The National College of art and Design,

Faculty of Design,

Department of Industrial Design.

The Interaction of Art and Technology in Traditional Animation

by

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The

Interaction of Art and

Technology in Traditional

Animation.

Note.

Accompanying this thesis is a five minute video showing, animation equipment, finished animation, artwork with special effects, Disney's multiplane camera and computer animation combined with traditional animation techniques.

The video title is ***The Interaction of Art and Technology in Traditional Animation.*** by Barry Holian. NCAD 1997.

List of Contents.

Acknowledgements.

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My Thesis Supervisor Mr Jerry Walker and the staff of the N.C.A.D. library.

Introduction.

Traditional animation involves a number of different artistic techniques and disciplines. These techniques and disciplines are used to achieve multiple images. Technology is used to enhance and combine this images, gelling them into an illusion of movement which is the continuous motion animated picture.

Early animated pictures were viewed as being magical some were even promoted as such. As time passed Animation established itself as a form of public entertainment with popular news paper comic strip cartoons being made into short animated films. By the early 1930s the Disney studio was breaking new ground in terms of artistic and technical skills. This lead to what later became known as *The Golden Years of Animation* during the 1930,s and 1940,s.

Many books have been written on the subject of animation in terms of its history and artistic techniques used. These books tend to overlook the basic technologies needed, the different artistic disciplines used and the technical support required.

The subjects discussed here are technical but necessary for all artists involved in the animation process to understand. Once understood the interaction of Art and Technology must be documented and recorded in an well organised and universally understandable manner.

Also discussed is what the technologies actually achieve in terms of creating and reinforcing *"believability"* and how this effect the final imagery i.e. *creating the illusion of three dimensions using two dimensional artwork.*

Each chapter in this thesis is broken down as follows.

Chapter 1, examines how *"Animation"* developed into a form of public entertainment. Current animation books and what they lack in terms of

information on the animation process itself. Also given is an insight into the different types of animated film production set-ups i.e. *from small one man operations to the large studio structure.*

In chapter 2, I discuss the artwork required in the animation process and the technologies used. The interaction of artwork and technology and the advantages and disadvantages are explained in chapter 3.

Chapter 4 provides an in depth view on the precise way that artwork achieves enhancement in the pre-production storytelling process.

Finally in chapter 5, I explore and explain how technology such as the *"film camera"* is used to photograph the final images that make up *"Animation"*.

The following I hope gives an insight into what is required and involved in the animation process, even before pencil is placed upon paper.

Chapter 1.

To understand the basis of how animated film successfully portrays the illusion of movement when view, the first aspect to be considered is the physiological factor known as the *"persistence of vision"*. Persistence of vision occurs because the retina of the human eye retains an image of an object for a brief instant after the object is removed from view. It is this phenomenon that allows a series of still images presented in rapid sequence to blend into a continuous image.

Animation even to-day is still a little known and an almost secret magical process to the average person. Animation in terms of children's cartoons and the Disney's films has had its basic principles and foundations developed in tandem with the invention and development of the photographic camera a century ago and even before, in one form or another. Animation principles can be traced back directly to the beginning of the nineteenth century with America's Coleman Sellers kinematoscope of 1861 *(see figure 1)*.

Fig 1. Opposite

Coleman Sellers Kinematoscope of 1861

Coleman's invention was a major breakthrough in animation, using a stereoscopic viewer and a rotating wheel action to project the illusion of continuous motion

when viewed through an opening. This is regarded as the world's first photographic animation device.

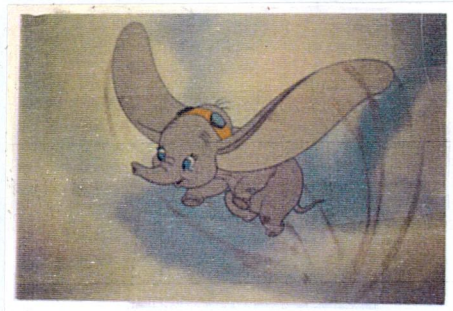
As continuous motion film cameras developed, the worlds first stop-motion animated film was made in England in 1899 by Arthur Melbourne Copper, using match stick characters. This short film was used as an adverts to promote *Matches* during the showing of films in the early picture houses *"cinema's"* of the day. This film is also the first time animation was used in advertising.

Later live action footage *(the use of real people's imagery)* and animation was both combined with experiment's using double exposure photography by a James Stuart Blackton.

The animated film quickly developed into a form of public entertainment during the mid too late nineteenth century. The early animators quickly discovered the vast flexibility and unrestrictive movements that could be achieve, defining all natural laws of physical possibilities i.e. *Dumbo* the flying elephant and *Willie* the operatic whale *(see figure 2, 2A, and video).*

Fig 2A. Above Willie the operatic whale.

Fig 2. Below Dumbo the flying elephant.



Popular newspaper cartoon strips such as Winsor McCay's *Little Nemo in Slumberland* (1911) and *Gertie the Dinosaur* (1914) became animated cartoons *(see figure 3, 3A).*

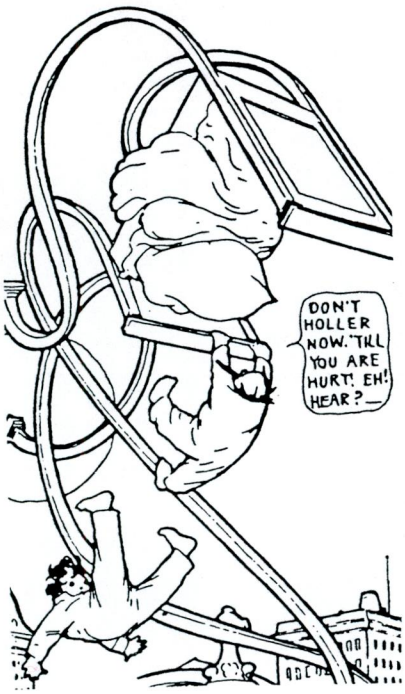


Fig 3. below left and right shows two drawings from Winsor McCay's Little Nemo in Slumberland (1911).

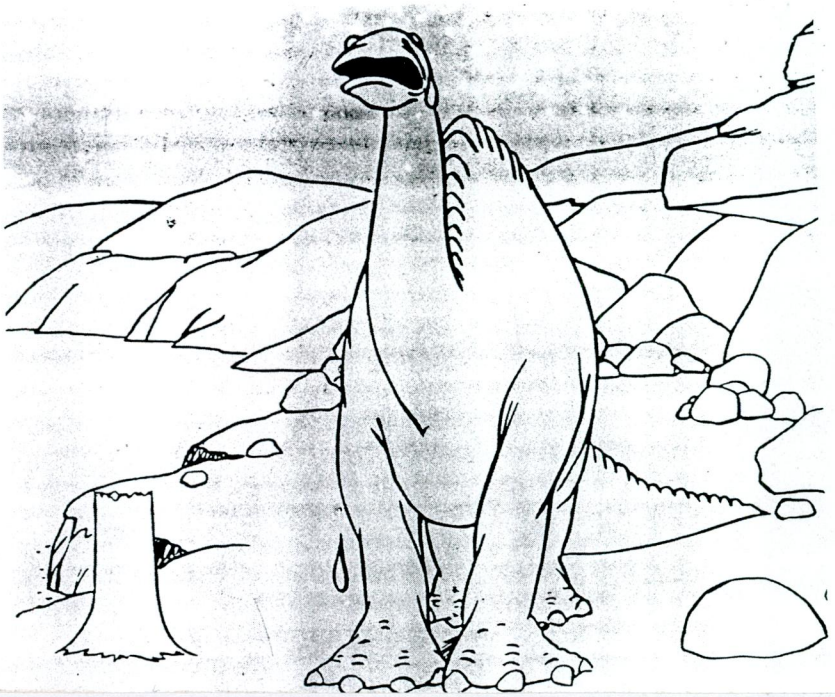


Fig 3A. Above shows a frame from McCay's Gertie the Dinosaur (1914).

