Production design for traditional cut-out animation: Digital remediation of genre-specific aesthetics

Ning Yuan

A thesis submitted to

Auckland University of Technology

In partial fulfilment of the requirements for the degree of

Master of Communication Studies (MCS)

2010

School of Communication Studies

Primary Supervisor: Gudrun Frommherz

Table of Contents:

List of Figures and Tables

Attestation of Authorship

"I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning."

_____

Ning Yuan

November 2010

Acknowledgements

I would like to thank a number of people for their help and support.

Firstly, I am grateful to my supervisor, Gudrun Frommherz, for her patience, persistence and believing in me when I doubted myself.

Further, my thanks go to Alex Challis for making the enormous effort of proofreading my final draft. And I would also like to thank my dear friend Rachel for her constructive advice.

Finally, I would like to express my gratitude to my parents for their continuous and unconditional support.

Ethical Approval

There was no Ethical Approval required for this thesis.

Abstract

Historically, cut-out animation has been overshadowed by mass-produced cel animation made in Hollywood and Japan. There are historical and production-related reasons that have led to the under-appreciation of this animation form. However, cut-out animation comes with unique aesthetics and narrative characteristics that are not normally found in dominant cel animation. These special qualities deserve to be recognized and re-introduced. This research analyzes the genre-specific characteristics of cut-out animation with the goal to preserve and to further develop this animation form via a digital workflow. Findings of this study suggest that most of the characteristics of traditional cut-out animation can be preserved, and even improved, through a careful digital transition from analogue to digital production design.

1. Introduction

This study is interested in the normative qualities of cut-out animation, one of the oldest animation forms, that, however, is not widely used for a long time. There are historical and production reasons which have led to an under-appreciation of this art form by both animators and audiences alike. As Wells (1998) points out in 'Understanding Animation', cel animation and hyper-realist animation films have overshadowed other styles of animation and different aesthetic approaches. In order to preserve a rich visual culture, animations using different aesthetic or narrative formats, or those that are made with other materials, deserve to be recognized, reclaimed and re-validated. One such alternative approach is cut-out animation, which has unique aesthetic interests not normally found in dominant animation films.

Cut-out animation is usually recognized as an experimental animation form (Russett & Starr, 1976; Wells, 1998; Furniss, 1999; Krasner, 2004). Along with the development of digital technology, a small number of studios and individuals have attempted to digitalize cut-out animation. Some animated television shows have been quite successful, such as "South Park", an animated American comedy cartoon show. However, adequate research into the questions as to how digital animation can represent the 'old' cut-out animation has been scarce. The goal of this research is to hark back to traditional aspects of cut-out animation, and, while keeping the characteristics of this form, to preserve and to further develop these traditions within a digital production workflow.

The leading research questions for this study are:

- Can, and if so, how, characteristics specific to cut-out animation be preserved in a digital workflow?
- What improvements and compromises can be made in transforming these characteristics into a digital version?
- What digital processes allow for time and labour reduction in cut-out production?

This thesis contains eight chapters. After this introduction, I position the research by discussing the need for and the significance of this study. Following, I review in chapter three, literature from the areas of the history of cut-out animation, dominant forms of

animation, experimental animation forms in which cut-out animation is usually catalogued, production issues and characteristics of traditional cut-out animation. A discussion of the idea of remediation, which is conceived in this research as a possible strategy for refashioning traditional cut-out animation, concludes this chapter.

In chapter four, I discuss examples of practical work that others have done in order to simulate the 'look & feel' of cut-out animation by using a digital approach. Here, I point out the lack of systematic research into the possibilities of a digital transition for cut-out animation. In chapter five, I discuss methodologies adopted in this research, and why I have chosen these respective approaches. Furthermore, I outline my strategy for data analysis. Chapter six presents the data analysis and my experiments for a digital remediation of the aesthetics in cut-out animation. Hereby, this thesis focuses on the design of movements in cut-outs and their translation into a digital form. Chapter seven discusses the findings of this research that go about answering the research questions. Following this, I then outline the limitations of this study. Finally, chapter eight concludes the thesis by summarizing the main concerns and findings. I hope that my study encourages further research into non-mainstream animation art for the preservation of aesthetic variation and artistic richness.

2. Significance of the Study

There may be a perception that the dominance of cel animation in some ways misrepresents the genre of animated film as a whole. A large number of industrially produced and schematised cel animations coming out of Hollywood and Japan may limit aesthetic vividness in animation and the imagination of audiences. However, there may be a need to recognize animation as an art form with a variety of aesthetic expressions and formats when evaluating the overall achievements of animation. Non-commercial animation forms with other aesthetics interests, or produced with different materials, could enlarge viewers' recognition of animation (Wells, 1998, p. 35). Cut-out animation as an old animation form may not be as popular as dominant animation forms (e.g. Disney cel animation). Yet, as a distinctive animation art form which has its intrinsic, unique characteristics such as a special gesture of figures, the variable texture of materials it uses, and stiff movements, cut-out animation deserves recognition and study.

Cut-out animation can be seen as 2D puppet animation. An aesthetic effect of puppet animation is, according to Priebe (2009), to trigger the subconscious mind of its audiences. Puppet animation has been known to make spectators remember their happy childhood when they were playing with toys and imaging them to be alive. The traces of cuttings and the textures in puppet animation can be regarded as a mark of the creator's work, "which is why we still travel miles to see the pyramids or an original Leonardo or Picasso" (Priebe, 2009). In this way, puppet animation or stop-motion animation is able to satisfy the human desire to connect to past and to put themselves into great art.

The pure black and white appearance of under-lit cut-out animation, known as silhouette animation, has been recognized as having special power, because it is relatively abstract compared to multi-colour background animation (e.g. Walt Disney's Mickey Mouse animations). Jouvanceau (2004) points out that a silhouette shape least resembles the image of a living person. Abstraction within art creates a sense of mystery. Mystery is a driving force for people to imagine (Bennett, 2005, p. 252). William Moritz (1996) cites Béla Balász when he concludes that the imaginative quality of silhouettes is stronger than any literary words. Rudolf Arnheim (1997) points out

that Reiniger's fairy tale animations utilized silhouette techniques to prevent the paralyzing of a child's imaginative abilities. The silhouette "spares the viewer, particularly the child viewer, the fear that sets in when the fairy tale passes a certain point of vividness and becomes tangible reality" (Arnheim, 1997, p. 141). A silhouette animation film perfectly maintains the sense of balance of art and life. For these reasons, and for reasons of its unique aesthetic forms, the silhouette technique is a valuable animation technique to be studied.

Cut-out animation was popular during the early 1900s, in the years when it was developed (Furniss, 1995). The art form has become less and less appreciated since then. Instead, cel animation has become a dominant animation form. There are historical and production reasons that have lead to this change. One reason is that the American film industry quickly developed and took over the European commercial market during World War I. Another reason for the rapid decline of cut-out animation is that cel animation extensively sped up workflow and reduced labour by following an assembly-line method of production. Cut-out animation was not able to follow such a streamlined production flow because each frame has to be created separately by repositioning figures frame by frame executed by a small group of people. Since cut-out's early days, this process has not been vastly improved. In order to bring attention back to cut-out animation, my goal is to find a way to speed up the workflow and to reduce the labour intensiveness of cut-out animation while maintaining its aesthetic and narrative characteristics.

In the 1980s, digital tools were introduced to the animation industry. Many animation studios changed to a digital workflow process (Dowlatabadi and Winder, 2001, Jones and Oliff, 2008). There are two deciding causes for using computer generated (CG) elements on traditional animation: creative and production efficiency. Components of an animation, such as character design or any other aspect generated on a computer, can be easily created, altered and reproduced (Dowlatabadi and Winder, 2001, p. 17). Therefore, CG might be a principal solution to re-create cut-out animation and, in this way, to re-popularize this animation form.

According to Jackson (1998), a small number of animators used digital tools in the past in order to mimic the look and feel of traditional cut-out animation. One example of this is a production studio in the USA, which uses computer generated techniques to simulate traditional cut-out looks in an animation series called South Park. However, very little research has been done on the aspects of reproducing and maintaining characteristics of the traditional paper-cut animation via CG. This thesis intends to investigate these aspects and help to fill the gap between traditional analogue animation aesthetics and computerized CG production.

3. Literature Review and Discussion

This chapter reviews some of the literature in relevant areas of scholarship. It starts with a review of a definition and history of animation. It then moves to the historical and production reasons that led to an under-appreciation of cut-out animation as a commercially viable animation form. Following this, the chapter reviews the production issues in cut-out animation along with aesthetic characteristics of this particular art form. Finally, I review the concepts of remediation as a possible platform for the digital transition of cut-out animation.

3.1 History of cut-out animation

In the early years of animation, a number of different varieties of animation techniques emerged, several of which led to their own distinct genres: clay animation, puppet animation and cut-out animation are such examples. Cut-out animation developed during the early 1900s (Furniss, 1995; Priebe, 2007), a distinct technique that manipulated flat 2D 'puppets' under a camera pointing downwards onto a tabletop. The cut-outs, typically made of paper, cardboard or fabric, were usually joined with strings or tiny paper fasteners so that they could be moved frame by frame using same methods as stop-motion animation. Technically speaking, much of early cut-out animation was produced in stop-motion technique.

At the beginning of the nineteen century, film makers such as J. Stuart Blackton (1875-1941) and Emile Cohl (1857-1938) used cut-out figures in their animation films. Blackton used a cut-out figure in his film 'Humorous Phases of Funny Faces' (1906) as he found the use of puppets much easier than having to redraw a figure frame by frame. As a result, more and more animators began to rely on cut-outs in their films. In 1919, the German animator and director Lotte Reiniger (1899-1981) used the same technique to bring the traditional Asian art of shadow puppets to the movie screen. She made her first silhouette cut-out animation film in 1919, called 'Das Ornament des verliebten Herzens' (The Ornament of a Loving Heart). Her most famous work, 'Die Abenteuer des Prinzen Achmed' (The Adventures of Prince Achmed, 1926) is a feature-length animated film (running time: 65 min at 24 frames per second). Taking the ancient art of shadow puppet plays, perfected in countries such as China and Indonesia, she adapted this art form superbly for the cinema. It was Reiniger who elevated cut-

out puppetry within the genre of the silhouette film. She made about 40 silhouette films during her life time.

In 1958, Chinese animator Wan Guchan (1900-1995) gathered a number of Chinese artists using cut-out to create animation films. The first cut-out animation he directed was called 'Zhu Bajie Eats the Watermelon' (1958). In 1973, Russian animator Yuri Norstein (*1941) made his first solo cut-out animation, 'The Fox and the Hare'. In 1979, he finished his most accomplished work, 'Tale of Tales'. During the same period, several other animators, such as Frank Mouris (n.d.), Larry Jordan (*1934) and Harry Smith (1923-1991), created collage animations by using images which were not created by the artists directly (e.g. photos). These animators' works appear to be surreal and experimental (Furniss, 1995). Mouris won the 1974 Academy Award for Best Short Subject for his 1973 'Frank Film' which is still regarded as paving the way for the much later emerging 'graphical film' genre.

3.2 The hegemonic forms of animation

Cut-out animation has been categorized as an alternative (independent or experimental) form of animation (Russett & Starr, 1976; Wells, 1998; Furniss, 1999; Krasner, 2004). According to Furniss (1999) and Wells (1998), experimental animation forms can be considered an opposite of the hegemonic or orthodox forms of animation. In order to fully understand the evolution and decline of cut-out animation, it is important to briefly discuss the forms that have competed with cut-out.

Almost every cultural domain produces some dominant, normative, forms of aesthetic expressions; those that are regarded by its audiences as representing a genre and/or its associated industries. Animation is no exception. The mass-produced cel animation industries in USA and Japan have done a lot to overshadow other, less stream-lined, forms of animation (Furniss, 1998). Cel animation, "made-in-America", famous animators, and Disney studios are often synonymous to the dominating forms of animation in people's mind (Furniss, 1998). One reason for the dominance of one or two individual industries over an entire genre relates to historical and industrial factors. American animation became very popular during World War I. Thomas Edison (1847-1931) established the Motion Picture Patents Company (MPPC) in 1908 effectively

controlling the entire film industry in America. The power of the MPPC waned shortly thereafter because of government intervention and the growth of independent markets in America (Furniss, 1998). Following the breakup of the MPPC monopoly, the native film industry of America found opportunity to develop. When other nations were tortured by the events of World War I, the American film industry took the opportunity to produce and to distribute their educational and theatrical films directly to foreign markets.

Another significant reason for the dominance of cel animation lies in the assembly-line method of production, a key principle of prevailing Taylorism, which the emerging industry keenly adopted. Taylorism promotes a division of labour where production management is clearly separated from general labourers whose work can be systematically regulated. Most cel animation studios follow this divisional workflow. The first step of production, called preproduction, involves one or more leading animators to time and to provide all the key moments of actions for a character. From this point, during the actual production stage, the leads then hand their drawings to their assistants to fill in the subsequent animation drawings between each primary frame of action. This production technique is called the "pose to pose" method. The most labour intensive work for paper and cel animation is during the production stage when the distribution of labour can be achieved by having a large number of people working on drawing and colouring the images that would be filmed later. These so-called 'in-between artists' are typically paid less than key animators. By distributing labour, the cel animation industry can cut a great deal of costs and speed up production (Kitson, 2005). Like in cel animation, the most labour intense work in cut-out animation occurs during the shooting stage. However, in cut-out production only a small group of artists can concurrently manipulate cut-outs under the camera, because of the limitation of working space and the often very delicate and complex movements of cut-outs under the camera.

Priebe (2007) suggests that there might be an oversaturation of digital animation ever since Pixar and other animation studios have achieved a high level of success with

computer-generated imagery animation[1]. Mainstream Hollywood has found CGI as one of the best ways for animation production to be commercially viable. Priebe (2007) argues that animators, directors and producers prefer CGI because this approach, by virtue of its digital character, allows animators and directors to seamlessly go back and forth during the animation process in order to change sequences. In contrast, traditional stop-motion animation (including cut-out animation) does not typically allow animators to go back, at least not easily, and to change scenes or any one detail when a scene has been completed. Stop motion animation follows the "straight-ahead" technique: the animation from one frame to the next without the use of key frames or preset time markers. As digital technology becomes ever more sophisticated and complex, the production capabilities for CGI animation are getting faster and cheaper. The preference of CGI production versus stop-motion animation, which requires a lot of studio time, material, equipment, and specialized talent, is significantly driven by efficiency of production flow and budgets.

In summary, there are two main reasons why cel animation has become the dominant animation form. First, the Hollywood film industry took the advantage of World War I. The American film industry rapidly developed, and its products extended into Europe while these countries were busy fighting in war. Second, cel animation follows an assembly-line method of production. This significantly speeds up workflow and reduces labour. Thus, it was mainly historic and production reasons above aesthetic preferences that favoured the evolution and economic success of cel animation over alternative, more labour-intensive forms. Since cel animation had taken over the commercial animation market, cut-out animation along with many other animation forms, became less and less appreciated by most animators and, consequently, by their audiences. In order to re-popularize cut-out animation, reduction of production labour and costs appear to be an important criterion. However, this goal seems challenging by using the traditional, "hand-made" method. Therefore, this thesis proposes the use of digital technology to create cut-out animation that maintains the aesthetic characteristics of the traditional cut-out animation, while streamlining production. The rationale for proposing a digital approach to cut-out animation will be discussed in chapter five.

---

[1] Computer–generated imagery (CGI or CG) has two general categories like traditional animation technique: two-dimensional (2D) and three dimensional (3D).

3.3 Cut-out animation as experimental animation form

In the previous section, I have presented the argument that cel animation technique dominates the present-day animation industry. Cel animation films made in Hollywood and Japan have taken up most of the industry's attention. However, there are many more styles and approaches to animation that use different techniques, materials, and deliver a different aesthetic appeal. These animation forms are often considered as independent, experimental or alternative forms (Moriz, 1988, Wells, 1998, Furniss, 1999). It is helpful to characterise these forms in comparison with dominant animation.

