zindex:0, revert:false, onDrag: function(){
    window.status=document.getElementById(newimg.id).style.zIndex=
            Draggable.sharedZindex++;

    document.getElementById('panel-stage').style.display = 'none';
    document.getElementById('title').style.visibility = 'visible';
    activeDrag=true;
    document.body.style.cursor = 'pointer';
    mousex1 = document.getElementById(newimg.id).style.left;
    mousey1 = document.getElementById(newimg.id).style.top;
    mouseXBefore[newimg.id] = document.getElementById(newimg.id).style.left;
    mouseYBefore[newimg.id] = document.getElementById(newimg.id).style.top;
    flipStatus=flipStatusNow[newimg.id];
```

```
    coordData =
    trueId(newimg.id)+','+document.getElementById(newimg.id).style.left+','+document.
    getElementById(newimg.id).style.top+','+flipStatus+','+soundStatus+','+textStatus
    +','+storyText+','+rotateStatusNow[newimg.id];

    if (state == 2){
            coordList.push(coordData);
    }

    document.getElementById('monitor').value = 'Actor: '+newimg.id+' , Position:
    '+document.getElementById(newimg.id).style.left+','+document.getElementById(newim
    g.id).style.top+' , Flip status:
    '+flipStatus+','+textStatus+','+storyText+','+flipBefore[newimg.id]+',Rotate:
    '+rotateStatusNow[newimg.id];

    }, onEnd: function(){

    activeDrag=false;
    document.body.style.cursor = 'default';

}});
```

- Source code for AJAX request

```
var myAjax = new Ajax.Request(
           "fwritestory.php" , { method: 'post', parameters: params});
```

- Source code of the XML writer

```
// XML data preparation

$i=1;
$count=0;
$storyPerLine=explode("|",$truecoord);
$totalScene=(count($storyPerLine))-1;

$storyElement=explode(",",$storyPerLine[$i]);
$actor=$storyElement[0];

$writeTo = 'true';
$dialogBefore = '';

@date_default_timezone_set("GMT");

$writer = new XMLWriter();
// Output directly to the user

$writer->openURI($XMLfilename.'.xml');
$writer->startDocument('1.0" encoding="ISO-8859-1');

$writer->setIndent(4);

//declare it as an story document

$writer->startElement('story');

// story's information
//----------------------------------------------------
$writer->startElement('info');
$writer->writeElement('author', $foldername);
$writer->writeElement('title', $title);
```

```
$writer->writeElement('actors', $actors);
$writer->writeElement('date', date("d/m/Y"));
$writer->writeElement('description', $description);
$writer->endElement(); // Info
//-----------------------------------------------------

// scene's information
$writer->startElement('scenes');
$writer->writeAttribute('title', $title);
$writer->writeAttribute('sound', 'default no sound');
//-----------------------------------------------------

while ($i<$totalScene){
   $storyElement=explode(",",$storyPerLine[$i]);
   $actor=$storyElement[0];

   $background =
   array("grass","grass1","grass2","grass3","grass4","grass5","grass6","tree","tree1
   ","tree2","tree3","tree4","tree5","tree6","bamboo","bamboo1","bamboo2","bamboo3",
   "bamboo4","bamboo5","bamboo6","banana","banana1","banana2","banana3","banana4","b
   anana5","banana6","cucumber","cucumber1","cucumber2","cucumber3","cucumber4","cuc
   umber5","cucumber6","mound","mound1","mound2","mound3","mound4","mound5","mound6"
   );

   if (in_array($actor,$background))
     $figure='false';
   else
     $figure='true';

   $posx=$storyElement[1];
   $posy=$storyElement[2];
   $flipStat=$storyElement[3];

   if ($flipStat=='n')
          $flipStat='false';
   else
          $flipStat='true';

   $soundStat=$storyElement[4];
   $textStat=$storyElement[5];
   $dialog=$storyElement[6];

   if ($dialog==$dialogBefore && $dialog!='') {
          $writeTo = 'false';

