A Framework for Virtual Storytelling Using the Traditional Shadow Play

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Abstract

The virtual environment technology has emerged as a great structure for virtual storytelling with the support of multimedia interaction. The traditional shadow play which is a traditional storytelling art has a great potential to be incorporated into a virtual storytelling environment. In this paper we explore and investigate the possibility of developing a virtual storyteller that integrates the elements of the traditional shadow play in a virtual storytelling environment. A framework that maps the traditional shadow play to virtual storytelling environment including the proposed methodology for such an undertaking and endeavour is also discussed.

1. Introduction

A storyteller has been around for ages in most societies and has manifested children and even adults with various stories to build up their imagination and morality. A storyteller plays an important role in attracting a listener's attention to focus on a story. The storyteller must be able to express a story using various facial expression, intonation and gestures.

The purpose of a virtual storyteller is to digitally imitate the role of a traditional storyteller. A virtual environment is used to represent a virtual storyteller or puppets and also scenes of a story. A virtual storyteller is responsible in presenting stories to its audience and can be a synthetic character that tells stories or an environment that narrates and play stories concurrently. Whether it is a character or an environment, the main role of a virtual storyteller is to tell stories in a digital manner. When a story is read, a virtual storyteller must be able to find the right combination of emotions, scenes, music and gestures at the right portion of a story. A virtual storyteller must be able to process natural language because a speech synthesiser is required to synthesise into speech the texts that are input into the system. The text-to-speech method must be able to cater a large database of vocabulary to detect words. Another form of intelligence that is very well desired in a virtual storyteller is human-machine interaction. A virtual storyteller should be able to accept interactions from its audience and process it accordingly. For example, when the audience want to change a certain scene while maintaining the same storyline, the virtual storyteller must process it accordingly.

Here in South East Asia our society is slowly losing a beautiful and complex cultural masterpiece. This is none other than the traditional art of shadow play or Wayang Kulit in Malay, a medium of storytelling that has been passed down from generations to generations. Usually the traditional stories of the shadow play are based on Hindu epics such as Mahabhrata and Ramayana that have been assimilated with our own cultural flavour. The stories are used to teach moral values through trials and tribulations of the characters in a story. Each character represents values that people should or should not aspire to. However the story and characters alone are not the only components that make up the complex and beautiful experience of the shadow play.

The puppets in the shadow play are made of buffalo or cow hide and they are carved and painted uniquely because every puppet portrays a different character. The puppeteer or Tok Dalang needs to narrate stories to his audience with his immense skill and patience. A puppeteer must be able to control the movement and provide voice for every puppet on stage while at times, able to sing and play various traditional instruments to provide music for the show, backed by a gamelan orchestra. A gamelan orchestra uses various combinations of instruments that include tuned gongs,
instruments with tuned keys, a two-stringed fiddle, xylophones, flutes and drums.

The objective of this paper is to explore and investigate the possibility of developing a virtual storyteller that integrates the elements of the traditional shadow play. The elements of both storytelling methods i.e. the various existing virtual storytellers and the traditional storytelling method through the shadow play are studied and compared in order to provide the framework for such an undertaking and endeavour. Generally, this study will lead to a good head start for further research in digitally preserving this dying art through virtual storyteller technology for the future generations to cherish.

In the next section, we provide a literature review of related work namely the existing work on digital storytelling and virtual storyteller, and the existing efforts in the computerisation and digitisation of the traditional shadow play. This is followed by a discussion on a proposed framework that maps the traditional shadow play to virtual storytelling. This includes a discussion on the proposed methodology for such an undertaking and endeavour.

2. Related work

2.1. Digital storytelling and virtual storyteller

Over the past few years, numerous advancements and approaches in digital storytelling and virtual storyteller have been reported. These advancements, all with their unique approaches serve as guidelines and standards for those that intend to tackle the exciting technology of virtual storytelling.