These early cartoon films were advertised as the first attempts of an artist to draw pictures that could move. These early animation's amused and delighted audiences, establishing a firm link between comic strips cartoons and animation that has remained to this day i.e. *Garfield.*

In the process of my research I discovered that many books on the subject of animation basically covered two areas, "*The Animation Studio*" i.e. The Disney Studio and the *"How to Draw Animated Cartoons"* type of book i.e. "*Animation by Preston Blair"* from the Walter Fosters collection of art books *(see figure 4).*

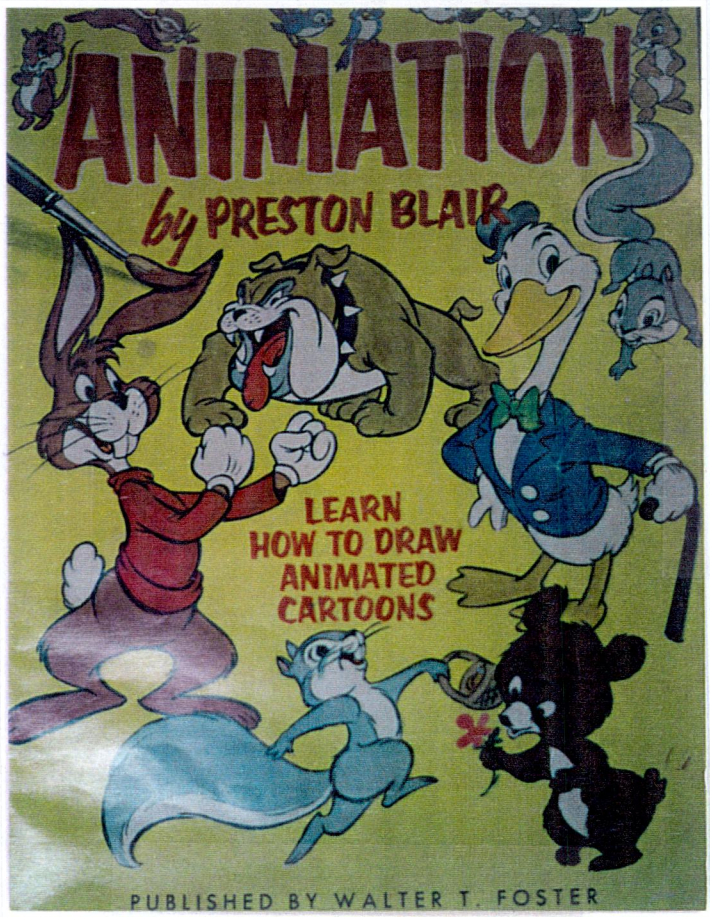


Fig 4. Above is an example of a "How to Draw" book based on animation

Books on information in terms of the interaction of art and technology within the animated film process *i.e. camera equipment* and *effects procedures* were virtually impossible to acquire. The lack of this information and my own interest for many years in this specific area of animation is the reason for this thesis subject. Books based on the art of an animation studio such as the Disney Studio, *(see figure 5)* discusses animation in terms of its relevance to that studio i.e. development of skills, discoveries, styles and basic information on technical

innovations etc. These are discussed using photographs of artwork, character diagrams and animation sketches etc. *(see figure 5, 5A, 5B, and 5C)* with limited information on i.e. the registration of drawings etc. It seems in reading such books that this type of information is viewed as not relative or uninteresting to the general public.

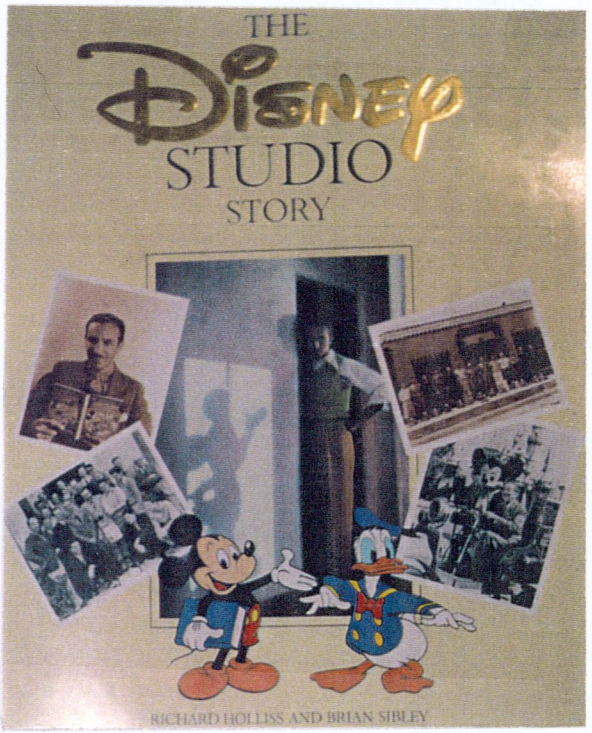


Fig 5. Above is a typical example of a studio type book.

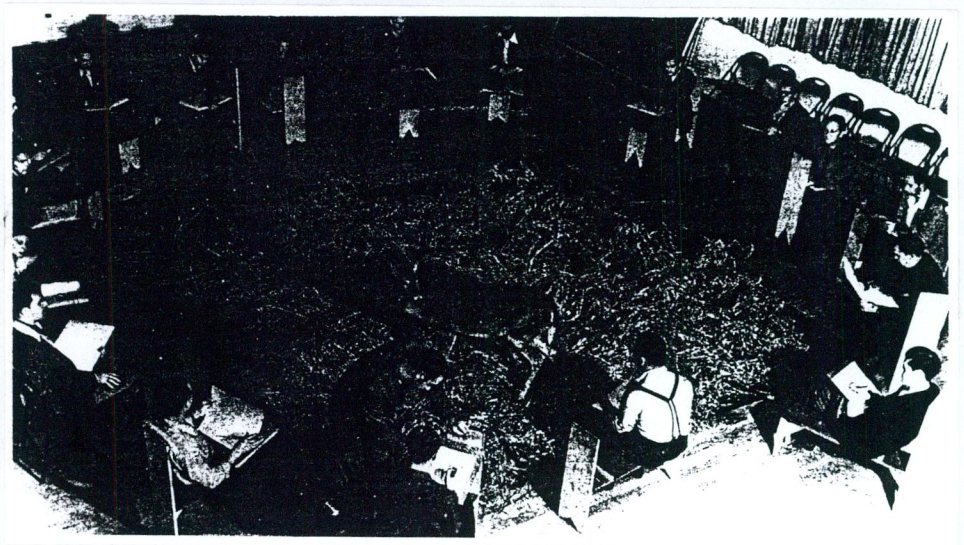


Figure 5A. Above shows animation artists studying a deer before any animation way carried out on the film Bambi. It was this research and observation that developed the required artistic skills needed to successfully animate the deer with realism and meaning.

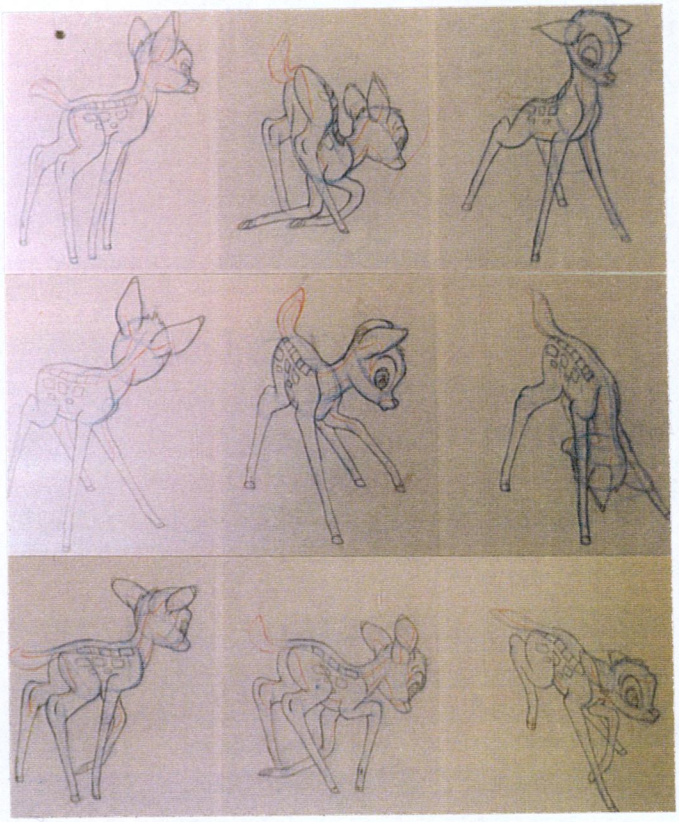


Fig 5B. Above show some animator sketches of Bambi. The realism of "Bambi" was a challenge to all the artists involved in the film. The results of their study and their discoveries in deer behaviour etc. are expressed in these drawings.