Whereas hegemonic forms of animation, which are predominantly CGI, tend to use identifiable 'figures', logical continuity of the story, and narrative structure, experimental animation films often create aesthetic forms, shapes, and colours, and invent new expressive motions (Moritz, 1988). The freedom from logical and linear story telling is a prominent feature of experimental animation (Furniss, 1999). Often, a defining aesthetic approach by experimental animation is to use "abstract forms in motion, liberating the artist to concentrate on the vocabulary he/she is using in itself without the imperative of giving it a specific function or meaning" (Wells, 1998, p. 44). Norstein's 'Tale of Tales' (1976) perfectly illustrates these experimental ideals.

Contrarily, the hegemonic forms of animation, especially Disney's arguably "hyper-realistic" (Wells, 1998, p. 25) animation films, give prominence to narrative content; colours, design and materiality of film are to follow the narrative intention of the product. Experimental animation films focus more on materiality than narrative content, and some of them contain multiple techniques and styles of animation. Colours, shapes and textures of cut-out figures trigger certain feelings, moods or ideas. For example, the silhouette figures in under-lit cut-out animation give just enough detail for audiences to recognize what they represent yet leave room for viewers to imagine. In Norstein's 'Tale of Tales' (1976), colours and textures bring audiences into the gray and gloomy mood of the animation (Kitson, 2005).

In order to achieve efficacy in the cel animation industry, the significance of the artist is often removed (Wells, 1998, Furniss, 1999). In experimental animation, personal, subjective, or original responses are main characteristics. Dialogue is an important part

in hegemonic forms. Key aspects of dialogue are often used to define characters in these forms. An alternative to the importance of dialogue, experimental animation often emphasises a visual rhythm of movements, colours, or shapes, and synchronise the visual experience with music or other auditory media. In this way, experimental animation often has been considered to be more 'poetic' compared to dominant, commercial animation.

There is another animation form pointed out by Wells (1998) known as the developmental form. Wells defines developmental animation as a style that combines characteristics of both experimental and dominant animations. As suggested by Wells (1998), developmental animation has traditional aspects of animation films, whilst, at the same time, attempting to restructure these aspects with dominant approaches. For example, many animators have tried to resist or redefine the 'hyper-realist' agenda of dominant animation by experimenting with a number of alternative approaches such as using clay and puppets instead of traditional drawing techniques. The digitalized cut-out animations attempted in this research can be seen as a developmental animation form, because they rely on the aesthetic characteristics of traditional cut-out animation, and, at the same time, amalgamate these characteristics within a contemporary digital workflow.

3.4 Production issues

Furniss (1998) points out that animation is an art form that is intersected by many artistic practices, and it is important to recognize these influences on the aesthetics of an animation piece. Production procedures and materials significantly influence the aesthetics of animation works, and detailed knowledge of the production process is very important for the researcher into animation art. This knowledge helps the researcher to discover characteristics of many aspects of animation. There are many production details in traditional cut-out animation. Characteristics of traditional cut-out animation can be located by reviewing production details of a significant number of works of this art form. Furniss (1998) affirms that there are two principle production techniques in cut-out animation which differ through their lighting method. The more common lighting technique is *top-lit*, allowing the audience to see colour and texture of the puppets. An example here is the animation film 'The Fox and the Hare' (Norstein,

1973). The second technique describes the *under-lit* method that is typical for 'silhouette' films. Most of Reiniger's animation films used the under-lit technique.

The following section forms a detailed discussion of Reiniger's and Norstein's cut-out animation techniques. Reiniger is a representative of silhouette animation. When Reiniger created animations, she studied and mastered the techniques of silhouette animation and developed a very detailed production workflow. Contrasting, most of Norstein's work used the top-lit lighting technique. As a result, a discussion is needed in order to appreciate the traditional workflow of cut-out animation.

An essential element in cut-out animation during the pre-production stage is to have the right puppet model. Initially, the artist needs to decide how many articulated limbs are needed to make the puppet as flexible as possible, and what materials are suitable to achieve smooth movements. Reiniger's figures were made using hinge-joint limbs. In order to avoid damaging the paper while achieving a good level of flexibility for each limb, Reiniger used a combination of lead and cardboard for her cut-out figures (Reiniger, 1970). Norstein did not use hinges to join limbs, because he believed that unfastened body parts would retain a higher level of flexibility of the figures during animation (Jurgens cited in Furniss, 1998). Norstein used many individual pieces of celluloid to make up the characters. Because he used many layers on a figure to achieve flexibility yet he did not want every layer's edge to be seen by the audience, he only drew in the middle of every celluloid piece and left the edges to remain transparent. Also, the different materials showed different textures which added more aesthetic variety to his productions.

The next preproduction step would be to decide how many sets of each figure will be needed. Though cut-out animation saves a lot of work in the preproduction stage by using one cut-out figure throughout the whole production, the figure has to be moved in front of the camera frame by frame. This technique is called *straight-ahead* animation, and stop-motion animation can only be animated in this way (Priebe, 2007). Straight-ahead production is extremely labor intense and requires a lot of time and patience. Many animators have experimented with different ways in order to reduce time under the camera. For example, the Chinese animator Wan Guchan tried to

reduce labour during the shooting stage by making a frontal figure, a profile figure and a three-quarter figure, each with a close-up, a mid-shot and a long-shot piece of each character figure (Quiquemelle, 1985). With these different 'shot-size' figures, a slight reduction in production time and labour could be achieved, but not significantly enough to compete with automated production techniques. In addition, the figures' sizes should be handy and suitable for the rather small shooting table, with the consequence that the body figure would not be as detailed as an animator would often wish. Close-ups typically contain a lot of detail, which may not be achieved with a small figure. According to Reiniger (1970) and Wan (Quiquemelle, 1985), an easier way would be to create a separate larger figure for close-ups, and to cut to the close-up part when needed.

Another preproduction task of traditional cut-out animation involves the preparation of the shooting table. The shooting table is a piece of equipment that holds the camera facing down onto a table with one or several glass planes. The camera attached to the shooting table can not only move up and down, but also horizontally (Reiniger, 1970; Furniss, 1998), and the plane on the shooting table can also move from side to side. Apart from these movements of the camera, there are no other camera movements, such as tilt and panning. Reiniger tried to imitate panning in 'The Adventures of Prince Achmed' (1926). She made her scenery with smaller figures in the middle, and when she was animating, used a full-size figure first before switching to a smaller one when the figure moved to the middle. After this, she changed back to the full size once again to finish the walking scene. Between each change, she made the figure pass through trees or a rock to avoid the abrupt change of size of figure (see figure 1). This strategy is workable but the scene still appears flat. Other camera movements such as crane shots are more difficult to implement due to the flatness of cut-out figures. The adjustment of camera lenses, to zoom in and out, and changing of focus, is also rarely used.
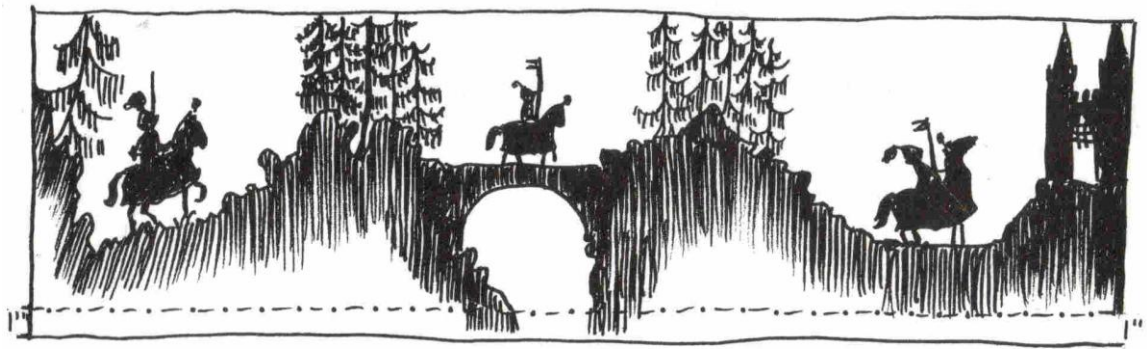
Figure 1: Panning with figures on different sizes (from: Shadow theatres and shadow films, pp. 111).

Norstein's cut-out animation is top-lit. The spotlights were used on each side of every plane to light up every part of the image. Silhouette animation uses a light box underneath the shooting table. However, in traditional cut-out animation, the light tends to flicker and not always stable, and as a result, differences in lighting between separate frames are unavoidable. Environmental changes in the work space, such as the animators walking around and shadows of other pieces of equipment, also affect the consistency of lighting (Priebe, 2007).

The most important process during the production stage is manipulating figures under the camera. The film-making technique of cut-out animation, as well as stop-motion animation, is a process where a camera takes a picture of a puppet, the puppet is moved a little, and another picture is taken, and so on. After repeating this process hundreds of times, the film reel is played back and shows the puppet as moving frame by frame. Stop motion animation can only be produced this way in straight-ahead technique (Priebe, 2007). It is an extremely labour intensive process.

Many characteristics of movement result from the shooting process. First, due to the body parts being rigid objects, the body of the characters cannot be stretched or squashed as they are in cel animation. Therefore, the movement of cut-outs are somewhat stiff. Second, the movements of characters are mostly horizontal and vertical as it is difficult to achieve depth movement in the z-axis (Reiniger, 1970). Next, it is tricky for animators to create transformations (or morphs) in cut-out animation (Reiniger, 1970). Last but not least, unlike in natural movements, not all parts of a character's body can be smoothly moved together in a synchronized way. These limitations of movement in cut-out animation can be seen as one of the reasons this

art form has never been widely used. Nonetheless, many of the cut-out animation films are still remembered because of their extraordinary quality where part of their attraction are the abstracted graphic style they display (Priebe, 2007).

To sum up, rigid form and abrupt movements with noticeable pauses are significant characteristics of cut-out animation (Taylor, 1997). Determined by production techniques in traditional cut-out animation, the flickering light is a defining characteristic of this animation form. Similarly, the texture of the cut-outs affects the aesthetics of cut-out animation. Because figures in cut-out animation are flat (2D), the camera is facing down on the shooting table where most cut-out animation films were shot. Consequently, camera movements – a prevailing technique in contemporary 3D animation – are very limited, if not completely absent, from cut-out animation styles. Also consequent to flat figures and a single vertical camera, depth of visual illusion is difficult to achieve. The above examples are just a few of the many characteristics of cut-out animation, but these genre-specific characteristics are significantly different from cel and contemporary 3D animation. These characteristics indicate the value and potential for the willing animator to re-discover and re-popularise cut-out animation.

3.5 Remediation

According to Bolter and Grusin (2000), media forms tend to find ways to re-fashion themselves, a process the authors call 'remediation'. Remediation relies on the concepts of transparent immediacy and hypermediacy. Remediation always works "under the contemporary cultural assumptions about transparent immediacy and hypermediacy" (Bolter and Grusin, 2000). Thus, immediacy and hypermediacy can be seen as two strategies used in remediation.

3.5.1 Immediacy

"To disappear" is the purpose of transparent immediacy, which means to let the audiences forget the presence of the medium that mediates a particular content or message. Immediacy makes the content more direct, immersive and immediate. The logic of immediacy applies to both immersive and non-immersive digital environments. Virtual reality is considered an immersive environment in which the viewer is surrounded with computer-generated images. Virtual reality is expected to reduce and

eventually to deny the presence of a computer interface – and with this to diminish the distance between the viewer and the content, and between the viewer and the experience. Similarly, in non-immersive digital graphics that are presented on a computer screen, on film or television, the logic of immediacy strives to remove the medium as much as possible by captivating the viewer's attention and imagination, and to cause him/her to suspend disbelief.

The desire for immediacy has a history. In order to appreciate immediacy in computer graphics, it is important to understand the ways earlier media has attempted to satisfy immediacy. Early media, that is painting, photography, film, and television, "sought immediacy through the interplay of the aesthetic value of transparency with techniques of linear perspective, erasure, and automaticity, all of which are strategies also at work in digital technology" (Bolter and Grusin, 2000, p. 24). Traditional paintings use the technique of linear perspective to achieve immediacy. But the linear perspective is adjusted by the artists' dramatic or allegorical effects. The linear perspective is further perfected by the invention of photography. Photography erases the agent of human creation by automatic mechanical and chemical processes. In the case of digital graphics, the computer-generated projective image can be seen as mathematically perfect because of the underlying algorithmic mathematic program.

3.5.2 Hypermediacy

According to Bolter and Grusin (2000), hypermediacy refers to a medium's representation style and, in contrast to immediacy, reminds the audience of the existence of the medium. The medium thus competes with the content of the message it mediates.

The initial goal of 'Microsoft Windows', the graphical user interface, was to make itself transparent when it was invented in 1960s and 1970s. However, with current versions of the Windows interface, their multiple representations of texts, graphics, videos, and a multitude of visual styles compete for a user's attention. In this way, users are constantly reminded of the existence of the medium and the fact of mediation when s/he clicks a button, or chooses a menu item. The age-old computer debate about interface design, in many ways, is also a negotiation between immediacy and

hypermediacy. Hypermediacy can be considered as a counter force to immediacy in the digital world. Hypermediated forms tend to be more varied and complex than immediate forms. In the early days of digital representation, hypermediacy was not present as a multiplicity. By multiplying media (e.g. as "multimedia"), hypermediacy caters to a multisensory human experience.

Like the desire for immediacy, the fascination of media has a long history. For example, coloured glass, relief statuary, and inscriptions in European churches create both physical and representational hypermediated spaces. In the nineteen century, hypermediacy could be seen in mechanical invention, such as the diorama, the phenakistoscope (an early animation device), and the stereoscope. In the twentieth century, not only high art, but also media shows are of interest to hypermediacy. Hypermediacy appears in the designs for printing (news paper and magazine), computer interfaces, even in forms mediated by television and by music.

3.5.3 Remediation

Bolter and Grusin (2000) define remediation as the process of a medium refashioning its media ancestors or other contemporaneous media. Remediation, this way, is a representation of one medium in another. Bolter and Grusin (2000) believe that remediation is a normative feature of digital media. There is a range of different methods through which new digital media represent their predecessors.

In one case, new digital forms attempt to represent old forms without acknowledging the differences between the original and the new medium. For example, picture galleries on CD-ROM or online digital literary collections are such examples. The new medium presents the old genre the way it was originally presented – as a sequence of images that remain apparently unaltered whether presented as a flip catalogue, slide show, or digital image sequence. The digital media presents the images as a "traditional" slide show, and it wants them to look the same way as the old medium. Only the navigation control (forward button or the slide bar) remind the viewer of the underlying digital platform. Thus, in the given example, the digital medium remains largely transparent; it does not desire to become visible as a medium and it does not attempt to define the experience of the viewer.

Some digital forms offer an improvement to their predecessor instead of trying to be fully transparent. For example, Microsoft's 'Encarta' Encyclopaedia on CD-ROM provides not just text and graphics, but also sound and videos. The World Wide Web is also an example of a representation of old forms by adding ease of access and/or navigation without changing the original genre completely. The user can easily recognize from which book, magazine, film or television source a text or image comes from through a convenient mouse click via the computer interface.

Other digital forms are more aggressive in refashioning the old forms. Nevertheless, they remind their predecessors that they can keep the feeling of hypermediacy. This form of aggressive remediation makes audiences clearly notice the differences between original and new mediums. The discontinuities between the old media and the new medium are quite obvious, as in the case of photomontage and collage for example.

Then, a new digital medium may absorb the old medium completely. In this way, it can minimize the discontinuities between the old media and the new digital medium. However, in this form of remediation, the old medium is not completely untraceable; the new medium relies on the old one in recognized or unrecognized ways. For example, the computer game can be recognized as 'interactive film' (Bolter & Grusin, 2001, p. 47).

Digital technologies have been absorbed by television and film. For example, Hollywood action films often use digital techniques to create cinematic special effects, such as explosions. Here, the goal is to make a scene appear as real as possible; in other words, to render the medium transparent to its own presence. This shows that remediation works in both directions: digital media can refashion the old media, such as television and films; television and films also can refashion the digital medium.