Silva et al [1] have developed a virtual storyteller system called the Papous. This system incorporates the use of computer-generated characters that are used to narrate a story. With the interaction of the virtual character in a virtual environment that changes to reflect the storyline, the virtual character also displays proper voice intonation and gestures to bring about a realistic experience to the audience. This system is a technological marvel as well as a unique teaching and edutainment tool for the future. The entire process as shown in Figure 1 actually consists of different processes or modules that come together to produce the desired effect. The input manager controls the flow of the story by reading the story and at given places where appropriate, tags are positioned to indicate where the virtual character should show certain expression or the environment should register a change. These actions are done by the Deliberative Module and the Environmental Control Module. The Deliberative Module is further divided into the Affective Speech Module, which from its namesake controls the speech of the virtual character, and the Affective body Expression module which control the bodies of the virtual characters.

![Figure 1. Architecture of Papous virtual storyteller](image)

However, the Papous system reflects the differences in approach that two very varied schools of thought hold on virtual storyteller. In some cases, there is a call for more interaction in the story instead of it being so linear. Katre [2] states that there are three distinct and different forms of stories namely defined, evolving and epicentric stories. There are also two different styles of storytelling i.e. narrative and interactive. Narratives are stories that are linear and have a predetermined end while interactive ones may change according to their tastes. However, the fear is that the user might lose sight of the main story and in the end lose interest. This is solved with the use of epicentric stories where there can be numerous side paths but in which all evolve along a common main story.

2.2. Computerisation and digitisation of the traditional shadow play

Computerisation of shadow play with the aim of preserving the art form started back in 1997 by Rahman [3] when an experimental attempt at combining the traditional shadow play together with three-dimensional model using the "IRIS Showcase" Silicon Graphics software. Later, a production called Computer Graphics Imaginary (CGI) Wayang [4] converts the world of shadow play into 3D world to attract the attention of younger generation in appreciating the traditional shadow play.

Recently Zhu et al [5] have worked on a system to visually simulate the Chinese shadow play. The system uses high quality digital photographs of the original puppets that are then used to recreate the puppets virtually through methods such as texturing and assigning material properties. The shadow creation in this system involves photon mapping which simulates the movement of photon particles that allows for computation of the light on specular or diffused surfaces. This method was combined with Monte Carlo
ray method to reproduce a photorealistic effect. Since the puppet would be a 2D image on the screen as it appears in real life, the multi polygon table usually used for rendered objects was replaced with 2D polygon tables, thus simplifying the computation process. This work by far comes closest to the effort in providing a virtual storytelling that integrates the elements of the traditional shadow play.

3. Proposed framework

3.1. Challenges

In order to carry out the task of integrating the traditional shadow play into digital storytelling environment successfully, we need to consider all possible eventualities that we might have to deal with. We can classify them into two categories namely human and technical issues. The first category relates to problems that might arise from the people involved in the shadow play. For example, we require the cooperation of the puppeteers. However this is not something easily achieved. They might be reluctant to release their knowledge and expertise to us as they might feel that the art of shadow play belongs completely to them. They would not want outsiders to partake in their art and cherish the safe-kept traditions for a long time. Though this issue might seem rather blasé it is very important. The knowledge of the shadow play is wholly kept by the puppeteers, from the sound to story, they all to all intents and purposes the director, the sound effect manager, the visual effect manager and the lead actor. Thus it is imperative that we gain their cooperation and trust.

Although many existing virtual storytelling technologies may be directly applicable to virtual storytelling using the shadow play, it may not seem very straightforward particularly in the styles and language of the shadow play. The stories and feel of the traditional shadow play would not just be there if we change the narrative to another form. However it might be possible to combine both of the worlds without damaging either.

The technical challenges include considering the best methods for the implementation of the algorithms, methods and interactions as well as the hardware perspective. Another important technical issue is in the rendering of the shadow of the puppets. As the puppets are moved or animated, the shadow reflected on the display may vary such as in size, texture or colour. Thus, a proper shadow algorithm as well as the blurring effect should be used to portray such effect in a virtual storyteller that integrates the shadow play.