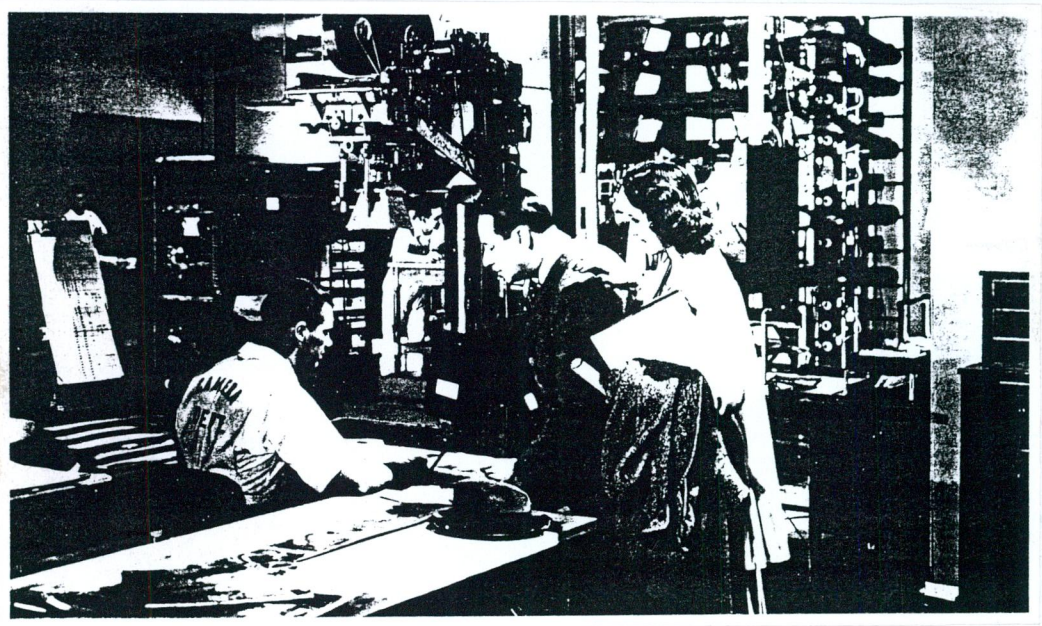


Fig 5C. The interior of the camera department at the Disney studio. In the photograph a Rostrum camera can be seen in the foreground with the famous Multi-plane camera located behind to the right of picture.

Similar studio books discusses Walt Disney the person in terms of his personality, ambitions, dreams and determination to achieve the impossible. His constant pushing of artistic limits in the quest for perfection, in the imagery that makes believability in the illusion of the animated film. These books also discuss the achievements accomplished using this imagery in each film, explaining and analysing the way it tells the story.

Walt Disney warning against the use of "comic supplement colouring" before work being carried out on Snow White and the Seven Dwarfs. Quote: "We want to imagine it as rich as we can without splashing colour all over the place... We have to strive for a certain depth and realism... the subduing of colour at the right time and for the right effect". (Holliss & Sibley, 1988, p. 29)

Other literature on animation takes the, '*how to draw'* a cartoon approach. These books usually give a simplified over view on how an animated film is made. This is usually explained visually with diagrams in terms of a background artwork with a drawing of a character placed on top *(see figure 6)*. Accompanying notes and sketches are listed nearby.

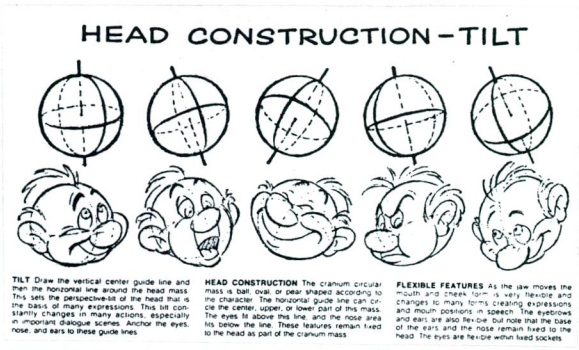


Fig 6. Above is an example of a page from such a "How to Draw" book.

These books are the beginners guide to animation offering instructions on how to go about making simple animation's, with basic information is not only on the animation process, but also the hardware used i.e. DIY plans and instructions on how to build a simple light-box and how to set up a simple animation camera. *(see figure 7, 7A, and 7B).* Notes explain the need for, and suggest simple systems of registration. These books try to encourage their readers to participate in the animating of cartoons.

Fig 7. Above shows basic instructions on how to make simple animation's, Body parts separation system ,simple lip sync and dialogue system.

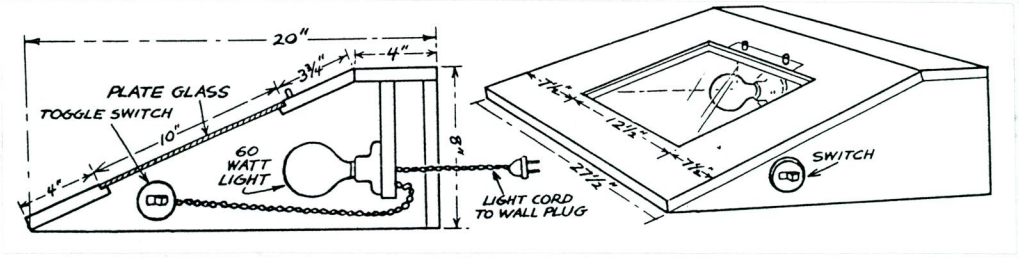


Fig 7A. Above shows how to build and use a light-box.

A light box (fig 7A) is positioned under the animators drawings so he or she has a clearer view through each layer of paper, several drawings at once. This is a standard piece of equipment not only in animation but also Graphics Art, Photography and Industrial Design, etc. For this reason I will not be going into it in detail.

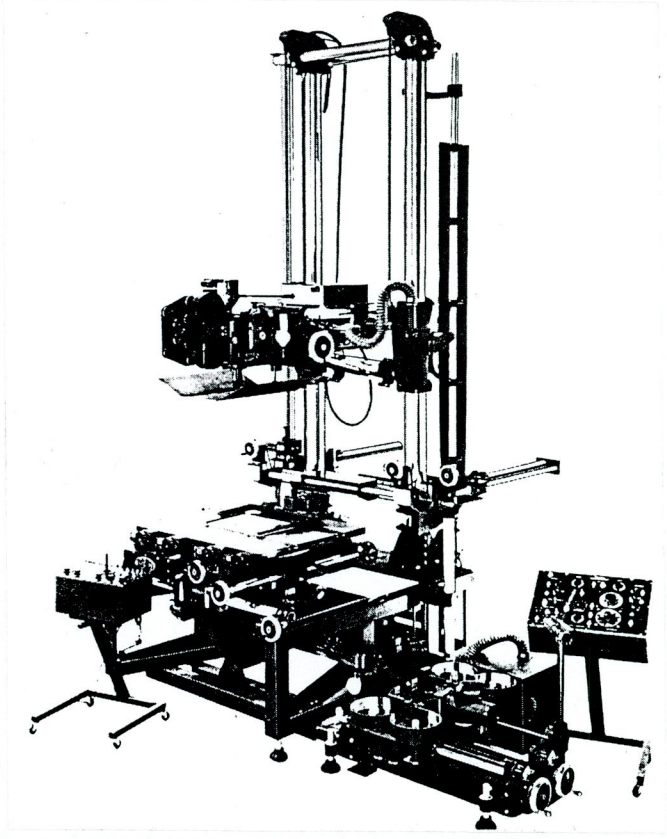


Fig 7B. Above the Rostrum Animation Camera.

It was the lack of basic information on the mechanical and technical aspects of the animation process that compelled me to write about this most interesting subject.

In today's animated film environment there are basically three types of animated film production. The personal film, the animation studio production and finally the corporative production *(co.-production)* for example, a production supported by a number of different animation companies.

In the personal *'film'* animation production, the animation artist is in total control of his/ her work. After the animation in terms of pencil drawings is complete, the finishing work such as ink, paint and camera can be farmed out. *(The word farmed out refers to letting others complete the production in accordance with the animation artists wishes.)*

In the animation studio production where a large number of artists are involved, success relies on organisation, communication and discipline. The major advantage in this type of production is that if any problems arise, they can be easily dealt with, for example walking to the appropriate department and sorting the problem out.

The co.- production or *(international co.-production, common within the European Union)* must have in place a highly developed communication skills and organisation. Artists involved in this kind of production may be working from different locations or countries and may speak different languages. This necessitates clear instructions so avoiding misunderstandings. Any delays in this kind of co.-production can rapidly escalate costs.

For the purpose of my thesis I will be mainly concentrating on the studio environment, using the traditional two dimensional animation techniques and associated technology as my examples.

In no other artistic medium is there such a well developed and sophisticated construction and production system and process to achieve the final art-form as

there is in animation film production. To animate is to bring to life a drawing or model, the animation process is difficult to illustrate adequately for it depends on movement to achieve the illusion of life. With drawn animation a number of drawings are static and lifeless. When movement is added, simply by letting these drawings fall continuously in order and keeping them roughly in register. For example with ones hand, the drawings will appear to move as each one passes the eye. This simple technique *(see video)* used by animation artists the world over at the initial stages of animated film production and is refereed to as *"flicking"*. This flicking gives a rough indication of how a movement is progressing from an artistic point of view. This technique is developed when an animator is learning his or her trade. In today's animation environment line or pencil test machines are used in a similar fashion where the number of drawings cannot be physical held and flicked so to give an accurate representation of the animation.