With respect to animated film, the original medium remediated itself by incorporating digital technologies in order to survive and to flourish (Bolter & Grusin, 2000). For example, in Disney's Beauty and the Beast (1991), the animators imitate the tracking

shots by using digital techniques, camera movements that would be difficult to achieve in traditional manual animation techniques but are easy for live-action film. Here, not only in live-action film but also in the musical "Broadway" are remediated in animation by imitating musical, stylistic and thematic characteristics. Computer graphics can also replace the traditional manual techniques when creating an animation film. For example, Toy Story (1995), a completely computer-generated animation film, can be seen as a remediation of clay animation.

These examples show that computer graphics can extend the traditional forms of animation. Cut-out animation, in several ways, combines both hypermediacy and immediacy in their remediation. Cut-out animation itself remediates the ancient art of shadow puppet play. In this remediation, a higher level of immediacy could be achieved, which leads the viewer away from the obvious set-up and staging of puppet theatre. However, silhouette animation itself remains technologically hypermediate for the many particularities and constrains that cut-out animation imposes. Nevertheless, one of the most remarkable characteristics of cut-out animation is its psychological immediacy, a drawing-in of the spectator into the visually reduced world of silhouettes that leave room for imagination and narrative immersion. Many traditional animation forms have in the past, and are seeking today, a digital remediation in order to evolve. Thus, cut-out animation, as a distinguishing animation form, may survive and further develop through digital transition.

4. The problem of digital transition

As the last chapter discussed, media have a tendency to look for ways to refashion themselves. This is no exception for animation. In the 1980s, digital tools had been introduced to the animation world. More and more animation studios partly or fully changed to a digital workflow (Dowlatabadi & Winder, 2001, Jones & Oliff, 2008). Hollywood and Japanese cel animation remediated by absorbing the new techniques in order to perfect themselves. Fully computer-generated three dimensional animation films can be regarded as refashioning of stop-motion animation. For example, the first "South Park" animation film was produced in traditional cut-out animation strategy with paper and scissors. The following episodes were all created with computer software to simulate the cut-out style. Through a digital production approach, time and labour was significantly reduced. Eric Stough (*1972), the director of South Park, said "it used to take three months to finish a show. We've [now] gotten it down to six days" (Driver, n.d.). The producers used software such as Corel Draw and Adobe Photoshop to create characters, and 3D software to animate these characters to keep the "home-made" appearance (Cheplic, 1998; Driver, n.d.). The scanned original paper images were used as textures in 3D animation software. There are also other digitally simulated cut-out animation films, such as an American children's show called "Blue's Clues" which uses Adobe Photoshop and Adobe After Effects to imitate the traditional cut-out sense.

However, most of the literature about digital cut-out animation only discusses the idea of using digital tools to simulate the analogue cut-out animation in general, and point out that time can be saved through this approach. More detailed questions, such as what analogue cut-out animation aesthetics and narrative characteristics can be saved in a digital workflow, whether working time has really been saved, and what improvements or compromises can or should be made in digital reproduction, have rarely been asked. Studies of the aesthetics and narrative characteristics explore the distinctiveness of cut-out animation. To better preserve the unique style of this animation form in the digital workflow, it is necessary to locate these features and to study them individually. Therefore, in order to understand the differences between traditional cut-out animation techniques and its digital transition, and to devise a digital workflow, an adequate research on digital transition is desirable.

5. Methodology/Design of the Study

In this section, I introduce the research methods I use in this investigation, and explain why I have chosen these methods for this study. After that, I introduce the practical research questions in this study. Finally, I explain my approach to the digital experiments that I undertook in order to investigate my questions and how I have organized the findings of the experiments.

The overall methodology for this research project is a practice-based enquiry into the digitisation of traditional cut-out animation. The main reason for this approach results from a need to deconstruct, analyse and re-construct an artefact, an artistically conceived and produced animation piece. As I see it, the topic of this research into production-related aesthetics requires a practice-based approach.

Finley (2005) suggests that there are different ways to know the world. Artists, writers and scientists each have important things to tell about the world; however, they may arrive at their insights by different means and methods. Both Hockney (2001) and Bolt (2007) set out that creative people may engage in practice-led research because they have additional insights resulting from the processes of making things. Hockney also suggests in *Secret Knowledge* (2001) that a specific tacit knowledge can emerge by handling materials in practice.

Bolt (2007) cites Heidegger as concluding that people know the world through experience first and only later may theoretically understand its aspects and processes. As a result, new knowledge can be recognised as emerging from practicing materials, methods, and tools. The search for a new method, or, the demonstration of how research makes a contribution to new knowledge in a particular research discipline, is the essential goal of creative arts research (Bolt, 2007, p. 31). Thus, the goal of practice-led research is not only to explain and to contextualise practice, but also to produce insights to the respective practice through practice.

Practice-led research, in general, is one of many methodological and theoretical forms of qualitative research (Finley, 2005). It is a process of interrogating and refining ideas through cycles of practical experimentation and critical reflection (Schon, 1983;

Scrivener, 2000). There are two main concerns in practice-led research: one is what knowledge emerges through the process of managing materials, tools and ideas, and the second is what this emergent knowledge brings to contribute to the respective discipline (Bolt, 2007, p. 34). Furthermore, researchers may come up with a production pipeline based on the practical experience of making. Thus, for my study which scrutinizes and 'dissects' a particular production practice, practice-led research is a most appropriate method.

While the main method in this research is practice-based, this study nevertheless includes a conceptual-theoretical investigation into the production-driven aesthetics of traditional paper-cut animation. Hereby, the study attempts to:

1. De-constructively analyse traditional practices and their determination by production technologies.
2. Re-constructively experiment with 2D software and production techniques while preserving and re-enforcing original aesthetic characteristics.

The software packages I use in the experiments are Adobe Photoshop, Adobe Illustrator, Adobe Flash and Adobe After Effects. Both Adobe Photoshop and Adobe Illustrator are used to create figures in the experiments. These figures would then be animated in Adobe Flash and Adobe After Effects.

The discussions of this thesis touch on a few only of the many characteristics of cut-out animation, and each of them requires careful consideration and aesthetic translation into the digital workflow. I have conducted a large number of experiments about possible translations of analogue to digital aesthetics, and a lot of time has gone into this comprehensive research. In order to manage the range of the research project, I am focusing on a small number of animation aspects only, namely genre-specific motion (movement), in both characters and environment, with respect to their narrative qualities.

Following the above outlined approach, I have developed a number of procedural research questions that aim at dividing and structuring my investigations into workable

problems. The following workflow experiments discussed in chapter six are largely based on these procedural research questions:

1. How can I digitalize the basic form specific movements of traditional cut-out animation? Do these techniques change the features of traditional cut-out animation? If they do, can I find a way to make them similar. Which digital techniques are more efficient than others?

2. How does traditional cut-out animation deal with transformations? How can I digitally imitate these? Can these transformations be developed digitally from scratch? What is the difference between the original analogue and the remediated digital transformation? How can I make the transformation convincible as an art form, whilst at the same time make it more efficient?

3. How did traditional cut-out animation achieve move z-axis extent? How can I create this movement by using computer techniques? How can digital depth movements preserve the original analogue aesthetics?

In the following chapter, I look in detail at motion characteristics from selected cut-out animation film clips, experiment with digitalizing these characteristics, and compare the digital transitions with originals side-by-side in order to assess the successfulness of each digital transition. I also look at possible compromises in aesthetics for the benefit of saving production time or achieving a streamlined workflow. After that, I discuss the results I gathered through my experiments and suggest possible choices for a digital transition of cut-out motion.

6. Analysis of Workflow Experiments

I have chosen several clips by Lotte Reiniger, 'The Frog Prince' (1954) and 'Cinderella' (1954), and by Yuri Norstein, 'The Hedgehog in the Fog' (1975). The selected pieces are all masterpieces in the achievement of cut-out animatic motion. I was particularly interested in those types of movement that appeared more challenging to the original cut-out techniques. I wanted to investigate how these movements could be reproduced in the digital workflow with their malleable, 'fluid' forms. I experimented in recreating exact movements using digital techniques. In the meantime, I have kept archiving and documenting results of each experiment as both reconstructed animation sequences and procedural write-ups.

6.1 Experiments on basic movements

As Priebe (2007) said in 'Art of Stop-motion Animation', animation is an art form that has been created with pencil and paper, clay or other materials during most of its history. The computer sometimes can imitate similar effects that are created with these materials, but the original art forms have to be learned first in order to understand the characteristics of the related art form so that artistic similarity can be achieved (Krasner, 2004; Priebe, 2007). In order to understand how cut out figures move, I felt it was important to actually create paper cut figures by hand. I used black paper to cut out the main figures' body parts (see figure 2).
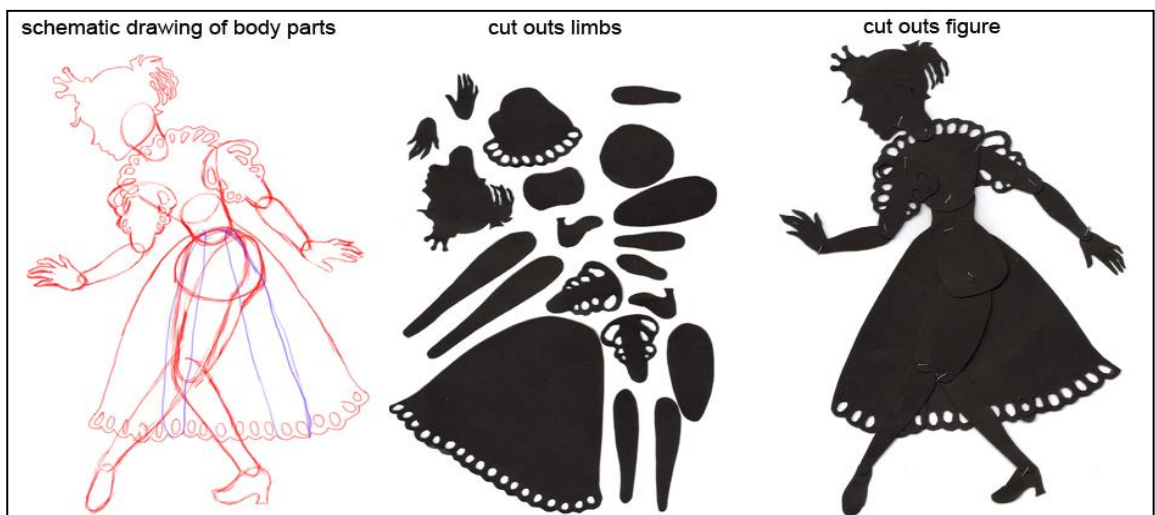

Figure 2: Sketch, cut-out limbs and figure

However, I noticed that it was not easy to find the most suitable material to join parts together because I wanted the material to be as flexible as possible. Finally, I chose to

use thread for the joints. With this, the flexibility of joint movements was satisfactory. By studying the figure I had cut, I learnt that in order to make the cut-out shape of the figure convincible, some light pruning of every part was unavoidable in order to prevent unintended shapes appear from moving joints. I also realized that, for full motion flexibility, more than the actual body parts were required for creating the figures. For example, the main body had to be separated into three pieces to achieve complex movements, such as bending. Furthermore, the figures used in cut-out animation had to be handled extremely careful during the shooting process, because when a figure is moved away to and from its position, a tiny disturbance by accident may cause the whole scene go awry. Also, it appeared difficult to regulate exactly how and when the figure will reach a particular point, unless a very detailed story board and motion board with timings were used. If a character would be moving too fast or too slow, the scene would require re-shooting.

6.1.1 Test 1

I chose Lotte Reiniger's (1899-1981) under-lit short film, 'The Frog Prince' (1954) for this initial motion experiment. Although the film is only ten minutes long, it contains many types of movements, from gentle movement to dance, from turning to transformations.

Initially, I chose a simple movement from the film, a two second gentle movement of the princess's head, to do some basic tests. *(The original clip 'gentle-movement-original.mov' can be found in the folder named 'basic test 1' of the CD-ROM).* In this clip, the princess sits at the table. She looks at the frog, then the king, then the frog again. First, I created a motion board to mark the time and the duration of every movement (see figure 3).
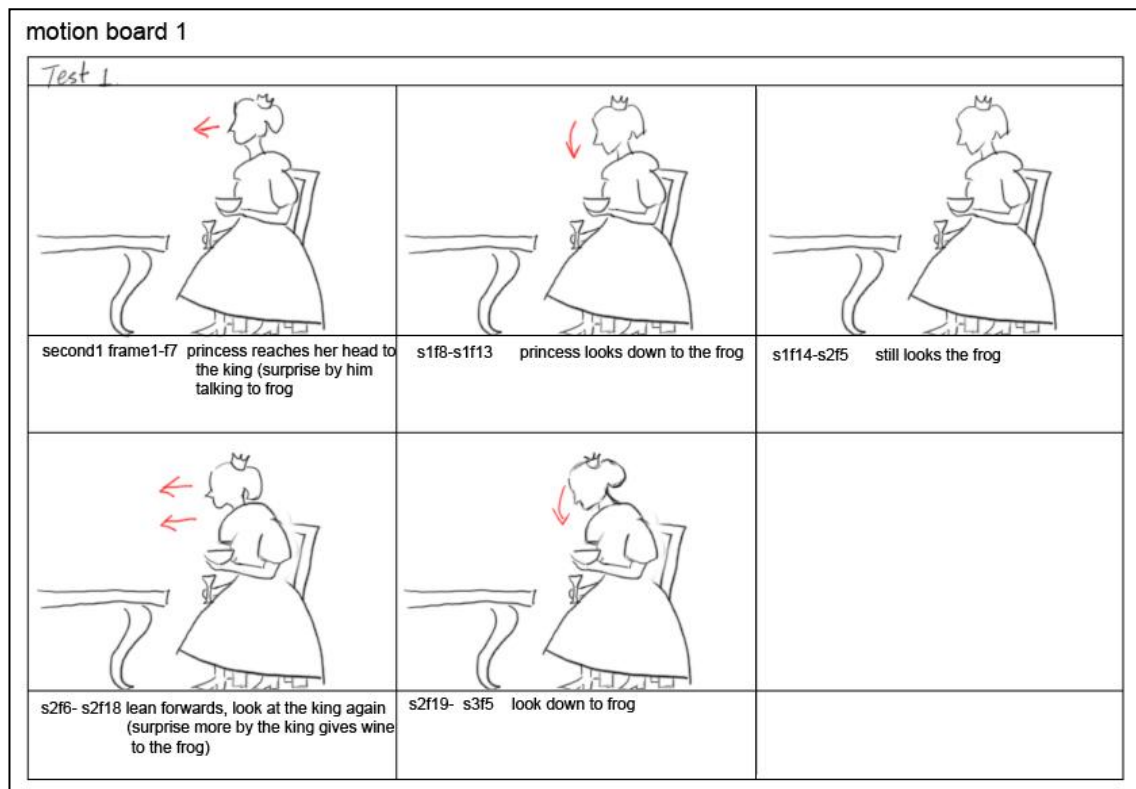
Figure 3: Motion board of the princess' gentle movement

Next, I used Adobe Illustrator to create the body parts. Because the original animation is a silhouette film, the texture of the main figures does not show in the film, only a black silhouette. I identified that the neck had the most significant movement. The princess' neck is used to raise her head, to look down, and then to lean forward. I tested two different ways in Adobe After Effects to recreate these actions:

By using a similar strategy to analogue cut-out, I call it here *basic strategy*, I placed head, neck and body in different compositing layers, changed their anchor points to the 'joint point'[2], and then parented[3] them together. After that, I moved them digitally following the motion board. The result is satisfactory but has not reduced work much. In the traditional way, if one wants to animate a head from one position to another position, one has to move it little by little, and take pictures frame by frame. However, by using software like Adobe After Effects, one just needs to change the head from the

---

[2] Comparable to the 'pin' in the real puppet.