3.2. Mapping of the Traditional Shadow Play to a virtual storyteller

The significant difference of a traditional shadow play and a normal storytelling is the environment. This is due to the fact that the scene in a shadow play is represented by puppets while the scene in a normal storyteller is the storyteller himself. In a virtual storytelling, the scene can either be represented by a virtual character that acts as a storyteller of a set of characters that make up virtual actors of a story. Figure 2 shows a typical virtual storyteller that uses a virtual character to act as a storyteller. The main components of the virtual storyteller include the design of scripts and storyboard, human-machine interaction using natural language, music, behavioural actions, real-time animation of characters and lighting.

![Figure 2. Architecture of a typical virtual storyteller (Adapted from [1])](image)

Figure 3 illustrates the architecture of a traditional shadow play. The architecture includes a storyline based on the Hindu epics, the puppeteer, the gamelan orchestra, and the environment that includes puppets and lighting. A one-to-one mapping is almost possible between the virtual storyteller and the traditional shadow play. Unfortunately, there are some elements that do not fit well into the shadow play. The first element is the behavioural actions that are
implemented in most of the virtual storyteller. Behavioural actions are needed for virtual storyteller because the characters need to express their emotion and gestures while for the shadow play, the puppets do not portray any emotion or gestures but the look has already been carved on the puppets itself. The behavioural actions are also depicted in the shadow play through the voice and expression of the puppeteer and the melody and rhythm of the traditional gamelan orchestra that accompanies the play. In virtual storytelling, a storyline or storyboard usually comprises of a fully scripted storyline or a character-based storyline while in a shadow play, the storyline is based on a fully scripted type because the epic has been inherited from generation to generation with some modifications to suit the local values and environment.

Figure 3. Architecture of a traditional shadow play

Virtual storytellers are known for their intelligent agents that work on character driven systems. As mentioned earlier there is no need for such a system in the case of the shadow play due to the fact that its story is static, and therefore can easily be implemented using the script based system as seen in [1]. Although a highly interactive system is not necessary, we can introduce more interactive parts in the storyline of the virtual storyteller using the traditional shadow play so that its use will become more widespread in edutainment in many different cultures around the world.

Figure 4 illustrates the architecture of a virtual storyteller which adapts the shadow play concept. This virtual storyteller may retain the Hindu epics-based storyline as well as provide the facilities to allow other storylines and a higher degree of interactivity. The role of the puppeteer (Tok Dalang) is taken over by the natural language processor and the animator. The gamelan orchestra is replaced by the audio processor to process the orchestra music. Also the environment is generated using computer graphics which comprise of shadow rendering, animation/ animator and lighting. The shadow rendering of the shadow of the puppets is discussed next.

Figure 4. Architecture of a virtual storyteller using the traditional shadow play

3.3 Shadow rendering of puppets

Shadow rendering is the most essential technique to be considered in any effort to develop a virtual storyteller that adapts the shadow play. Shadow in this context is a shaded area that is caused by an obstruction of an object on a light source. As long as there is an object occluding between the light and region of interest, a shadow exists, regardless of whether the material is opaque or not. The shadow play environment deals very little with hard shadows. On the other hand, the soft shadows play an important role in shadow play since most of the shadows
generated by this play are soft shadows. Soft shadows are slightly lighter shadows formed around hard shadows under the right light and circumstance and are vital for realistic visual simulation of the shadow play. Soft shadows are the shadows that make soft blurring of puppets possible and create a more cinematic experience.

The understanding of soft shadows and light generation and its effect on the environments is necessary in order to fully simulate an authentic shadow play performance. Generally these performances are carried out using a mild light generated from light bulbs of the filament type. The light type is an area light source, which generally means that the light is not focused into one point. Instead it is spread out over an area and not to strong as to inhibit the generation of soft shadows. From a technical standpoint not much focus has been given to the different varying degrees of shadow generation. Most developers in this field are more or less happy when a shadow is generated given a light source and these shadows can be applied to a dynamic environment.

Another factor that has to be taken into consideration is the image that is displayed on the screen of the rendered display area. During the play, the shadows that are produced on the screen are directly related to the distance between the puppet and the screen in relation to the light source. Basically this means that an object, in this case a puppet, that is placed closer to the screen will show up more clearly with the viewer being able to distinguish colour and form of the puppet. Those further away from the screen appear as shadows, black or blurred thus giving the viewer a sense of depth and will therefore enhance the storytelling experience. Figure 5 illustrates the relation between the distance between the puppet and the screen in relation to the light source.