The artists involved in the production of animation must display more then the ability to draw. They must require flawless draughtsmanship, creative imagination, knowledge and appreciation of acting, staging and timing as well as a clear understanding of all the mechanical and technical details used in the execution of their trade. To help achieve these aims some animation studios may provide their artists with trips to the ballet, cinema etc. Lectures on acting and drawing as well as special technical information that may be required in a specific production. As early as 1935 Walt Disney had listed what he believed to be the essential Qualities of a good animator:

1. Good draughtsmanship.
2. Knowledge of caricature, of action as well as features.
3. Knowledge and appreciation of acting.
4. Ability to think up gags and put them over.
5. Knowledge of story construction and audience values.

6. Knowledge and understanding of all the mechanics and detailed routine involved in his work, in order that he may be able to apply his abilities without becoming tied in a knot by lack of technique along these lines. (Holliss & Sibley,1988, p.29)

Chapter 2.

Animation is a manipulation of images that interact with technology to achieve the illusion of life. The artwork is "*expressed*" through it association with the technology, resulting in the technology *"breathing life into the art work*". The animated film regardless of the artistic techniques used, incorporates two fundamentals. Firstly, the artistic imagery e.g. *all artwork used in a production.* Secondly, the process of transferring this imagery into a consistent, coherent and understandable end product that is an "*Animation*". The physical imagery (Art) used in animation can and may originate from a variety of sources. These sources such as ink, paint or clay models can be used to produce the final imagery in two or three dimensions. Regardless of source an image must be present to be recorded. This is a constant for all animation's. The processes of recording the image also originate from a variety of photographic technology and optical techniques. Regardless of the technology employed it must be present and activated in tandem with the manipulation of the physical image being recorded, to capture each new individual image being produced or created. The animation artist differs from other artists, in that while animating they work not only on one drawing or image, but on several drawings simultaneously to create the required action and movement. To achieve this the animator must follow a defined

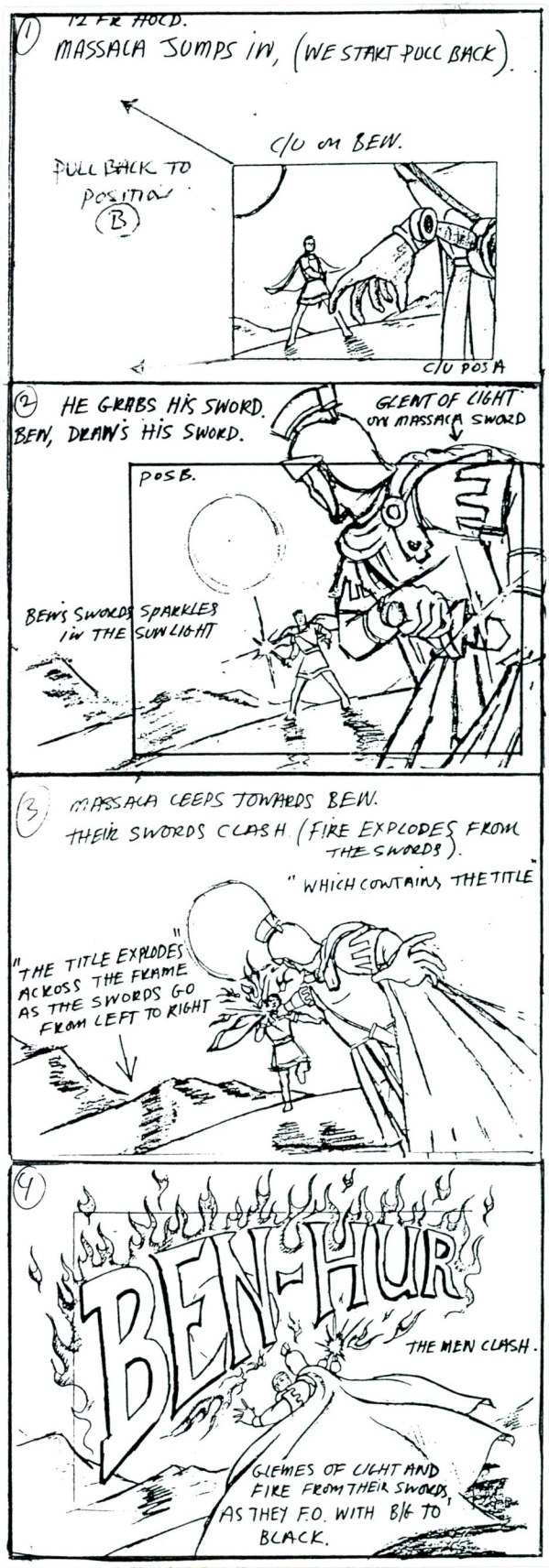
structured approach. This approach has two vital requirements. Firstly, all artwork must be allocated, "identification" i.e. *numbers or letters etc*. Secondly, all artwork must be held in position in relation to each other. This is called artwork registration, this system uses a number of punched holes on the artwork and corresponding positioning pegs located on Animation Desks and the Rostrum Camera Table.

In modern animation studios the artwork used is combined and enhanced using technology such as the rostrum camera etc. This artwork being story-boards, model sheets, layouts *(both background and animation)*, all finished artwork such as backgrounds, and the animation itself *(interns of pencil drawings and finished painted cells)*. The technology used in the animation process is as follows. The Line Test or *(pencil test)* machine, the Rostrum Camera and its optional attachments such as the Aerial Image Projector and the Multi-plane Camera. These cameras can also enhance the artwork even further by the use of special effects photography i.e. *multiple exposure's etc*. In the production of traditional two dimension animation the physical image *(artwork)* consists of Storyboard, Model Sheets, Layouts and Animation.

The Storyboard *(see figure 8 and video)* is the first time that the visual ideas for the animated film in terms of linear imagery come together in a visual sequence of representational drawings. Animation Storyboards come in many levels of detail. From very roughed out images *(fig 8A)* using vague loose linear imagery indicating the bones of what is required to tell a story, to a very precise detailed set-up *(fig 8B)*. Roughed out Storyboards are usually used in larger animation

studios where a well developed and highly organised animation layout department is in place.

Fig 8. Right shows the opening sequence story board of Emerald City Productions animated version of Ben Hur.(1988)



These rough Storyboards are usually drawn or sketched up by the animation director and used to inspire the imaginations of the layout artists. In smaller or fragmented animation studios' set-ups the animator may be responsible for his or her own layouts. In this situation more accurate and detailed Storyboards must be produced for continuity purposes *(fig 8B)*. A Storyboard panel may just simply need to be enlarged on a photocopier to the required size, indicated in notes contain in the Storyboard *(fig 8C)* to obtain the required layout. The Storyboard provide the production crew with a visual reference of all the characters etc. in their perceived environments and indicates references to camera instructions and any special effects required i.e. rain, lighting etc. *(fig 8D)*.

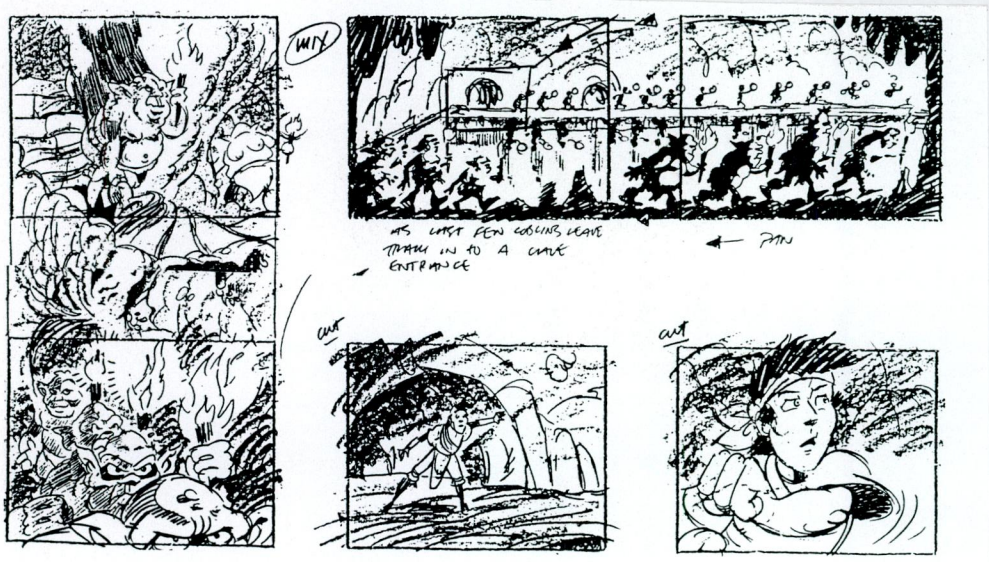


Fig 8A. Above is an example of a rough Storyboard. Siriol Productions Cardiff Wales 1991.