[3] Parenting is to match up transformations or movements to layers by assigning a layer's transformations to b layer. After a layer is made a parent to the b layer, the b layer's changes become relative to the parent layer instead of to the composition.

beginning to the finishing position, and let the computer generates the "in between" period (see figure 4 upper images).
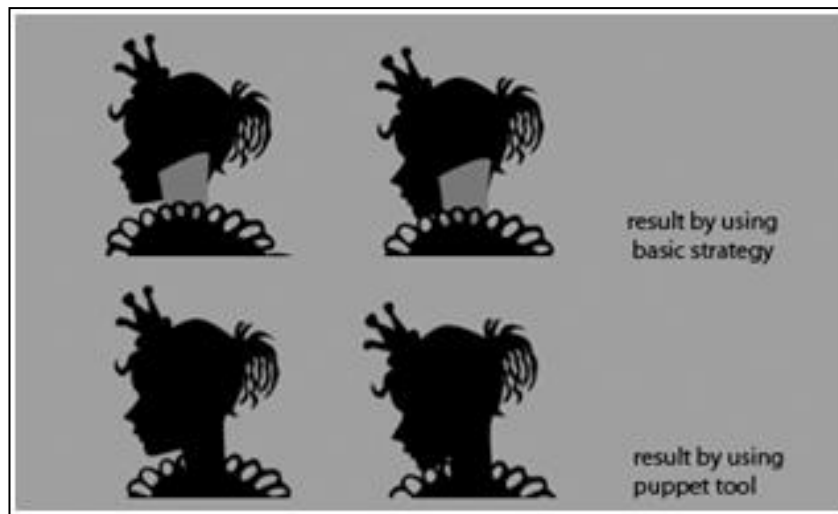

Figure 4: Comparison of the results from two different strategies

By using the puppet tool[4] in Adobe After Effects, I first placed the head and neck together on the same layer, and the body on a different layer, and after that, I used the 'puppet starch tool' to preserve the shape of the head. Following this, I used the 'puppet tool' on the neck with only three puppet pins[5] needed. I could create the head movement by only manipulating these pins. The cut-out shape of the neck did not deform much, the movement is smooth, and the head and the body are still a solid image. Thus, the result is fairly acceptable (see figure 4).

When I tested these two strategies on the princess's whole body, the advantage of using the puppet tool became more apparent. By using the first strategy, I need at least ten layers, because when the figure leaned forwards, her whole body would move together. In order to gain control over the body movement, I needed to change the anchor points of each part and parent them together. When the princess's body leant forward, many body parts were moving together, which as a result, required a lot of adjustments on each layer. However, by using the puppet tool, there are only three

---

[4] Puppet tools are used to quickly add motion to images. The Puppet effect works by distorting the shape of part of an image according to the positions of pins that place and move.

[5] Pins are used to define which parts of an image should move, which parts should remain rigid, and what parts should be on top when overlapping.

layers. Layer one contains the head with neck, layer two the body, and the third layer contains the chair. I used the puppet tool on layers one and two. This approach works quite well, and in this way, I reduced the amount of labour significantly. This outcome suggests that using the puppet tool is a good approach when dealing with gentle movements during the process of digitalizing cut-out animation.

6.1.1.1 Test on camera shaking

In order to simulate the unsteady lighting in the original animation sequence, I used an effect called 'wiggle' and set the parameter to wiggle (25,0.5), which means the wiggle occurs 25 times per second, and the amplitude in units of the property is 0.5. When I compared the result with the original clip from the movie, I found that they look almost identical. *(For demonstration of the wiggle effect, I have included a 'basic-movement-4-together. mov' in the folder named 'basic test 1' of the CD-ROM).*

6.1.2 Test 2

For the second experiment, I chose a clip that shows the frog dance on a table. This sequence is interesting because the limitations of cut-out do not allow for fundamental animation techniques such as stretch and squash. The cut-out forms are rigid compared to the possibilities of cel animation. *(The original clip 'frog-dance-original.mov' can be found in the folder named 'basic test 2' of the CD-ROM).*

First, I did a little experiment on the Frog's leg (see figure 5). Like before, I created the Frog's body parts in Adobe Illustrator. I then imported the artwork for the whole leg into Adobe After Effects. I set puppet pins and used the 'puppet starch tool' to freeze the thigh, calf, and foot except for the joint parts. When I tried to manipulate those parts in order to imitate the movement from the original animation, the joint's shape had serious distortions along the movement; the leg bent like folded paper. Therefore, I went back to the alternative strategy as outlined above: I imported each body part into a different layer, changed their anchor points, and parented them. Such prepared, I animated the leg movement key to key (see figure 6). *(The related clip 'test-on-leg-puppet.mov' can be found in folder named 'basic test 2' of the CD-ROM).*

Figure 5: Distortion of leg when using puppet tool

Figure 6: Comparison of the digital version with the original

As there were too many layers that had to be animated at the same time, this strategy was not as efficient as I hoped it to be. Nevertheless, the outcome looked like the original animation. These basic movements are the major part of a cut-out film, and therefore I considered it important to keep the stiff and firm appearance of the original analogue animation when digitalizing this form.

Result:

There are two major findings resulting from the basic movement experiments. First, one of the characteristics of cut-out animation is that only a part of a figure's body moves at any one time, such as the nodding of the head, leaning over and drinking wine beside the table. As long as the range of motion of a silhouette figure is not over 45 degrees, I can just use the 'puppet tool' to animate it in Adobe After Effects without breaking the figure into several pieces first. Using the 'starch tool' to solidify all body parts except for the joints was an important step in this process in order to avoid distortion of the major parts. Second, because one of the priorities of these experiments is to keep the 'stiff' feeling of traditional cut-out animation, according to my second test on basic movement, it was better to use the *basic strategy* when dealing with complex movements, such as the frog dancing. *(I have included 'final-result-compare-original.mov' in the folder named 'basic test 2' of the CD-ROM).*

6.2 Experiments on transformations

In 'Shadow Theatres and Shadow Films' (Reiniger, 1970), Reiniger said that when she dealt with transformation effects, she added pieces protruding from the figure little by little until they looked like the figure morphing into what it was supposed to become. In the next three experiments, I analyze three transformation effects from two well-known silhouette films of Reiniger: 'The Frog Prince' (1954) and 'Cinderella' (1954). After that, I will test the feasibility of recreating the transfigurations digitally.

6.2.1 Transformation Test 1

In this experiment, I wanted to test the transformation of the frog into the prince in 'The Frog Prince' (1954). When analysing the original cut-out animation carefully, I found that Reiniger cleverly used a unique feature of silhouette animation, which is, when two objects overlap, they appear as one shape because of their solid black colour.

In the original transformation of the frog, he raises his hands above his head, and, at the same time, the prince rises together with the frog in an unfolding manner. The prince transforms together with the frog starting from the ground (which is also solid black) until his crown overlaps with the frog's hands. Once this stage of the transformation has been reached, the frog is removed from the stage and the prince is shown squatting on the floor. The figure of the prince then rises and stands up. The whole production process of this transformation in the original cut-out animation is quite complicated. However, in order to make the transformation look smooth, the duration of the transformation only takes up one second. *(The original clip 'frog –to-prince-original' can be found under the folder 'Prince' in the folder named 'Transformation' of the CD-ROM).*

My first method was using the *basic strategy* to recreate the exact transformation as the original. Since the shape has changed dramatically, I could only use the *basic strategy* as in the frog dance (see above), and use two discrete compositions to separate the movements of the frog from those of the prince. And then, I over-lapped the two shapes to achieve the transformation (see figure 7). *(The film clip of this test 'transform-like-original' can be found under the folder 'Prince' in the folder named 'Transformation' of the CD-ROM).*
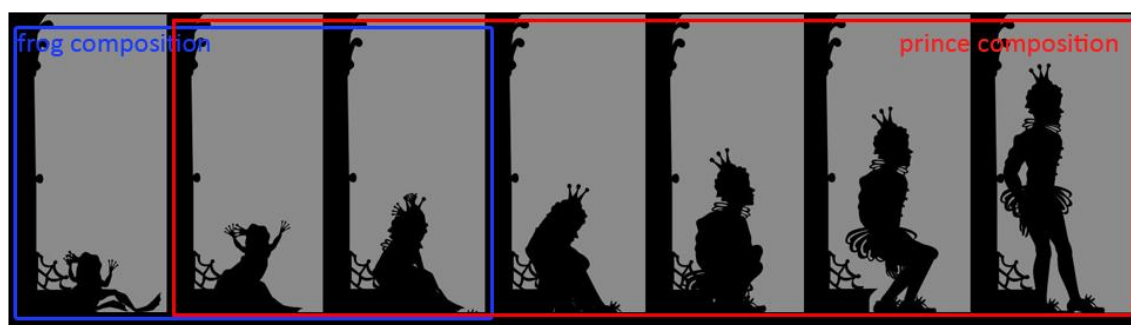

Figure 7: Using a basic strategy to create the frog-prince transformation

My second method in this experiment was to use Adobe Flash to recreate the transformation of the frog. I imported both the frog and prince figures into Flash and then placed them together onto the same layer but at different key frames. After this, I created a shape tween[6] between them. However, the result was not satisfactory by

---

[6] In Flash, a shape tween is a technique - to morph a shape into another.

default because of the risk of "negative" shapes i.e. when parts of the image turn "inward-out" or exchange positive form (foreground) with negative form (background) (see Figure 8). *(The related clip 'failed-transformation.swf' can be found under folder 'Prince' in folder named 'Transformation' of the CD-ROM).*

I assumed there could be two reasons which caused this unsatisfactory result. First, the outline of the prince was too complicated for the software to recognize. Second, the original shape already contained a number of interior cut-outs ("holes") that would increase the risk of negative tweens. Simplifying the original shape was not an option, as my goal was to retain the original aesthetic of the cut-out animation. Instead, I attempted to solve the tween problems as and where they occurred. For this purpose, I replaced the hollowed prince figure with a completely solid figure, this way avoiding the interior white spaces or "holes", and made the frog figure transform to this new, solid prince figure. At this stage, I used several shape hints[7] to guide the transformation (see figure 9). Only after this "gross" transformation was completed, I placed the final prince figure with the hollows beneath the initial transformation layer and let the solid figure fade out to show the final prince figure on the lower layer. As a result, the whole transformation looked logical and smooth (see figure 10). *(The related clip 'prince-final.swf' can be found under the folder 'Prince', in the folder named 'Transformation' of the CD-ROM).*

---

[7] Shape hints are used to adjust -a shape tween; shape hints are like morph pins that tell flash where a particular point or edge in shape 1 should end up in shape 2. Without shape hints, morphs can become quite arbitrary.
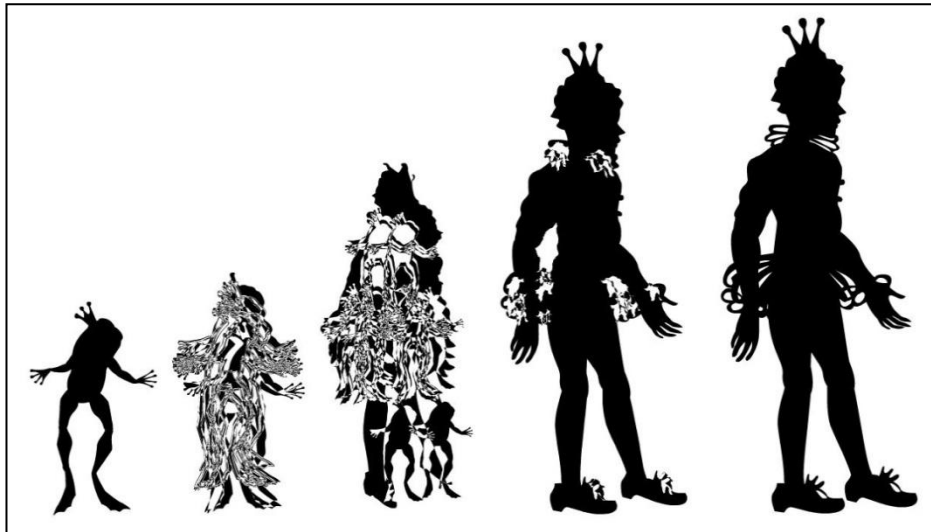
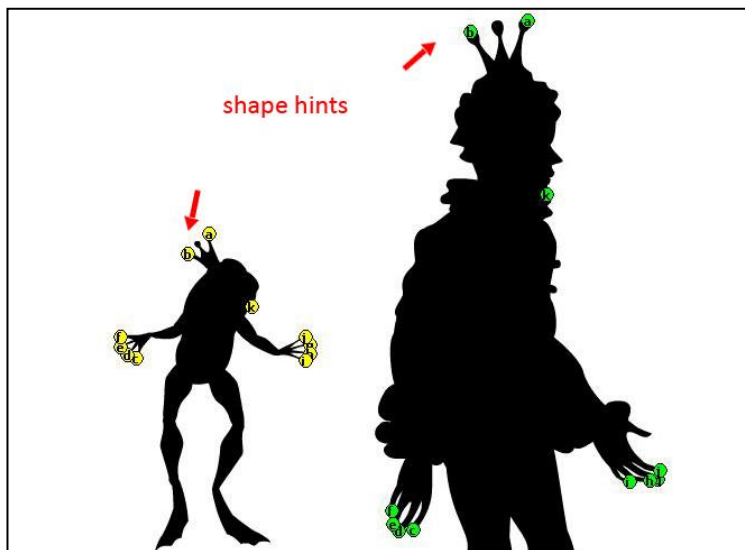*Figure 8: "Negative" shapes showed when simply using shape tween*
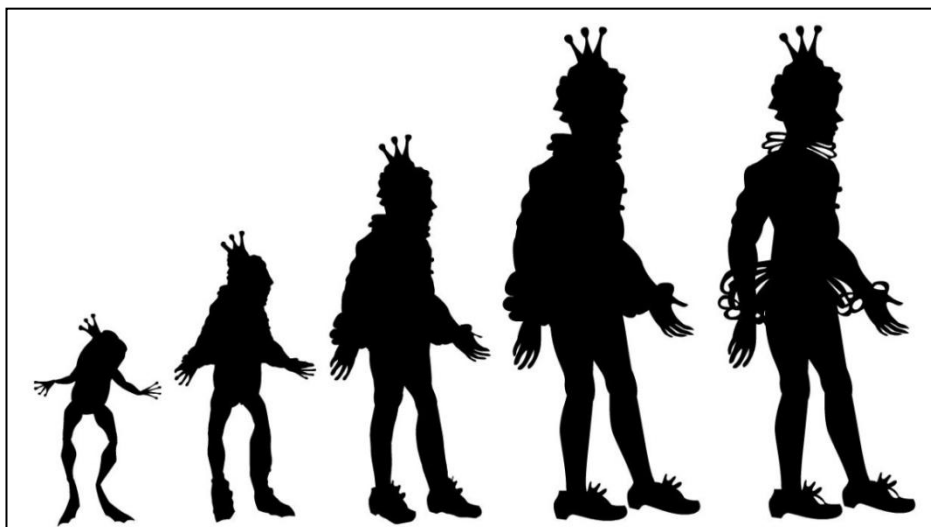

Figure 9: How shape hints work

Figure 10: Transformation with shape hints

Although the tests' results were very similar to the original clip, the first method was still complex and time consuming. There are many layers that had to be worked on at the same time, with the result that the transition appears too quickly, too rough and non-logical. The second method I have used for the transformation appeared to be smooth and time saving. However, this approach fundamentally influences one of the key features of cut-out animation – i.e. that shapes are principally rigid and will not transform in a malleable way. Against this genre-specific constraint, the final morph from frog to prince in the second approach shares a similarity with cel animation, i.e. the ability to freely deform an image gradually until it becomes a different shape. *(The final test film clip of this test 'match-flash-compare-to-original.mov' can be found under the folder 'Prince' in the folder named 'Transformation' of the CD-ROM).*
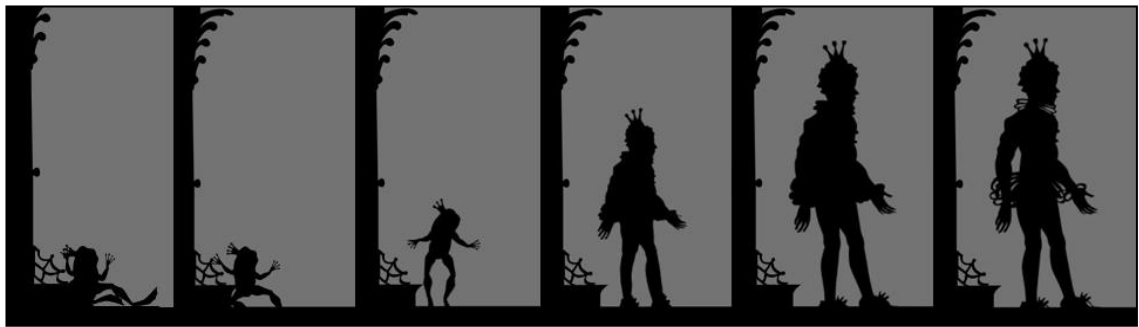