   } else {
          $count = $count+1;
   }

   $dialogBefore=$dialog;

   if ($dialog==='') {
          $dialog=" ";
   }

   $rotate=$storyElement[7];

   if ($rotate=='rR') {
          $rotateL='false';
          $rotateR='true';}
   elseif ($rotate=='rL'){
          $rotateL='true';
          $rotateR='false';}
   else {
          $rotateL='false';
          $rotateR='false';}

   if ($writeTo=='true') {
```

```
    $writer->startElement('scene');
            $writer->writeAttribute('number', $count);
            $writer->writeAttribute('time', $count);
            $writer->writeAttribute('isFigure', $figure);
            $writer->writeAttribute('flip', $flipStat);
            $writer->writeAttribute('sound', $soundStat);
            $writer->writeAttribute('dialog', $textStat);
            $writer->writeAttribute('rotationL', $rotateL);
            $writer->writeAttribute('rotationR', $rotateR);
            $writer->writeElement('actor', $actor);
            $writer->writeElement('pos-x', $posx);
            $writer->writeElement('pos-y', $posy);
            $writer->writeElement('text-dialog', $dialog);
    $writer->endElement();
    }

    $writeTo = 'true';
    $i++;
}
//-----------------------------------------------------

// End scenes
$writer->endElement();

// End story
$writer->endElement();

$writer->endDocument();

$writer->flush();

chmod($XMLfilename.'.xml',0777);

$dir = "story/".$foldername;

if($handle = opendir($dir))
{
    while($file = readdir($handle))
    {
        clearstatcache();
        if(is_file($dir.'/'.$file)) {
           $find=substr_count($file,"@");
           if ($find > 0) {
                          $myFile = $dir."/".$file;
                          unlink($myFile);
             }
        }
    }
    closedir($handle);
}
```

- Source code of the XML parser

```
if (!($fp=@fopen($file, "r"))) die ("Couldn't open XML.".$file);
$usercount=0;
$userdata=array();
$state='';

function startElementHandler ($parser,$name,$attrib){
    global $usercount;
    global $userdata;
    global $state;

    switch ($name) {
        case $name=="SCENE" : {
```

```
                $userdata[$usercount]["number"] = $attrib["NUMBER"];
                $userdata[$usercount]["isFigure"] = $attrib["ISFIGURE"];
                $userdata[$usercount]["flip"] = $attrib["FLIP"];
                $userdata[$usercount]["sound"] = $attrib["SOUND"];
                $userdata[$usercount]["dialog"] = $attrib["DIALOG"];
                $userdata[$usercount]["rotationL"] = $attrib["ROTATIONL"];
                $userdata[$usercount]["rotationR"] = $attrib["ROTATIONR"];

                break;
        }
        default : {$state=$name;break;}
    }
}

function endElementHandler ($parser,$name){
    global $usercount;
    global $userdata;
    global $state;
    $state='';
    if($name=="SCENE") {$usercount++;}
}

function characterDataHandler ($parser, $data) {
    global $usercount;
    global $userdata;
    global $state;
    if (!$state) {return;}
    if ($state=="ACTOR") { $userdata[$usercount]["actor"] = $data;}
    if ($state=="POS-X") { $userdata[$usercount]["pos-x"] = $data;}
    if ($state=="POS-Y") { $userdata[$usercount]["pos-y"] = $data;}
    if ($state=="TEXT-DIALOG") { $userdata[$usercount]["text"] = $data;}
}

if (!($xml_parser = xml_parser_create())) die("Couldn't create parser.");
xml_set_element_handler( $xml_parser, "startElementHandler", "endElementHandler");
xml_set_character_data_handler( $xml_parser, "characterDataHandler");

while( $data = fread($fp, 4096)){
    if(!xml_parse($xml_parser, $data, feof($fp))) {
    break;}

}
xml_parser_free($xml_parser);
```

Declaration

I declare that, I have carried out this work myself, all literally or content-related quotations from other sources are clearly pointed out, and no other sources or aids other than the ones specified are used.

I also confirm that this doctoral thesis has not been previously submitted or published in any national and international universities.

Bremen, June 2011

Place, Date

Signature