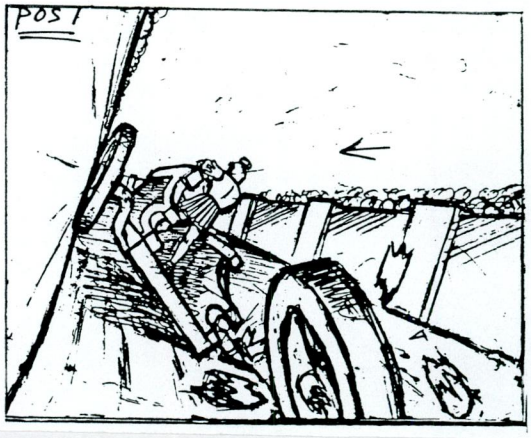
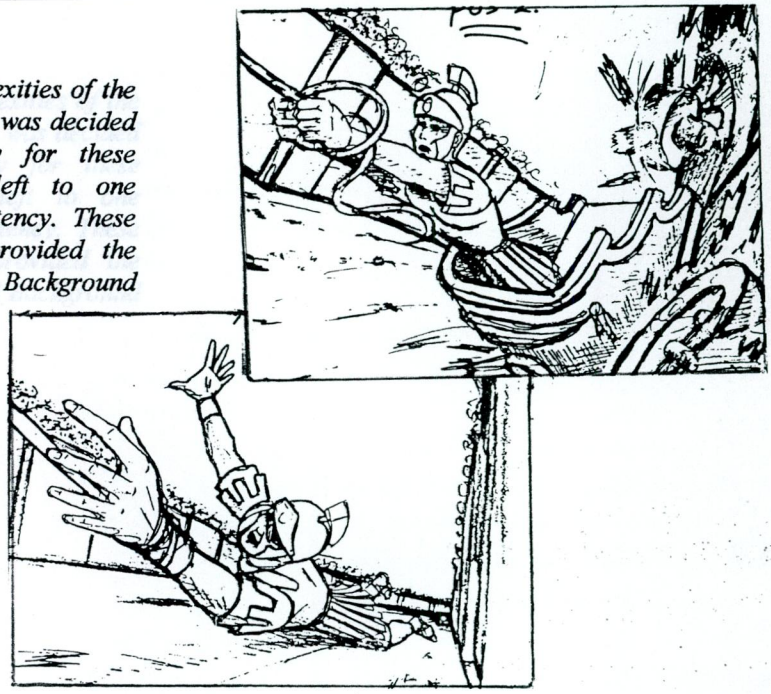


Fig 8B Right. These three Storyboard panels are taken from an action sequence from (1988) Emerald City Productions of Ben Hur. This is a good example of where an animation artist developed the entire chariot race from the start of production. This

Fig 8B continued.

was due to the complexities of the action required. So it was decided that the responsibly for these scenes should be left to one individual for consistency. These Storyboard panels provided the initial Animation and Background Layouts.(see video).



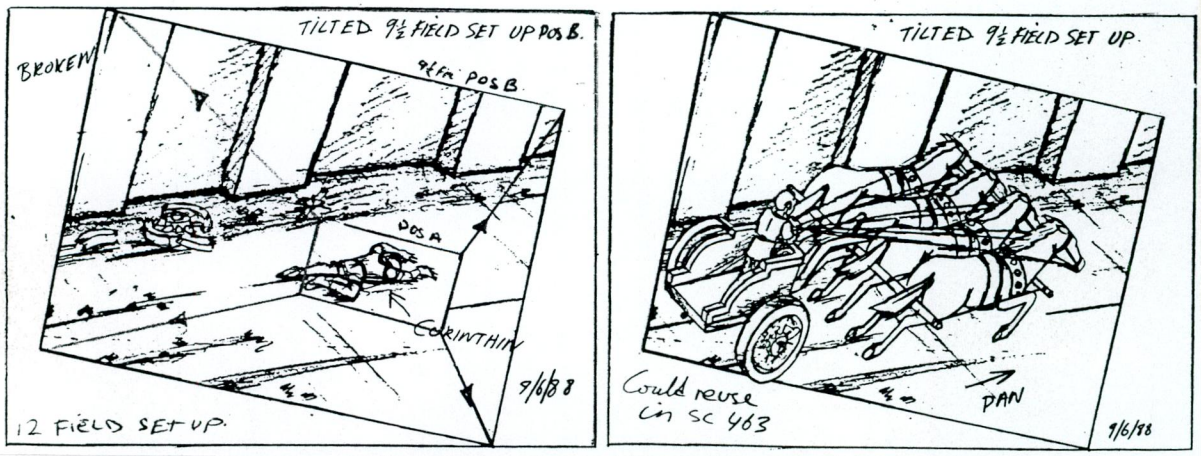


Fig 8C Above, is an example of storyboard panels showing two images from one scene. These panels also contain information on field sizes and animation positions etc.

Model Sheets, in their simplest form show everyone working on an animated film production what the characters look like. There are basically two types of model sheets. Line drawing of characters show and explain the character detailing from as many different angles as possible, that may be needed during production *(see figure 9)* and how a specific character is constructed etc. *(fig 9A)*. The second type of model sheet deal with colours and is referred to as a *colour model (fig 9B)*. Both types of model sheets are also prepared for any object that appears in the film such as a carriage and horses etc.

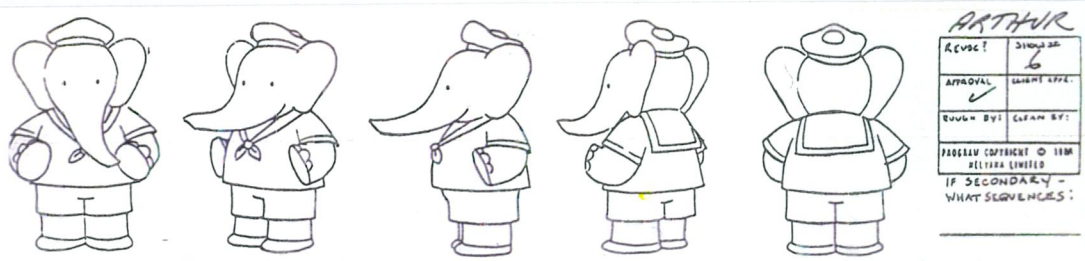


Fig 9. Above, shows a typical model sheet of a character.

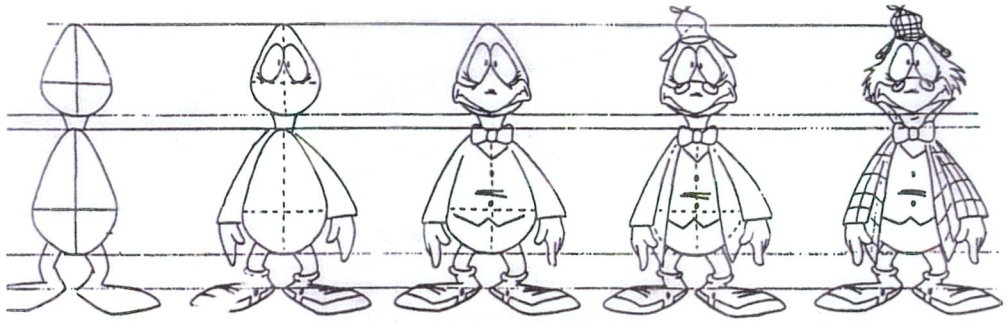


Fig 9A. Above shows a typical character construction model sheet Cosgrove Hall Productions 1989.

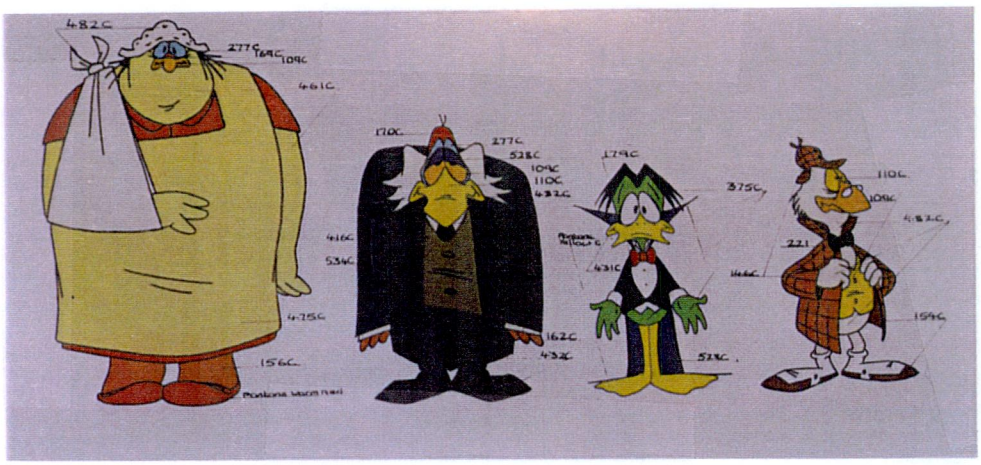


Fig 9B Above is a colour model sheet from Cosgrove Hall Productions. Note: The colour reference codes on each character.