![Figure 5. The distance between the puppet and the screen in relation to the light source](image)

3.4. Proposed methodology

In any undertaking, a proper methodology is required in order to accomplish the task successfully. In this work which is concerned with using the traditional shadow play as medium for virtual storytelling, there are many elements to be considered. The first component is the puppets, which have a unique identity and role. A thorough study must be made on the details of the puppets which vary from region to region. Each puppet comes in different shapes, from human characters to objects. As for colours, some are bright and colourful while some are just plainly dull. The colours are especially interesting; monsters and demons are coloured red or green while heroic or beautiful characters are coloured in brown and mellow colours.

The colour might be an important factor as the screen for the shadow play performance allows for colour and shape to bleed through in particular the puppets that are close to the screen. The colour scheme might seem simple but proper sampling and study is required to reproduce its authenticity. The colour also works to differentiate the characters. In the same way the design of the puppets also play a role in the unique creation of the characters. For example, the evil characters are carved with anguish and aggressive facial expression while the good characters are carved with a gentle and wise look.

After a careful look at the puppets, the second component to look at is the setting of the environment that is considered very important to bring out feeling of the shadow play. There are three elements to be studied. The elements are the light, the material of the puppets and the material of the screen.

In beginning the puppeteers used oil lamps to create the light for the play. These days they use electrical light bulbs to produce their light. The intensity and colour of the light greatly affects the overall performance. Fluorescent or direct lights do not allow for the right combination of shadow effects and at times does not allow for the light to bleed through the puppets. A careful study of the direction and type of
light will greatly enhance the realism of the shadow play experience.

The puppets are made from cow hide which is to say that they are not solid but slightly semi-opaque or translucent which allows for light to pass through to a certain degree. This will allow the audience to see the details and the different colours of the puppets. This is an important factor that needs to be considered in the calculations for the rendering aspect of the virtual storyteller in order to simulate the play as realistic as possible.

The screen represents the last component in the system that was an ingenuous form of entertainment and edutainment for the people of the past. The screen was to them as the television is to us now. It has to be reiterated that the images displayed on the screen are not all just black or white. But there is colour and the sense of motion as well as depth when the puppets are deftly manipulated by the puppeteer, and it is also possible to make out objects behind the screen.

Now that the environment and puppets have been considered, another component to be observed is the puppeteer or Tok Dalang that brings the show alive. The puppeteer contributes to every single puppet movements, voices and songs with a supporting gamelan orchestra. The digitisation of the puppeteer needs to take into accounts of the advances in human-computer interaction.

The final component is the story. The stories of the traditional shadow play or wayang kulit are adapted from Hindu epics such as Ramayana and Mahabhrata. As mentioned earlier, this virtual storyteller using the traditional shadow play may retain the Hindu epics-based storyline but at the same provides the facilities to allow other storylines. With a highly interactive technology, we can introduce more interactive parts in the storyline of the virtual story teller so that its use will become more widespread in many different cultures around the world and provide a new dimension to the world of virtual storytelling and digital edutainment.

4. Conclusion

With the advances in graphics technology and virtual environments it is now possible for us to simulate and preserve our cultural arts and heritage in a more interactive manner compared to just plain recordings. It is now possible to implement a virtual storyteller that integrates the elements of the traditional shadow play that can be used for edutainment purposes in many different cultures around the world. The advances in shadow rendering and human-computer interaction and many more have paved the way for the preservation of a much loved cultural heritage which is the traditional shadow play.

We have laid out a practical framework for integrating the elements of the traditional shadow play environment in a virtual storyteller. This includes challenges, the mapping of the traditional shadow play to a virtual storyteller, shadow rendering of puppets and a methodology in undertaking such development. This is made possible by looking at existing virtual storytelling endeavours and technologies and also the more recent advances in shadow rendering.

5. References