Figure 11: Transformation in composition

6.2.2 Transformation test 2

The second test investigates the transformation of pumpkin, mice and pigeons into coach, coachman and footmen, and horses in Reiniger's 'Cinderella' (1954). First, I investigated Reiniger's work. Because it is a transformation, the shape of pumpkin, mouse, and pigeons shift dramatically in the original film. I found that Reiniger had cut out a large number of different shapes in order to visualise the transition. The result is satisfactory, although an attentive viewer can still see the constant replacement of cut-out figures and the sudden appearance of carriage parts. However, it is evident that she tried to smooth the transition (see figure 12). *(The original clip 'coach-original.mov' can be found under the folder 'Coach' in the folder named 'Transformation' of the CD-ROM).*
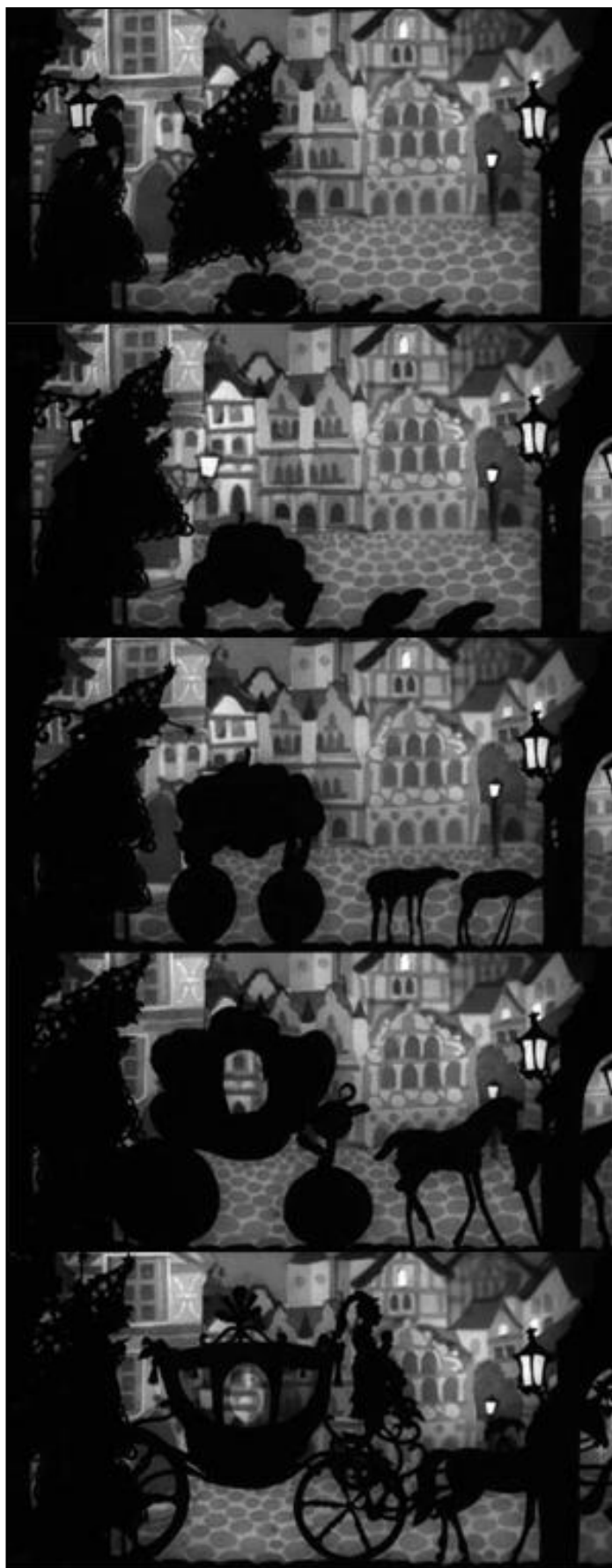
Figure 12: The original transformation

When I was digitizing the transformation, the first idea which came to my mind was using Adobe Flash, because of the success I had with the frog-to-prince shape tween. Because the final shape is rather complex, I separated the compound shape into several sections and placed these different parts onto a different layer each. My initial approach involved five layers; one layer each for the two mice and two pigeons, and one layer for the pumpkin. In order to recreate the transformation in the original cut out animation, where the pumpkin changes into a carriage (a transformation from a relatively simple to a relatively complex shape), I found that I needed to create at least three more in-between figures to guide the morph shapes for each of the five figures. I marked every frame that I thought the figures changed significantly in the original movie clip. According to this approach, I drew the additional figures (that were meant to serve as in-between morph-stages) in Adobe Illustrator, and laid them out along the timeline according to the original clip. In order to be accurate with the morph timings, I imported the original clip into Flash for comparison.

I then created shape tweens between each of the in-between shapes. In the given case I found that it was not easy to control how the shape tweens unfolded. Also here, a significant number of negative artefacts appeared as a result of Flash's automated tweening behaviour. In order to let the figure morph like it was supposed to, I added shape hints to guide the changes. This technique worked quite well on the body of the carriage. The only thing that concerned me was whether the 'hollow parts' (e.g. the windows of the carriage) would appear at the same time with the body of the carriage or after the morph. So I undertook a small experiment. In the first approach, I let all the shapes morph together (see figure 13).

In the second approach, I let the pumpkin change into the carriage first, and added the windows later (see figure 14). In the first approach, it was more difficult to control the tween process and I needed more hints to make the process convincible. The second option required fewer hints to control the morph, and less in-between images needed to be drawn. From this perspective, the second option saved production time. Also, this approach resulted in a smoother morph. On the other hand, the outcome of the first option is visually closer to the original clip – something that I was keen to preserve. However, the second option still appeared logical in that the transformation proceeds

step by step and it is easier for the viewer to accept because there are not too many shapes morphing at the same time to distract the attention of the audience. Moreover, the same morphing process also had been used in Reiniger's original clips on the wheel, i.e. the overall shape changed first, then 'the hollow part' appeared later, which means this second approach is not an entirely new strategy for digital cut-out animation. Therefore, I chose to use the second option to recreate the morph from pumpkin to carriage.
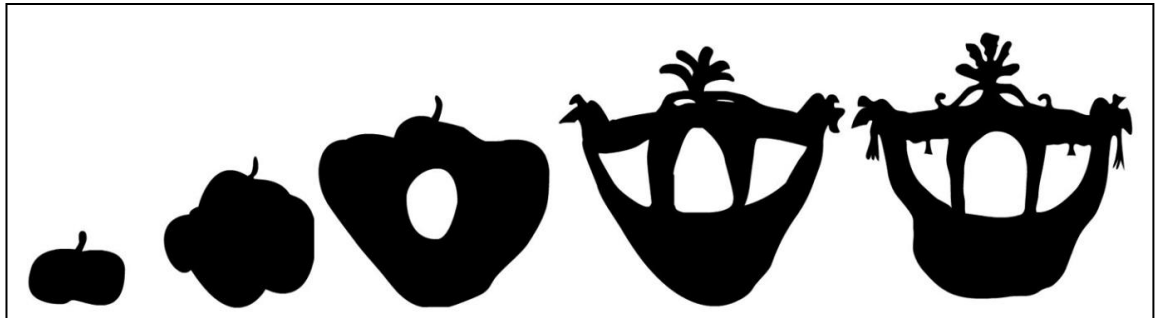

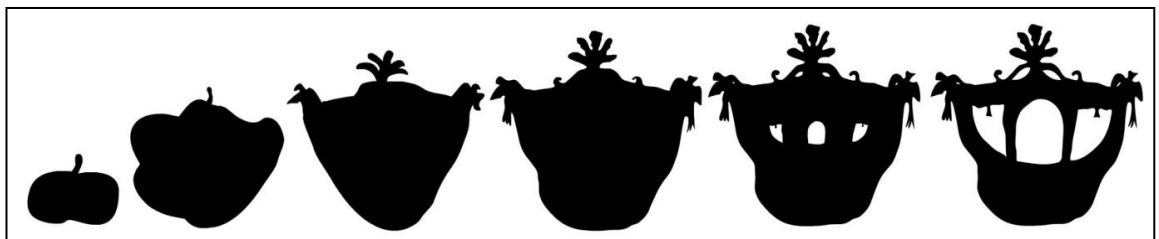*Figure 13: The first approach of pumpkin change*

Figure 14: The second approach of pumpkin change

Then, I moved onto the next test, the mice transformations. One mouse's transformation is rather complicated, the body of it transformed to the front wheel and shaft, and the head transforms into the coachman. In the first 42 frames of the transformation, the shapes of the mice do not change dramatically, and the shade of the wheels, the shaft and the coachman are still merging together. As a result, a simple shape tween works well for this segment of the transformation (see figure 15). After that, the shapes of wheel, coachman, and shaft become more and more defined which makes the transformation become complicated. So, at frame 43, I divided the one shape (where the wheel, shaft and the coachman were still merged together) into three parts; one part would morph to the coachman (see figure 16), one to the shaft (see figure 17), and one to the wheel (see figure 18). I placed each item on a different layer to work on later. The wheels and coachman's morphs are relatively easy, because their shapes are simple. I simply created a shape tween from the beginning frame to

the destination frame and added a few shape hints. The outcome is satisfactory.

The transformation to till and shaft was much more difficult to achieve, because this shape transforms dramatically during the process (see figure 17). For example, when I tried to use shape tween on the right shape, even though I added as many hints as I could to control the change, I still could not avoid generating negative shapes/artefacts. Also, if two hints are too close, Flash tends to confuse their start and end points – something that causes undesirable results. I have also tried to break the shape into two parts and let them transform separately, but because the ending shape was still very complex, the result remained unsatisfactory.
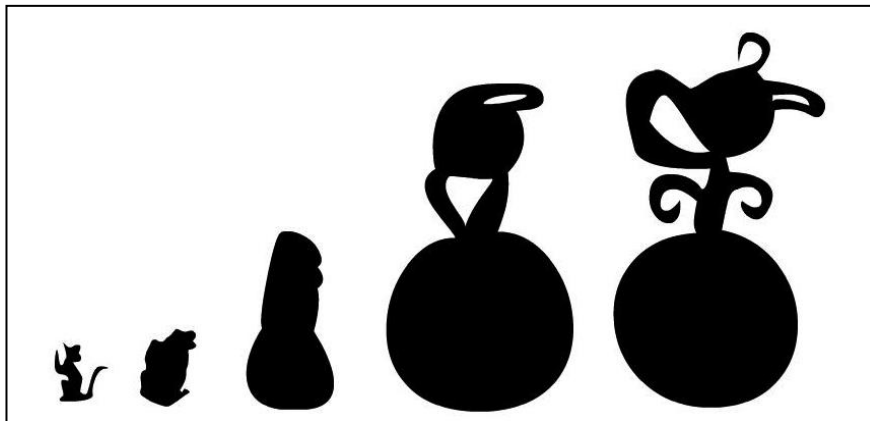

Figure 15: Transform in one shape (the wheel, shaft and the coachman were still merged together)
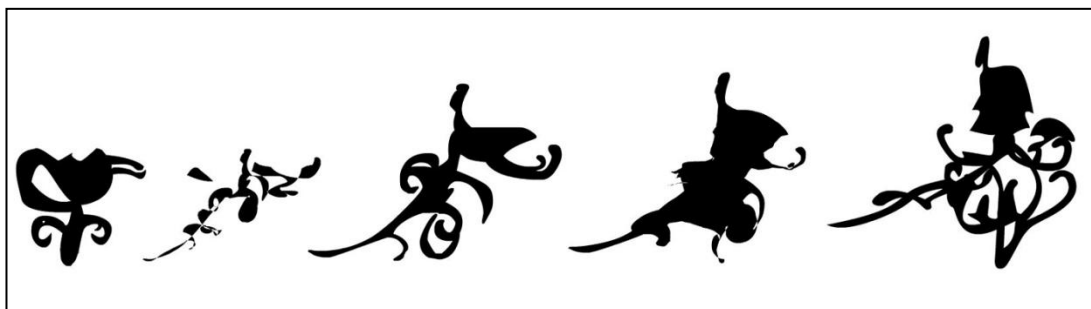

Figure 16: One part morphs to the coachman

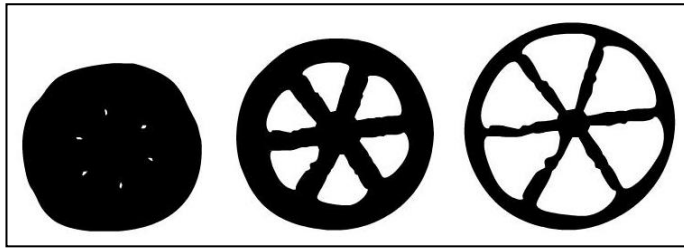

Figure 17: One part morphs to shaft

Figure 18: One part morphs to the wheel

In order to remedy these problems, I tried another technique. I used the pen tool to draw the beginning shape of the shaft, compared it to the original clip, and changed its shape by moving vector points. More vector points were needed when the structure of shaft became more complicated. In this way, I had full control over the shape, and the result was pleasing. Also, this approach was not as complicated as it initially appeared. The number of vertexes was reasonably small. So I decided to use this method to recreate the morph of the shaft (see figure 19).

Figure 19: Test shaft transformation in After Effects

For the transformation of the pigeons, I found that in the original, the figures at the beginning of the transformation were just pigeons without legs. So it was easy to transform the solid shape of the pigeons to the solid body of the horses. In my first experiment, I placed the pigeon's body on one layer. I created four legs on another layer in Adobe Flash. I let them become longer and longer until they could be seen on the stage. Then I used a layer which contained a shape of a pigeon with legs to replace the body layer and legs layer. Following, I created a shape tween for the transformation to the final shape of the horse (see figure 20). *(See the clip 'coach-transform-total-horse-in-flash' in folder 'Coach' in the folder named 'Transformation' of the CD-ROM).*
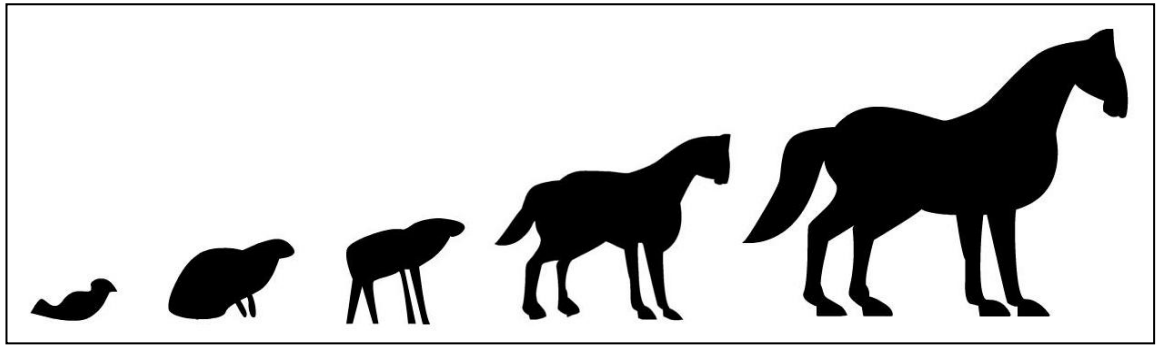
Figure 20: Transformation of the pigeon into horse in Flash

I found that the horse in the original clip is walking forward while it transforms its shape. I understood that this double-transformation would invariably complicate the tween process in Flash, because when the horse walks forward, the legs' shapes will overlap each other. Consequently, the horse could not be treated as a whole shape. If I were to place all four legs in Flash on a single layer, they would overlap and merge during the tween. Thus, in order to keep the scene as close to the original as possible, I separately created the transformation from the pigeon to the horse's body in Adobe Flash. For this step I chose to use Adobe Flash, as the body of both pigeon and horse were solid black shape, and a simple shape tween would do the transformation very well.