Layouts *(see figure 10)* combine the elements of Storyboard and Model Sheet into a workable drawing from which the animator and background artist can start working from. This stage in animation production can be regarded as the first step into multiple imagery *(levels)* which makes up an animated image.

The layout stage is where each elements / levels of an image is separated and given its identification mark i.e. *scene number and part letter etc.* (fig 10B). Any mistakes or miscalculations at this stage in production can result in major problems later during filming.

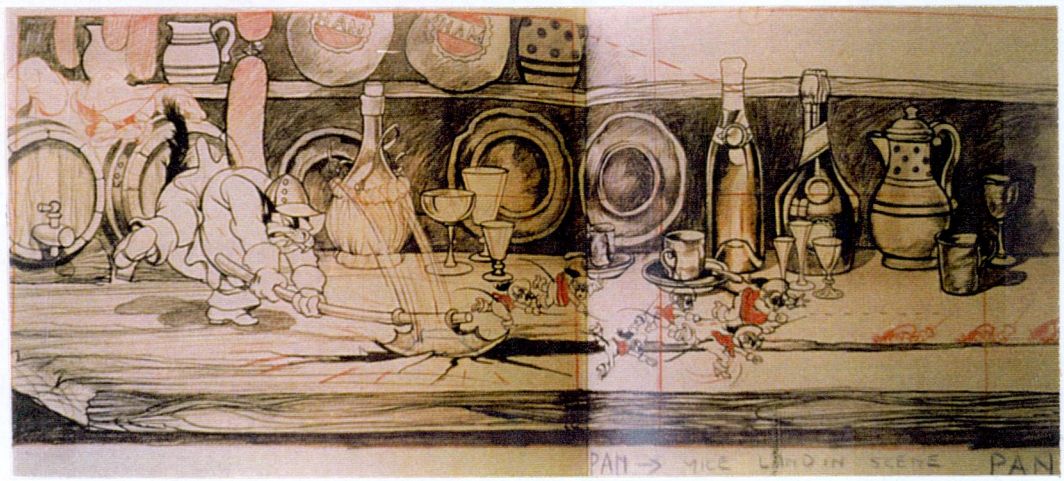


Fig 10. Above is a layout drawing for " The Three Blind Mouseketteers. Disney 1932.

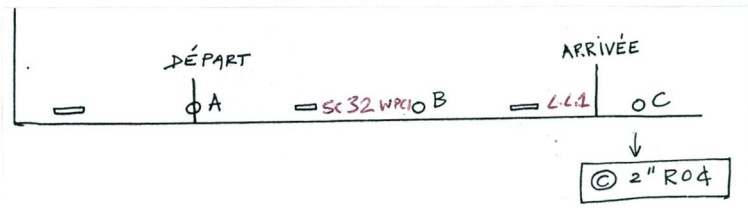


Fig 10A. Above is an example of Level identification marking.

Animation can be broken down into two parts. Firstly cells i.e. *the finished animation that create the illusion of movement on the screen.* Secondly the background artwork where cells are placed upon to be photographed. The background is a location i.e. *a room interior, a building or a street etc.*

The recording of animation can be broken down into two basic parts. *The Line Test or Pencil Tests Machine* and *The Animation Camera* or *Rostrum Camera.* The Line Test *(see figure 11)* caters for two needs. Firstly, to see if the animation is working in the way the animator intended. Secondly, as a quality control procedure for the production team and the animation director. In the early days of animation this testing way carried out be means of using a film based camera. The animators drawings were photographed and the film was developed as quickly as possible so that the animation could be viewed to established weather the animation was working. Later video based systems were used, the advantaged being instanced play back facilities. This system has been now replaced with computer using digital technology to capture the artistic imagery. The advantages being not only instance play back, but the manipulation of image positioning and its timing in relation to the number of frames of film allocated to that image.

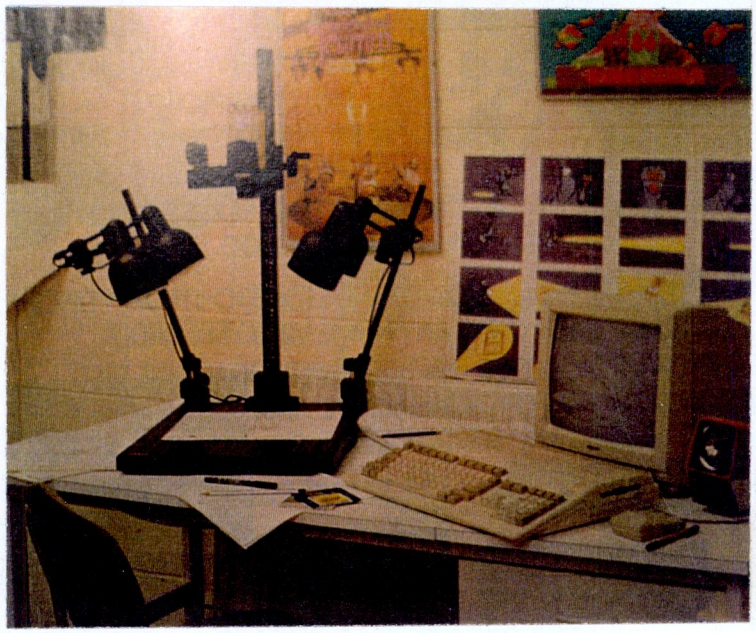


Fig 11. A Line Test or Pencil Test Machine.

The Animation Camera / Rostrum Camera *(fig 7B)*. This camera system can be further broken down into four parts. *The Camera, The Camera Table (see figure 12), The Rostrum and Aerial Image projection system (fig 12A).* The camera may be Film, Video or Digital based and mounted in the vertical position above the camera table.

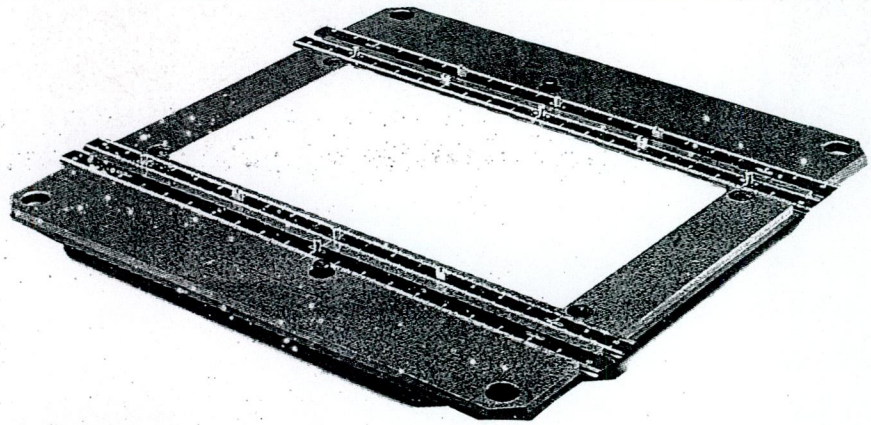


Fig 12. Above shows an typical animation table set-up with top and bottom peg bar arrangements.

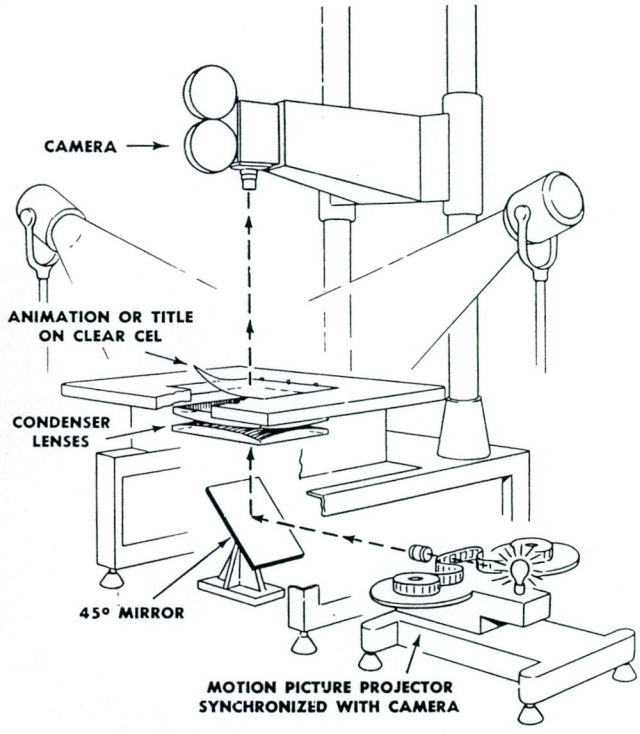


Fig 12A. Above shows how the aerial image System works.

The camera table is where the artwork is positioned, combined and registered to form the completed image to be photographed. The rostrum refers to the main frame that's supports the camera and the camera table, keeping them in register while the photographic process is being carried out. The rostrum also acts as a running track, so allowing the camera to move up and down vertically to facilitate mechanical effect's photography and camera moves etc. finally, the aerial image projection system facilitates effect's photography.

Chapter 3

The interaction of art and technology in the animated film can be broken down into two categories, *(low tech and high tech)*. Starting with the registration process at a *"low tech"* mechanical level and end up with the *"high tech"* process of computer controlled photography, where all artwork is transferred onto film, video or a digital based medium. The process of registration can be considered the first of several points of interaction between art and technology. It can also be considered the foundation on which the animation process is built and a key factor in the success of continuous motion photography, *"Film"*.

This interaction can also be broken down into two distinct areas, *"Direct Interaction and Indirect Interaction"*. *Direct Interaction* is where artwork and technology physically come in contact with one another, that is the art work being positioned in place on the animation camera table using the registration pegs provided *(fig 12)*. *Indirect Interaction* is where the artwork is represented

by an identification numbers or letters *(fig 10A)* and the technology being represented by a series of grids or symbols, e.g. a *Dope sheet or Timing sheet. (see figure 13).*

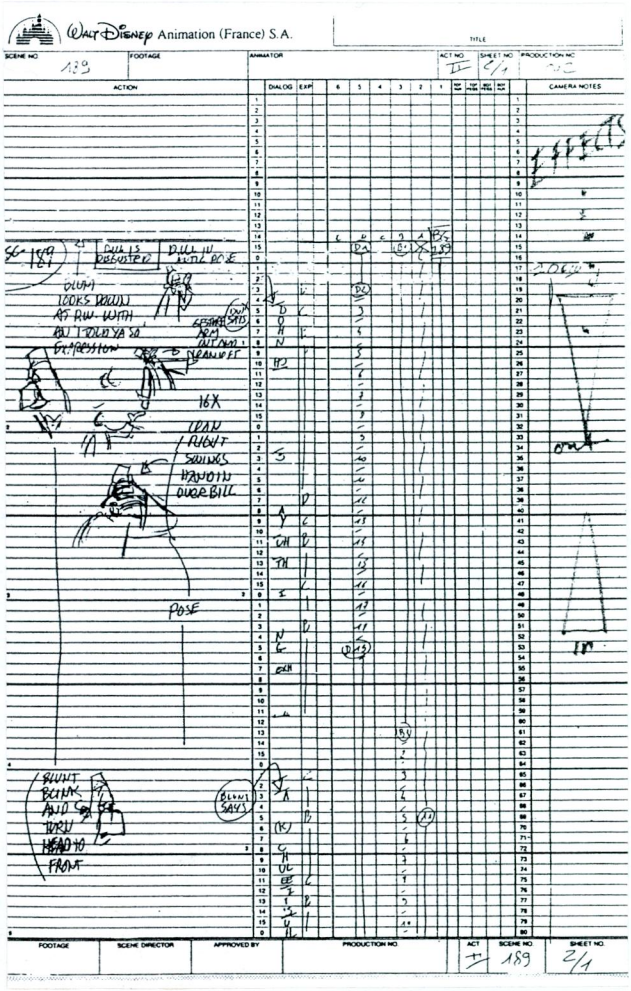


Fig 13. Above is a typical completed Dope Sheet.

The stages of interaction that occurs during the animation film process are as follows, starting with the registration process and ending with photography.

Registration, Any sequence of animated drawings will be meaningless unless it relates to a well-defined registering system, such as the peg bar *(fig 12)* and animation punch. *(see figure 14).* Registration holes made using this punch accurately match the animation pegs. Registration technology is a mechanical

process and can be considered a '*Low Tech, Direct Interaction'* between artwork and technology.

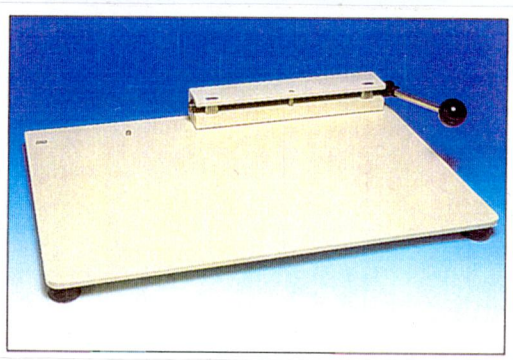


Fig 14. A general purpose animation punch.

The Dope sheets or *Timing sheets* as previously mentioned, is the next step in interaction. A completed Dope sheets represent all artwork literary, in terms of its specific location at any given frame of film *(fig 13).* The filling in of a Dope Sheets is refereed to as "*doping up the animation*". This process can be referred to as an indirect interaction between art and technology.

The Line Tests, the line or pencil test *(fig 11)* on the other hand is the first interaction of artwork with *"high tech" technology* and is a *Direct Interaction* where the animators drawings are positioned onto the machine so to be recorded.

Zerox, or photocopying is the second time that artwork and technology interaction on a *"high tech"* level in the transferring of a drawn image from paper to a transparent celluloid sheet. This is a direct interaction because the artwork must be positioned on the Zerox machine to be copied.

Zerox Registration is the aliening and punching of these cells. So registering the new celluloid copy, with the original animators drawing using a specially designed, electrically operated animation punch. This again is a *'high tech' Direct Interaction (see figure 15).*

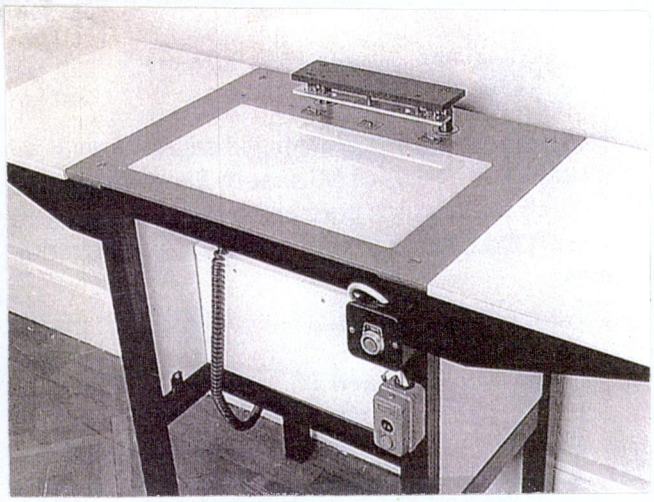


Fig 15. Zerox registration animation punch.

Animation / Rostrum Camera, the modern animation camera is a fully computerised controlled camera system. The artwork is located and positioned using the registration system in accordance with the animators dope sheet instructions. Once the artwork is positioned and the camera programmed and checked, the background artwork and animation can be photographed. In this interaction of art and technology the artwork imagery is transferred and relocated by optical exposure onto the negative film contained in the camera, *"note: this applies only to cameras where film is the medium used*". This is the final *Direct Interaction* between artwork and *'high tech'* technology.

Registration as already mentioned can be considered the foundation on which the illusion of movement is anchored. This *anchor* is used throughout the production

and is referred to as the animation pegs or simply *"pegs"*. The first time a drawing requires registration is when it's separated into it's required levels. *A level is one element that makes up an animated image e.g. background, foreground and characters etc. (fig 10A).* Registration achieves two purposes. Firstly, the physical alignment and cohesion of individual levels of artwork, building up the complete image to be photographed. Secondly, holding in place this *"completed image"* in it's required position or positions under the camera during the photographic process. For registration to enhance the illusion of movement all the positions and locations of each individual piece of artwork must be organised correctly and clearly. So eliminating any misunderstanding between the animation artist intentions and the camera person.

Dope Sheets are used to record all artwork and technical information required to shoot *"photograph"* a scene. These sheet indicates frame by frame all artwork which must be positioned beneath the camera, their exact positions in relation to each other and to any special effect's animation or photography needed etc. Dope sheet also accommodates animators instructions, dialogue, instructional sketches *(fig 13),* positions of any camera moves and framing *(see figure 16).*

Depending on the number of frames of film allocated to an individual piece of artwork the timing of a scene or action can be altered *i.e. the less frames allocated the quicker the action, the more frames allocated the slower the action etc. (see video).* The standard dope sheet is divided into one hundred linear segments representing individual film frames and equivalent to four seconds in time. The standard film speed in animation is 24 frames per second.