I recreated the leg parts in After Effects. Here, I can easily manipulate legs with the pen tool. I placed four legs on one shape layer, where, unlike in Adobe Flash, each shape can change without affecting the other shapes. Also because each shape (leg) is separate with each other in After Effects, I have full and logical control of each shape. When the horse moves forward, I can manipulate its legs one by one. Each leg contains the movement to step forward, whilst simultaneously to grow bigger. Although with legs growing and their shape becoming more complex, the increasing complexity is still manageable. It took a maximum of nine vertexes to shape a leg. Therefore, I only had to relocate nine vertexes every few frames. In Flash, it would take endless tweaking with shape hints to achieve a less effective result.

I also tried to use puppet tool in After Effects to make the horse walk concurrently with its legs growing. This approach would save a lot of time. This way, I can manipulate each leg as a whole, instead of moving every vertex individually and repeatedly.

However, I found that this approach did not work (see figure 21) because the puppet tool only recognizes the first shape and can only manipulate this particular shape. When the shape grows, the puppet considers the growing part as separate from the whole figure.
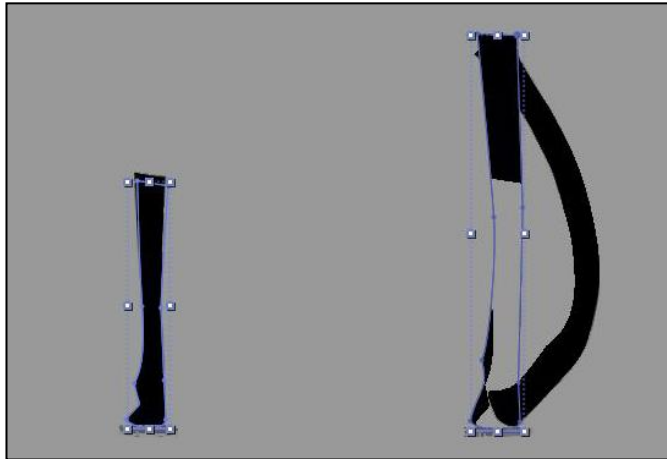

Figure 21: Test on one leg (use puppet tool in After Effects to make the horse walk concurrently with the leg growing)

When the horse fully transforms into the final shape, I replaced the horse legs with a walking cycle that I created separately in another composition. I used the puppet tool to control the movement of the legs. The walking cycle is not a very complex movement, so the puppet tool does the job well.

It was my initial assumption that it would be better to use a single software package to create a figure, so I tried to use the pen tool in After Effects to create the transformation from the pigeon to the horse. I was concerned that if I use two software applications, it may introduce some unnecessary complexity into the process. For example, when I create the transformation of the horse's body in Adobe Flash, I have to export it as a movie clip, and then import the movie clip to After Effects in order to add legs. If I needed to change something about the body, I have to go back to Adobe Flash to change that, and then export the film again and so on.

The shape of the horse's body is not as complex as the carriage. Although I used a fair number of vertexes (16 to 17) to match the shape of the horse in the original movie clip, it did not take long to complete the transformation. It takes longer than in Adobe

Flash, but it saves time by not exporting and importing movie clips between the two software packages. Overall this approach was convenient for reshaping the body (see figure 22).
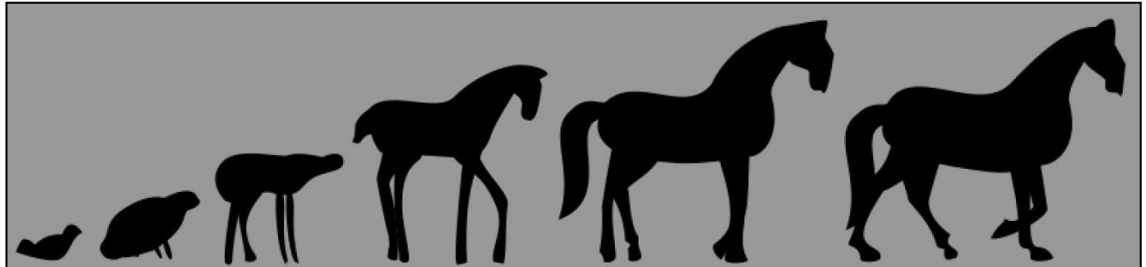

Figure 22: Transformation of horse in After Effects

For the movement of the carriage's wheels, it is not easy to control their rolling movement in Adobe Flash. Therefore, I copied the final shape of both of the wheels and manipulated them in After Effects to match the exact speed of the film clip.

By combining all of the above strategies, I created a transformation that looked very close to the original movie clip. *(The digital copy 'coach-transform-total.mov' has been included under the folder 'Coach' in the folder named 'Transformation' of the CD-ROM).* However, the entire process did not seem to remarkably reduce labour and time spent for managing the details of the transformation. Moreover, I found that some complexities during the transforming process were actually not necessary and could be seen as a distraction to the audience's attention rather than an aesthetic benefit. Such was the case for the horses' walking movement during metamorphosis in the original clip. This movement complicated the process in my recreation because I intended to make the digital version look as similar as possible to the original one. It is easier for the animator to deal with the morph separately. By separating these two movements, the final transformation process became more straightforward for the viewer to accept. In the original clip, the transformation and the rolling of wheels happen at the same time. In order to make the process logical and easy to accept by viewers, I decided also here to let the morphing happen first and the wheel rolling later.

6.2.2.1 Walking cycle

There are no walking cycles in the traditional cut-out animation films because of the straight ahead strategy they use. When dealing with walking or running, the animator has to reposition the puppet frame by frame – again and again. This process takes a lot of time and it is difficult to maintain the consistency of the walking pace and range. With the computer, a clip can easily be saved separately and put into the film anywhere where it is needed. So I made a walking cycle of the horse in order to test how this approach would benefit the digital animation.
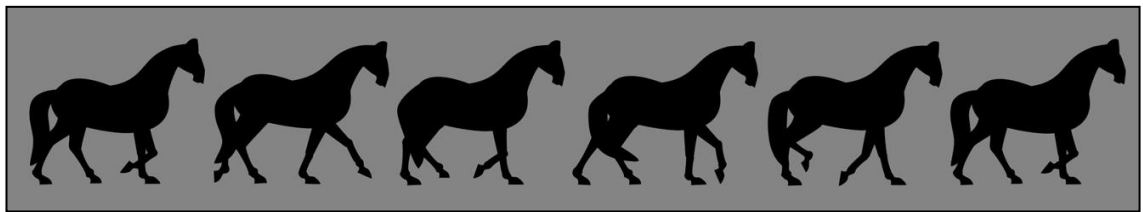

Figure 23: Horse walking cycle

Both the shape tween in Flash and the puppet tool in After Effects can be used to create a walking cycle. However, using these methods would distort the shape of the horse during the process. I used the *basic strategy* by creating each body part in Illustrator and importing them to After Effects and manipulating them key to key (see figure23). The amount of work in doing it this way may be more than using shape tween in Flash and the puppet tool in After Effects, but this way I could still keep the stiff movements typical for cut-out animation. In this experiment, I created the motion sequence of two legs which are on one side of the horse, and then reusing this sequence behind the horse's body by slightly changing scale and timing for the far two legs. The key point was to make sure to create the ending frame that could seamlessly connect with the first frame. When I then looped the final sequence of the walking horse into a cycling composition, the movements linked up smoothly. In this test, I used the same pose of legs in the first and the end frame. In addition, this clip can be reused in the film over and over at different places. The result was quite successful because the slightly rigid characteristic could be preserved while the walking pace could be created logically and evenly. *(I have included a 'horse-walk.mov' in the folder named 'walking cycle of horse' of the CD-ROM).*

6.2.3 Transformation test 3

I have chosen the emergence of the fairy godmother from star dust in 'Cinderella' for this third transformation experiment. In this test, I divided the transformation process into two stages, the first stage where the stars fall from the sky and gather together, and the second stage where the stars transform into the fairy godmother.

6.2.3.1 Falling stars:

First, I studied the original movie clip, and I found there are approximately three different sizes of stars in Reiniger's film. Small stars drop first, followed by medium size stars, then big stars. After that, they form a large conical shape like a teardrop, with the outer areas inhabited by small stars, then middle size stars, and then the biggest stars located in the centre of the conical shape.

Test 1 on falling stars:

In order to match the original movie clip, I decided to divide the stars into three groups: small stars, middle size stars, and big stars. I drew a star in Adobe Flash and converted it to a symbol (a self-contained and reusable Flash object), and then placed it onto the stage. I put all the small stars on one layer, middle size stars on a second layer, and the big stars on a third layer. I could not use motion tween to create the falling stars, because motion tween only works on a single symbol per layer. So I used shape tween to recreate the movement. This approach worked well in layer one and two. However, when I used shape tween in layer three, a lot of negative artefacts appeared in the transformation, even if I applied a large number of shape hints (see figure 24). The use of shape hints was rather limited because the objects (stars) were very close to each other. Moreover, there were too many stars in one layer. Also, it is very difficult to separate one object from the others, because they all were of the same size. These aspects made adding shape hints impractical. Therefore, placing too many stars in one layer is not an efficient way to recreate the falling stars.
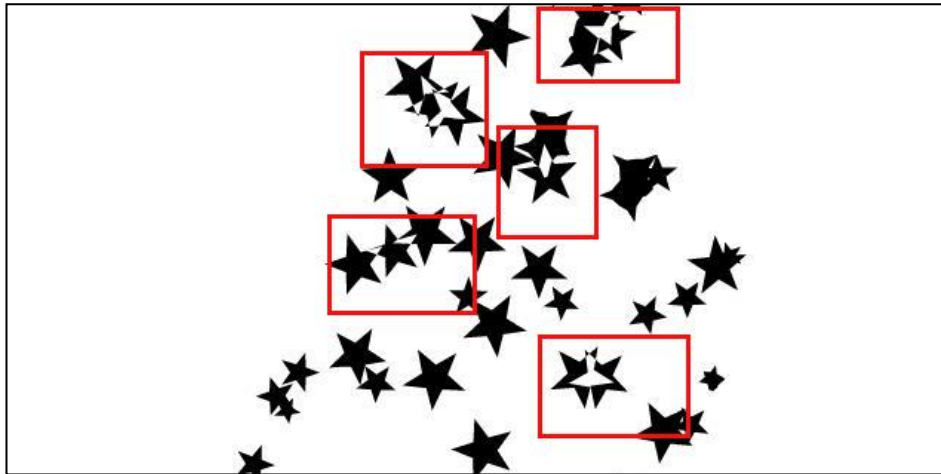
Figure 24: Negative images (see in red frames) show when using shape tween

Test 2 on falling stars:

In test two, I revised my approach by using multiple layers with one star object each and motion tween instead of shape tween. This approach gave me a great deal of flexibility in the animating process. However, I had to find a way to manage all star layers. So I organized these layers into three folders, the same sizes into the same folders. With motion tween, there was no trouble animating the stars like the cut-out pieces in the original movie (see figure 25). For comparison to After Effects, the process I used to recreate the falling stars is similar as in test 2 with Adobe Flash, except I did not have to create a separate layer for each star. Each object is recognized as a different path, even if they were located on the same layer, which can either be operated separately or together.
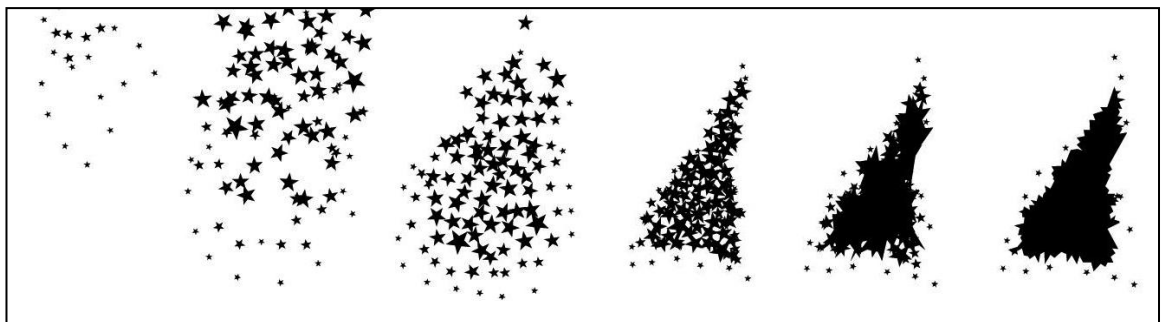

Figure 25: The falling stars

In summary, the movement of falling stars is an example of cut-out animation allowing multiple figures to transform at the same time. In traditional cut-out animation process, it is not easy to achieve with so many figures moving at the same time, so it is very easy

to forget one which may require reshooting. In the digital process, however, each figure has its own layer and motion path that can be easily changed and adjusted. Moreover, the animator can always add new layers or figures as and if necessary.

6.2.3.2 Test on transformation from stars to fairy godmother:

In the original movie clip, there are many noticeable gaps in the overall unfolding of the trans-formation after the stars had gathered. Reiniger used more stars and card board pieces for filling the gaps frame by frame. After that, she simply used the godmother's puppet to replace the stars. *(The original movie clip 'fairy-godmother-original.mov' can be found under the folder 'Fairy Godmother' in the folder named 'Transformation' of the CD-ROM).*

The aim of this test was to simplify the transformation and at the same time to streamline the process. As discussed above, it was not possible to simply place the gathered stars into one layer and to use a shape tween to transform to the fairy godmother shape. Because there are a lot of gaps in the gathered stars image, when it tweens, it will create an unpredictable transformation with many 'negative' shapes. In order to solve this problem, I had to fill these gaps first. I borrowed the technique from the original film and made a few improvements. I added a few more of the bigger stars, and let them fall and gather with others. After that, I enlarged some of the star objects to cover most gaps. In the next tween step, I replaced the interior star objects with a single image that covered all gaps (while keeping the edges of the stars visible), and made this image transform to the fairy godmother figure (see figure 26). This technique circumvented the problem of the unwanted tween artefacts in Flash. At last, I placed the final fairy godmother figure (with its hollow details) beneath this layer and let the layer fade out to see the underlying, final layer.

Figure 26: Transformation from stars to fairy godmother in Adobe Flash

The result of this method is quite satisfactory. The gaps between each of the stars were filled by gradually enlarged stars, and when the gaps were all filled, the transformation to the fairy godmother figure did appear smooth because the figure looks almost identical with 'the star group'.

For comparison, I tried to accomplish this transformation in After Effects. I used a transition effect called 'card wipe' on the figure of the fairy godmother to recreate the transformation (see figure 27). *(The related movie clip 'fairy-godmother-card-wipe.mov' can be found under the folder 'Fairy Godmother' in the folder named 'Transformation' of the CD-ROM).* This approach appears to be a quick way to accomplish the transformation, but the result was not very pleasing. It appeared that the stars had been replaced by black blocks that then transformed into the fairy godmother figure. Although this effect streamlines the process, the transformation visibly reveals the digital process. Thus, using this technique entirely changed the original transformation in Reiniger's animation.
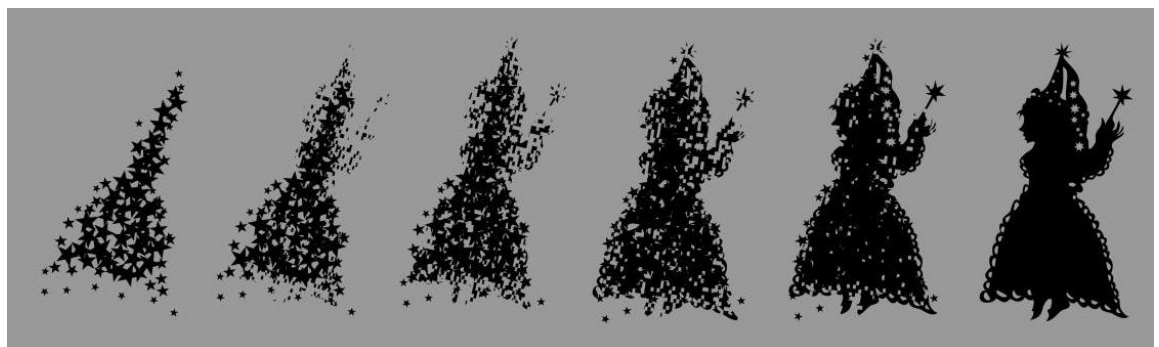

Figure 27: Using card wipe effects to create transformation to fairy godmother

To sum up, the transformation from stars to fairy godmother can be well achieved using digital techniques. The digital process does not have bits and pieces sticking out from figures, and the outline transformation from an angular (stars) to a rounded shape (fairy godmother) appears smooth. *(The result movie clip, 'fairy –final.swf', which include falling stars and transformation can be found under the folder 'Fairy Godmother' in the folder named 'Transformation' of the CD-ROM, along with a comparison clip called 'fairy-godmother-compare-final.mov').*

6.3 Experiments on depth movement

6.3.1 Test of the approach of a bat

The effects of distance or depth are hard to achieve at the same time whilst maintaining a purity of 'flat' style in cut-out animation, but these magical figures sometimes come into the picture from nowhere (Reiniger, 1970). To create this effect, both Reiniger and Norstein followed the same method as was later used in cel animation. In this test, I used a clip from a documentary video called 'The art of Lotte Reiniger' (Isaacs, 1970), where Reiniger introduced the technique she used to achieve the approaching of a bat. First, she created fifteen different sized flying bat figures. These shapes were then replaced frame-by-frame in various different sizes. Starting with a blank frame, the smallest of the figures is placed on the set, a shot is taken, and the next larger size in the series is put in its place, slightly changing the position, coming up or down. Gradually the figure will reach its destination and appear full-size on the screen. *(The original clip 'bat-fly-original.mov' can be found under the folder 'Bat' in the folder named 'Depth' of the CD-ROM.)*
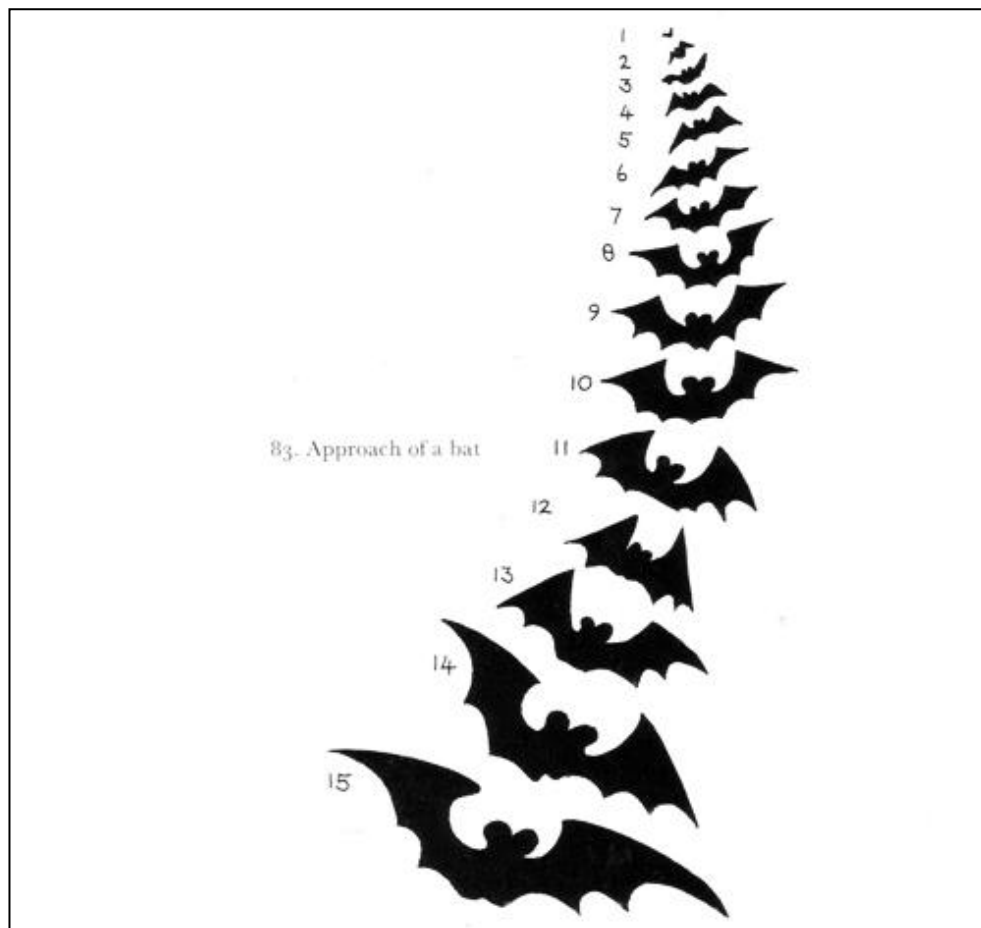
Figure 28: Approach of a bat (from: Shadow theatres and shadow films, pp. 109)

In a digital workflow, this process is undemanding. In After Effects, I first made a flying circle (along the principles of a walking cycle) of the bat. I placed this flying circle composition into a new composition, in which I scaled, repositioned and rotated it along the flight path of the bat. In Adobe Flash, this approach is straightforward, too. I made a flying circle of bat by using the shape tween, and converted it to a symbol (see figure 29). Afterward, I placed this symbol into a scene and created a motion tween to make it fly towards the audience. *(The resulting movie clip 'bat-fly.swf' can be found under the folder 'Bat' in folder named 'Depth' of the CD-ROM. There is also another movie clip, 'bat-compare-original.mov', which place the digital and the original clips side by side to show the difference).*
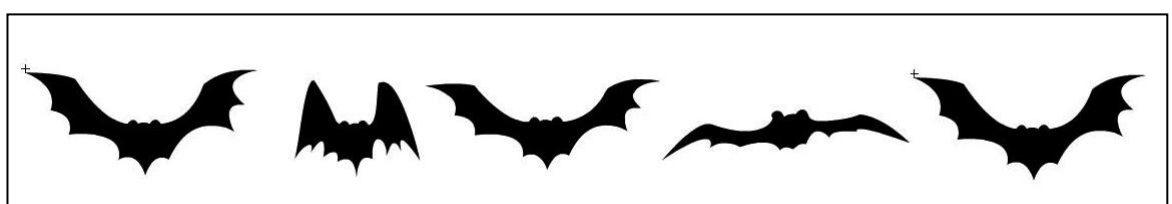

Figure 29: Gestures of bat when it flies

In summary, the digital process of creating the back-to-front flight path of the bat (along the z-axis) is much more efficient and time saving than the manual technique. Unlike in the traditional approach, cutting out numbers of different sizes and the poses of the bat figures for the process is not required. Instead, the motion object can be moved and scaled along the flight path as a pre-created motion cycle (flapping of wings). One might argue this approach loses the look and feel of cut out animation. However, the original movie clip shows that the animator tried to accomplish the fluency of the flight motion by using numerous bat shapes. By digitalizing it, some goals are achieved together with an improved smoothness in movement. As a result, I consider the outlined approach as an appropriate way to recreate depth-movement in digital cut-out animation.

6.3.2 Hedgehog goes through the bush

The original movie clip is from "Hedgehog in the Fog" (Norstein, 1975). In the original film, Norstein used a technique similar to a 'tracking shot' to create the illusion that the hedgehog is walking into the bushes from the viewpoint of the spectator. Using the 'tracking shot' technique is a brilliant idea to achieve depth in cut-out animation. In the film, the hedgehog figure is basically just moving up and down to imitate walking. And there are a few layers of bush figures which have been placed on both the right and left sides of the hedgehog that move gradually to the right or left until they are out of the scene. The depth is achieved by using lighting and changing the camera focus. However, cut-out figures have their own constraints. Their size cannot be easily changed. Yet in the real world, when the bushes come close to us, they appear bigger than when they are away. Another deficiency of this approach in the original movie refers to irregularities in the lighting. In the original, it appears that the hedgehog and the bushes are filmed separately and then composed later, because the light changes of the bushes are relatively obvious and are absent for the hedgehog with no lighting change. Consequently, the hedgehog appears brighter than the bushes but also more static. *(The original clip 'hedgehog-original.mov' can be found under the folder 'Hedgehog' in the folder named 'Depth' of the CD-ROM).*

I used screen shots from the movie to recreate the bushes scene. Like the original movie clip, I placed the hedgehog and the bushes in different layers in After Effects. In

order to make the hedgehog not look overly bright in the scene, I used an effect called *Brightness and Contrast* to control the brightness over the time of the scene. There are four bush layers, two at right and two at left. For each bush layer, I used the same effects, *Brightness and Contrast*, *Gaussian Blur*, and *Drop Shadow*. Using *Brightness and Contrast* rendered the bushes increasingly bright while the hedgehog was walking into the bushes. Using *Gaussian Blur* imitated the focus of the camera in the original. *Drop shadow* was used to create the shadow of the bushes on the hedgehog. At the same time, the figures of the bushes were getting bigger and bigger and gradually moved out of the scene (see figure 30). *(The related movie clip, 'hedgehog.mov' can be found under folder 'Hedgehog' in folder named 'Depth' of the CD-ROM).*
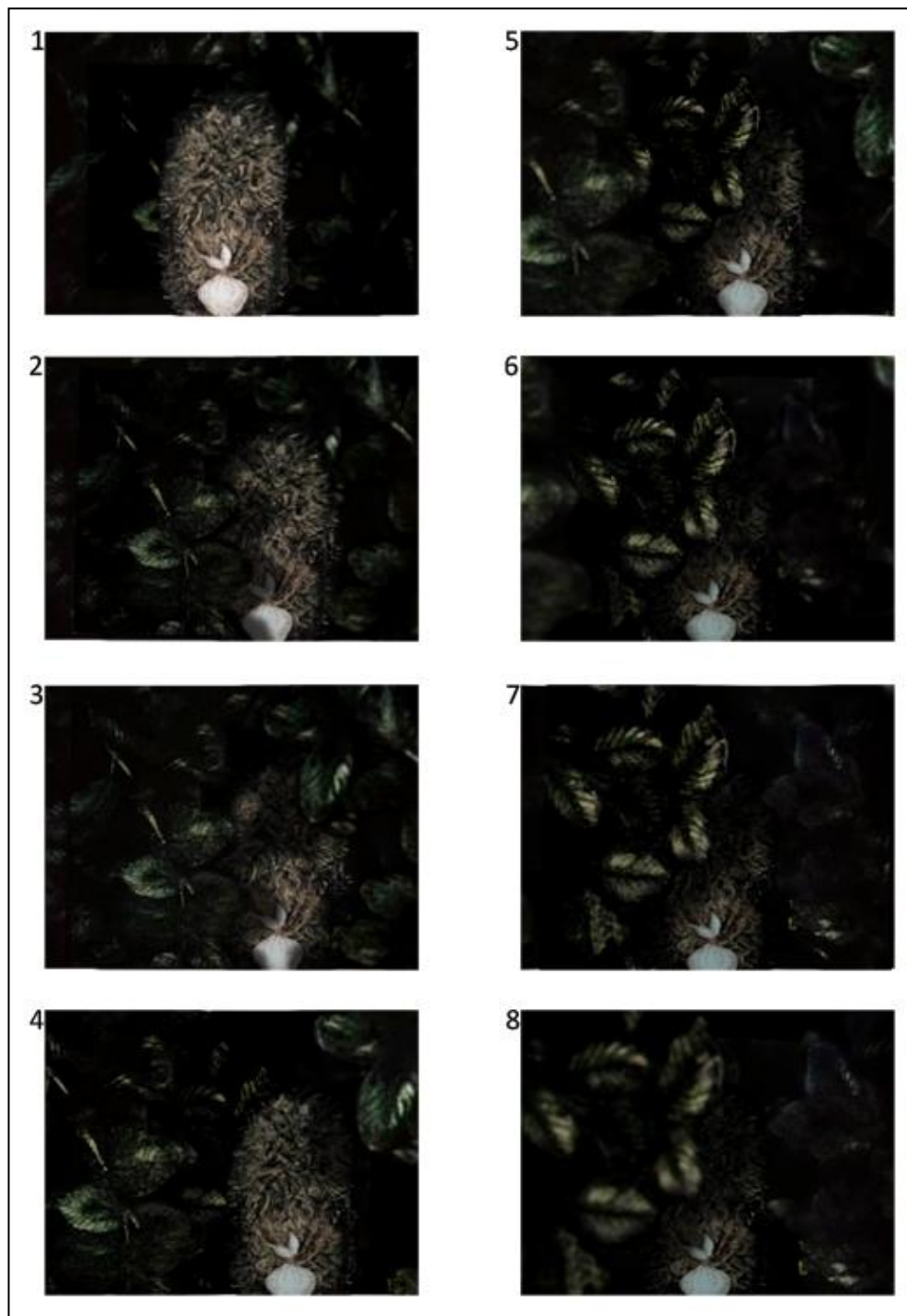
Figure 30: Test on hedgehog in the bushes

The outcome of this experiment is not as convincing as the original clip. There are a
number of reasons that cause the unsatisfactory result. The depth in the original clip
was achieved by using a combination of a number of manual techniques. One is texture.
The background of Norstein's animation film was not a single layer but was built up
with several layers of celluloid that created a texture of depth, a play of space and air
(Kitson, 2005, pp. 42-43). So, the bushes in the original clip contained many more

layers than I have used in the digital version. The second defining technique used by Norstein is a specially designed multi-plane animation stand. The notion of Disney's multi-plane system is to carefully adjust the distance between each level of the planes to imitate a classical perspective. However, Norstein's glass planes in his multi-plane system could move up and down in order to simulate the live-action camera movements. Lampolski (cited in Kitson, 2005) has pointed out that the art style of the 'Hedgehog in the Fog' was influenced by oriental art. The three-dimensional space which features in 'Hedgehog in the Fog' can be seen as a 'quasi-space', in which "things are portrayed appearing, disappearing, moving, and changing rather than in the static condition of most Western art" (Kitson, 2005, p. 44). And also, animation films are normally shot with a clean glass plate to avoid unwanted shadows and blurring of the image, but Norstein and his camera man, Alexander Zhukovsky (n.d.), chose to use glass planes that were not entirely clean in order to achieve texture, airiness and space. The fourth technique used by Norstein is a constantly changing camera focus in order to build the sense of walking along the z-axis into the depth of the 'quasi-space'.

To sum up, the z-axis movement that was used in the original clip relied a great deal on specialized equipments and techniques, such as the thickness of celluloid layers, the vertically moveable glass planes, and even the dust on the planes. The effects achieved by these techniques can only be approximated digitally. This specialist area of cut-out effects and its manual to digital translation will require further research that exceeds the scope and intentions of this thesis.

7. Summary of Findings

In chapter six, I have investigated the digital transformation of some typical character movements in traditional cut-out animation, such as basic movements, transformation, appearances and disappearances, and movements along the z-axis. The key aim of my experiments in digital transformation was to maintain as many characteristics of the original movements of cut-out animation as possible and therefore, as a result, the tests were designed to exactly simulate the original aesthetics of cut-out movements.

I found that the most significant change in the production method is from 'straight ahead' to 'pose to pose' method. Traditional cut-out animation uses 'straight ahead' as its sole animation method. In pose to pose animation, the important poses are drawn first, and other poses between the significant poses are filled later. In the case of computer animation, these 'in between' poses can be created automatically through computer software which significantly shortens the production time.

To test the basic gentle movements (range of movements less than 45 degrees), I have experimented with the nodding head and leaning forward of the princess in 'The Frog Prince'. By using digital tools, I could treat the figure as a whole shape instead of joined limbs, which significantly saved time and work because of the reduction of objects that needed to be handled at any one point in time. By using the puppet tool in After Effects, I could 'starch' the part that needed to stay still and animate the figure through puppet pins. However, this strategy works best when the range of motion of a silhouette figure is below 45 degrees; otherwise figure may be distorted. Therefore, if the motion range of a figure is generally over 45 degrees in a scene, it is better to import each body part to a different layer, parent them, and then animate key to key. This method maintains the firm movements of traditional cut-out animation well. The animation process is still labour intensive, because the body parts still have to be animated individually. However, the intense work of animating body parts can be, in a professional production workflow, divided and delegated to a team of animators as it is done in the pipeline production of cel animation. Due to the body parts being digitised, they can be copied and reused as many times as needed. It is therefore a big advantage over the analogue production approach where each object needs to be created separately. Compared to traditional cut-out animation, which allows only a small group of people

to manipulate characters at any one time, the digital method reduces the intensity of work by distributing production. As a result, production time can be significantly reduced.

According to Furniss (1998), creating constant movement in animation is a time-consuming and costly process. Some studios use a technique called the 'cycling' of actions to make their work stretch further. In the case of cut-out animation, it is almost impossible to create continuous movements because of constrains in production and the planning of an animation sequence. To remedy the problem of continuous movement in cut-out animation and to draw from the best of available approaches, I imported the 'cycling' technique into digital cut-out animation as demonstrated in the experiment of the movement of the horses in 'Cinderella'. By using this technique, I was able to create smooth and consistent movements that may be reused in the film wherever needed.

I have also brought the 'cycling' technique into recreating movements along the z-axis in cut-out animation. Movements in the real world are generally considered to occur along the three axes: x, y and z. For cut-out animation, movements along the x-axis and y-axis are mostly common. Z-axis movements tend to be much trickier because cut-out animation operates in a two-dimensional space with no natural z-axis. In digital animation, z-axis movements can be achieved much easier than in analogue animation. In the test of a bat flying towards the camera (i.e. from the point-of-view of the audience), a flying cycle was made first and then scaled, positioned and rotated along the motion path. This way, a fluency of the flying motion could be achieved and time was saved. Also, sudden changes in object size, which could be visible to the attentive eye in the original, could be avoided as the digital solution does not rely on various discrete object sizes. Overall, the resulting flight of the bat is more consistent and more logical than in the original.

These two tests confirm that 'cycling' is a very useful technique in digitalizing traditional cut-out animation. This technique can be used in a complete movement, such as continual walking, a clock with moving hands, swimming fishes, rolling wheels, and flying birds (Lewis & Luciana, 2002), or a simple rendering of a background figure,

such as a character walking past environmental objects. By using digital tools, the loop even can be resized and repositioned to achieve the movement in the z-axis. If compared to the tedious work in traditional cut-out animation', which is repositioning the character over and over, this cycling method indeed does simplify and speed up the process.

Another approach I have explored is the shape-shifting or metamorphoses of objects in cut-out animation. In this experiment, the advantage of the digital tool is very obvious. Because the example I chose was silhouette film, the characters are pure black which can be seen as shapes. I could manage to use the shape tween in Adobe Flash to recreate a smooth transformation from one to another. Compared to the technique used in the analogue animation films, this approach is uncomplicated, and the transformation appears logical and no unwanted pieces stick out of the figures during the process. In the original animation clips, Reiniger added small pieces of black paper to the beginning figure gradually until it resembled the ending figure. It clearly shows that the animators tried to achieve a smooth transformation, but the process still appeared inconsistent because of the texture of material used. In the digital process, this problem has been solved; the tween generated by Adobe Flash looks smooth and even. This can be regarded an improvement to analogue cut-out animation.

When animating several figures simultaneously in traditional cut-out animation, it is possible that the animator forgets one step which invariably leads to reshooting the scene. By using the CG technique, as I tested on stars falling from the sky, each star has its own layer and moving path which can be changed at any time. If one star is missing, it is easy for the animator to add and set a moving path for it. In this test, the movement of stars can be recreated digitally, and as animators have better control over figures with the CG technique, they can go back and forth to change the paths and rotation, even the size of figures.

In the experiment on the clip of the 'Hedgehog in the Fog', I realized that sometimes the movements of figures and camera are not the only tools for an animator to achieve movements in the z-axis in analogue cut-out animation. Norstein used the texture, the distance between glass plates, even the dirt on glass to create a spatial environment to

surround the character. This setting of the scene contributes to the success of the hedgehog walking along the z-axis. The experiment was not as successful as I expected because I only considered the character movements and camera movement at the time. Further research into this aspect of cut-out animation will be required.

The camera shaking and the flickering light, which made the images in most of the early animation films look unstable, do not occur in the digital animation. In order to make the digital transition look like the "old" cut-out animation, I have successfully managed to use an effect in After Effects to recreate this shaking. However, this movement, which is caused by the unstable camera, is nearly invisible in the later cut-out animation films, so it may not be needed in digital cut-out animation.

8. Conclusion

The goal of this research was to analyse genre-specific aspects of traditional cut-out animation, and, while keeping the characteristics of this form, preserve and further develop these traditions within a digital production workflow. Cut-out animation deserves to be carried over into the digital age as it has unique aesthetic characteristics that are able to foster narrative imagination and aesthetic appreciation in its audiences.

In order to answer the research questions in this study, I adopted a practice-based research approach that allowed me to micro-analyse the traditional art form. The goal to re-instantiate the original aesthetics in a digital workflow was driven by a number of experiments to deconstruct and digitally re-instantiate the animatic motion of the art form. Hereby, the research was driven by the idea of remediation (Grusin & Bolter, 2000) that provides a theoretical platform for the attempted digital transition of cut-out animation.

The result of my experiments shows that most characteristics regarding the movement in cut-out animation can be recreated in the digital workflow, and in some aspects, the digital method can be seen as an improvement on the traditional one. Some compromises have to be made to reduce the time and labour. Several strategies were developed that allowed to recreate traditional cut-out movements:

1. The production method of cut-out animation was changed from 'straight ahead' to 'pose to pose' when I used the computer CG technique to reproduce animatic movements.
2. For basic movements, if the moving range of a silhouette figure is not over 45 degrees, using the puppet tool to animate in After Effects without breaking the shapes out into pieces appeared very useful.
3. The 'cycling' technique can simplify and speed up production in digital cut-out animation.
4. Shape-shifting or transformations can be achieved by using the shape tween in Adobe Flash, and the production time can be saved significantly.
5. Depth or z-axis movements remain problematic also in a digital workflow. Here, more research exceeding the scope and intentions of this study may be required.

I also realized that digital tools have the advantage in animating multiple figures when recreating animation films. Instead of being animated at the same time, every figure has its own layer and can be animated individually first and brought together later. Even if a figure has been forgotten, it is easy to add into the composition, unlike in the traditional cut-out animation, where the scene has to be re-shot.

Because of time limitations, I have focused my research on the characteristics of movements of cut-out animation, and most of the examples I have chosen are from silhouette animation films. Without being distracted by problems of color, texture and lighting, I managed to concentrate on the characteristics of motion of cut-out figures. However, in some of the top-lit cut-out animation films, such as 'The Hedgehog in Fog', the movements of characters are affected by other aesthetic aspects, such as texture and lighting. Therefore, these aesthetic aspects need to be take into consideration in the future study of digitalizing movements of traditional cut-out animation, especially in top-lit animation.

In order to fully investigate the digital transition of cut-out animation, and the level of authenticity that traditional cut-out animation can pass on to digital methods, I suggest to further investigate digital cut-out animation by studying other aesthetic aspects, such as texture, lighting, and camera movements, music, and so on. As Furniss (1998) argues, animation is an art that is intersected by many artistic practices, and it is important to recognize that there is large number of influences on the aesthetics of how an animation works. Thus, all the visual and non-visual elements which affect the characteristics of cut-out animation should be taken into consideration in any further studies of digital cut-out animation, and as a result, a complete digital workflow may result from these thorough investigations.

References

Arnheim, R. (1997). *Film essays and criticism.* The University of Wisconsin Press.

Bhatia, P. K. (2008). *Computer Graphics.* I. K. International Pvt Ltd.

Barrier, M. (1999). *American Animation*, Oxford University Press.

Blair, P. (1994). *Cartoon Animation.* Laguna Hills, California: Walter Forster Publishing, Inc.

Bellucci, J. (2009). *Anecdotes.* Retrieved 30 September, 2010, https://ritdml.rit.edu/handle/1850/10898.

Bolt, B. (2004). *Art beyond Representation: The Performative Power of the Image*. London: I. B. Tauris.

Bolt, B. (2007). The Magic is in Handling. In Barrett, E. & Bolt, B. (eds.). *Practice as research: approaches to creative arts enquiry*. London: I. B. Tauris.

Bolter, J. D & Grusin, R. (2000). *Remediation: Understanding New Media.* MIT Press.

Bruner, J. (1986). *Actual Minds, Possible Worlds*. Harvard University Press.

Cheplic, M. (1998). *'As Crappy as Possible': the Method behind the Madness of South Park.* Retrieved 30 September, 2010, from http://www.digitalcontentproducer.com/mag/video_crappy_possible_method/index.html

Chen, K. L. (2007). *A Proposed Character Animation Workflow for Digital Production Arts with Preparation for Cloth Dynamics*. Retrieved 27 June, 2010, from http://etd.lib.clemson.edu/documents/1193078947/umi-clemson-1289.pdf

Dowlatabadi, Z. & Winder, C . (2001). *Producing Animation.* Focal Press

Driver, D. (n.d.). *South park studios: no walk in the park.* Retrieved 30 September, 2010, from http://www.apple.com/pro/profiles/southpark/index.html.

Faber, L. & Walters, H. (2004). *Animation Unlimited: Innovative Short Films since 1940.* Laurence King Publishing.

Finley, S. (2005). Arts-based Inquiry: Performing Revolutionary Pedagogy. In Denzin, N. & Lincoln, Y. (Eds).*The Saga Handbook of Qualitative Research (3rd Ed)*. London: Sage.

Furniss, M. (1998). *Art in Motion: Animation Aesthetics*. Sydney: John Libbey & Company Limited.

Heidegger, M. (1996). *Being and Time.* Trans.lated by J. Stambaugh. Albany: State University of New York Press.

Hockney, D. (2001). *Secret Knowledge: Rediscovering the Lost Techniques of the Old Masters.* London: Thames and Hudson.

Hookey, R. J. (1980). *Gathering of the Clan: 1980 Ottawa International Animation Festival.* In Cinema Canada, October-November, 1980.

Jackson, W. (1998). *Dig This! Using Computers to Simulate Cut-out Animation Techniques on South Park and Blue's Clues.* Animation World Magazine, Issue 3.6. Retrieved 30 July, 2010, from http://www.awn.com/mag/issue3.6/3.6pages/3.6digthis.html.

Jones, A. & Oliff, J. (2008). *Thinking Animation: Bridging the Path Between 2D and CG*. Thomson Course Technology.

Jouvanceau, P. (2004). *The Silhouette Film*. Translated by Clare Kitson. Italy: Chivari Film Festival.

Klein, T. (1997). Apprenticing the master: Tex Avery at Universal (1929-1935). *Animation Journal 6, 1* (Fall 1997), pp: 4-20.

Kitson, C. (2005). *Yuri Norstein and Tale of Tales-An Animator's Journey*. Indiana University Press.

Krasner, J. (2004). *Motion Graphic Design and Fine Art Animation: Principles and Practice.* Oxford : Focal.

Laszlo, J., Panne, M., Van D., & Fiume, E. (1996). *Limit cycle control and its application to the animation of balancing and walking.* Retrieved 20 October, 2010, from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.46.2337&rep=rep1&type=pdf

Leary, M. (2010). *Yuri Norstein and the Hedgehog at USC.* Retrieved 15 August, 2010, from http://www.filmwell.org/2010/02/22/yuri-norstein-and-the-hedgehog-at-usc/

Lehmann, AS. (2007*). Hollywood Computer Generated Animation: The Attraction of the Immediate.* Retried 20 October, 2010, from http://www.mediaengager.com/getreal.pdf

Leonard, D. (2006). *'South Park' creators haven't lost their edge*. Retrieved 30 September, 2010, from http://money.cnn.com/magazines/fortune/fortune_archive/2006/10/30/8391792/index.htm

Lewis, R. & Luciana, J. (2005). *Digital Media: An Introduction.* Pearson Prentice Hall

Lister, M., Dovey, J., Giddings, S., Grant, I. and Ketty, K . (2003). *New Media: A Critical Introduction*, Routledge.

Manovich, L. (2002). *The Language of New Media.* Cambridge, Massachusetts: The MIT

Press.

Moore, F. (2006). *Loud and lewd but sweet underneath.* Retried 30 September, 2010, from http://www.theage.com.au/news/tv--radio/loud-and-lewd-but-sweet-underneath/2006/12/13/1165685687176.html?page=2

Moriz, W. (1996). Some critical perspectives on Lotte Reiniger. In: Furniss, M. (2007). *Animation: Art & Industry.* Indiana University Press.

Moritz, W. (1988). 'ome Observations on Non-objective and Non-linear animation. In: Canemaker (Ed.) (1988) *Storytelling in Animation*, Los Angeles: AFI.

Myers, E. & Deneroff, H. (2007). *Survey of animation: Silhouette.* Retrieved 19 June, 2010, from http://www.emilydmyers.com/Silhouette.pdf.

Priebe, Ken A. (2007). *The Art of Stop-motion Animation.* Thomson Course Technology PTR.

Purves, B. (2008). *Stop Motion: Passion, Process and Performance*. Focal Press.

Reiniger, L. (1970). *Shadow Theatres and Shadow Films.* Norwich: Jarrold & Sons Ltd.

Robers, S. (2007). *Character Animation: 2D Skills for Better 3D (2nd Ed)*. Focal Press.

Russett, R. & Starr, C. (1976). *Experimental Animation: An Illustrated Anthology*. New York: Van Nostrand Reinhold Co.

Taylor, R. (1996). *The Encyclopedia of Animation Techniques*. Australia: Simon and Schuster.

Thomas, M. & Penz, F. (2003). *Architectures of Illusion: from Motion Pictures to Navigable Interactive Environments.* Bristol, Portland, OR: Intellect.

Schön, D.A. (1983). *The Reflective Practitioner: How Professionals Think in Action.* Basic books, New York.

Scrivener, S. (2000). Towards an Operationalisation of Design Research as Reflection in and on Action and Practice. In: *Doctoral Education in Design - Foundations for the Future*. La Clusaz Conference (Eds.). D. Durling, & K. Friedman. Staffordshire: University of Staffordshire Press.

Silvio,T. (2010*). Notes toward Anthropology of Animation*. Retrieved 20 October, 2010, from http://www.ioe.sinica.edu.tw/chinese/seminar/100612/paper/FSilvio.pdf

Sobchack, V. (Ed.). (2000). *Meta-morphing: Visual Transformation and the Culture of Quick-change.* Minneapolis: University of Minnesota Press.

Solomon, C. (Ed.) (1987). *The Art of the Animated Image: An Anthology.* Los Angeles: AFI.

Wells, P. (1998). *Understanding Animation*. London: Routledge.

Wells, P. (2002). *Animation: Genre and Authorship.* Wallflower Press.

Wells, P. (2006). *The Fundamentals of Animation.* AVA.

White, T. (2006). *Animation from pencils to pixels: classical techniques for digital animators.* Elsevier.

Appendix A: List of Digital Files submitted with this Thesis (see accompanying CD)

1. basic test 1/basic-movement-4-together.mov
2. basic test 1/gentle-movement-original.mov
3. basic test 2/final-result-compare-original.mov
4. basic test 2/frog-dance-original.mov
5. basic test 2/test-on-leg-puppet.mov
6. depth/bat fly/bat-compare-original.mov
7. depth/bat fly/bat-fly.swf
8. depth/bat fly/bat-fly-original.mov
9. depth/hedgehog in the bush/hedgehog.mov
10. depth/hedgehog in the bush/hedgehog-original.mov
11. transformation/coach/coach-original.mov
12. transformation/coach/coach-transform-total.mov
13. transformation/coach/coach-transform-total-horse-in-flash.mov
14. transformation/fairy godmother/fairy-final.swf
15. transformation/fairy godmother/fairy-godmother-card-wipe.mov
16. transformation/fairy godmother/fairy-godmother-compare-final.mov
17. transformation/fairy godmother/fairy-godmother-original.mov
18. transformation/prince/frog-to-prince-original.mov
19. transformation/prince/match-flash-compare-to-original.mov
20. transformation/prince/failed-transformation.swf
21. transformation/prince/prince-final.swf
22. transformation/prince/transform-like-original.mov
23. walking cycle of horse/horse-walk.mov