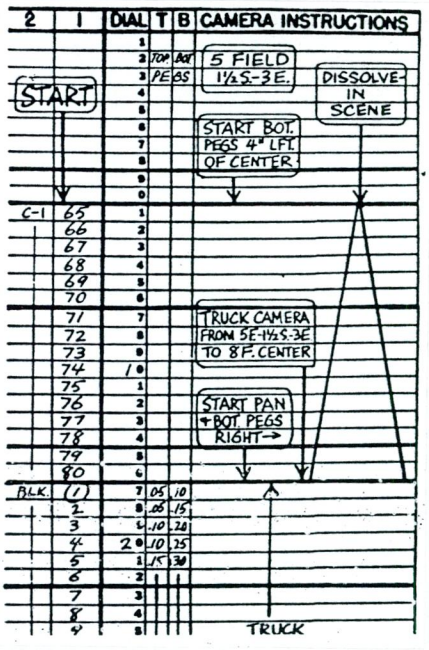


Fig 16. Camera instructions on a dope sheet.

The first use of the dope sheets is in the recording of the animators initial "*roughed out sequence of drawings*" that forms the frame work or skeleton for a specific action or movement. The animator must be able to see if a animation is working in terms of movement, timing and composition. This is where the line test machine *(fig 11)* becomes a vital tool, by allowing the animator to quickly sketch a few drawings of an perceived action, immediately photograph them and play them back instantly. Any adjustments in timing and positioning of these drawings in relation to each other can be easily carried out at this stage. The playback of a sequence of drawings quickly demonstrates whether or not the animation is what the artist originally in-visualised. The line test machine is also used to check the finished animation's before it goes onto the next stage of production *i.e. Ink and Paint.*

"Ink and Paint refers to the colouring in of each drawing". Before painting commence the animators drawings must be transferred on to animation cells (*celluloid transparent sheet as already mentioned*). The word *ink* in *Ink and Paint* refers to the transferral i.e. *tracing* of the image from the animators drawing onto a cell. This term *ink* originates from the early days of animation where inking by hand of each individual drawing onto cell was the only means of image transferral. This process is still in use. *(see video)*.

In today's animation studios image transferral is carried out in two ways. Firstly by manual means *"inking by hand"*. Secondly by using a Zerox / photocopier machine. There are advantages and disadvantages with both systems of transferral. Inking is time consuming and labour intensive, but is unrestrictive by cell size compered to the limitations on cell sizes with copiers. There are many other restrictions with using copiers, such as heat distortion. The advantages and disadvantages of Zerox machines must be weighed up against the more time consuming tradition hand inked methods of transferral.

If a drawing is transferred to cell using the Zerox / photocopying it must be registered i.e." *pegs holes punched into it*". There are two systems currently in use to register Zerox cells. Firstly by using a specially designed Zerox registration punch *(fig 15)* where the cell is positioned over the original drawing. lined up, and punched. The advantage with this system of punching is that the registration holes and the image are one entity. Secondly, in studios where this type of punch is not available the Zerox cells can be register manually using an adhesive registering strip *(see figure 17)*. The disadvantage is that the adhesive may fail in time.

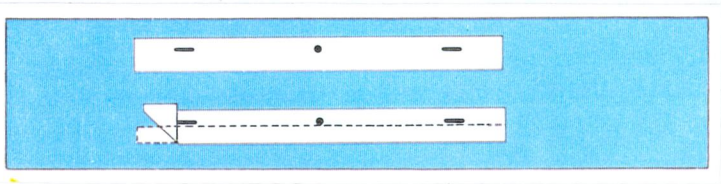


Fig 17. Above shows an adhesive registering strip.

When all the animation imagery is transferred onto cells, painting of each individual cell can commence. This is achieved by applying each individual colour onto the back *(underside)* of each cell in sequence, *(see video)*.

After all the cells are painted and checked the completed scenes are sent to the camera department. This is where all the finished elements of artwork come together to be photographed for the first time. The end result being the illusion of movement through the continuos motion picture process. This interaction between art and technology results in the enhancement of the final imagery *"Animation"*.

Chapter 4.

For Art to achieve enhancement artistic skills combined with technical knowledge of each individual process used in the production of animation must be in place. The dope sheet is the key link between the art and the technology at this stage and contains the animators instructions on how to put the scene together correctly from both an artistic and technical point of view.

Art and technology must be taken into account from the very start of the animation process and well before production starts. Every animated film develops from an basic idea. This idea may be sparked off by an image an event or a story-line. From the outset the idea may contain basics, such as a rough idea of potential characters and their surroundings etc. Once an idea is established a production proposal can written. To start with the proposal contains literally ideas of story-lines, more accurate detail descriptions of characters, their situations, locations and the overall atmosphere to be expressed to make the idea plausible. As the proposal develops artistic imagery can be included to help sum up the over all style and atmosphere of the project visually. For example, an image of a character or group of characters situated within their environment *(see figure 18)*, the colour scheme used *(see figure 19)* and the styling of artwork employed. *(see figure 20)*.

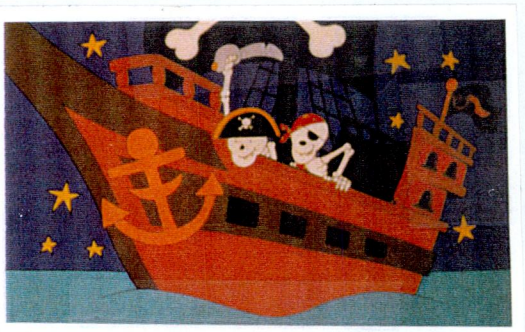


Fig 18. Opposite shows a scene from Funnybones by Cartwn Cymru, Animation Studios Cardiff.

Fig 19. Opposite an example of a colour scheme drawing for Disney's The Aristocrats.

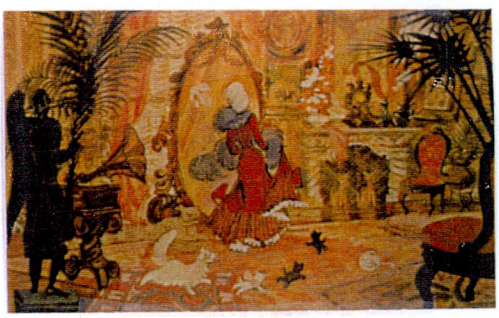


Fig 20. Opposite shows an example of " styling of art work" from Disney's The Aristocrats.

Production proposal may also sketch out literally the parameters for each story in a series and suggests possible story-lines that spark off ideas for scripts. A production proposal must contain all the information that makes an animation clear and accessible to the widest spectrum of end user i.e. *the projects financial backers and associates and the production team.*

The next stage in animation production is the script. Guide lines for script writing can be extracted from the proposal *(this system of script extraction is mainly concerned with larger animation projects using more then one script writer)* i.e. *telling the writers what sort of things are possible with in the film.* It also introduces the writers to the characters and explains how they interact with one another and their surroundings, suggest key features of personalities, any catch phases, voice accents and physical attributes. It's a good idea to compare a character to a well-known personality i.e. *"James Bond 007".* This kind of comparison quickly puts a character into perspective and is a valuable tool later in both dialogue and character personality development. Colour visuals are also produced to help seek a balance between story-line and the visual content of the film, where colour, angle of perspective, character design, set and background design, dramatic or soft lighting are all used to express the mood and atmosphere required *(see figures 21)*

Fig 21. opposite is an example of a colour visual,(Demon on Bald Mountain) from Disney's production of Fantasia 1938.

The first time that artwork and script comes together is in the initial rough production Storyboard. Storyboard panels *(that contain the visuals)* are constantly up dated as the story develops and unfolds with changes to character positions, camera angles and effects that may be required to enhance the mood and tone of the scenes i.e. *rain and lightening etc.* Many Storyboard artists like to work roughly at first trying out composition, constructing and redrawing locations again and again. Shifting scenes about until they arrive at something that works and runs together smoothly. Complex actions scenes and sequences may be left as blank panels to be worked out and developed later in-conjunction with special effects animators and the animation director.

It's important that the Storyboard artist captures the imagination and the spirit of the film in these initial drawings. The use of compositions principles such as perspective etc. is not vital at this early stage. Each story panel provides the basic visual to tell the story in a comic like form.

As the Storyboard develops more accurate visual representations and information i.e. *regarding the atmosphere to be expressed in each scene etc.* is included along with all the other reverent information needed. The Storyboard is the most crucial part of any animated production in that it dictated the structure of the film artistically. It is the main reference to which everyone involved in production will turn to for guidance and inspiration. Later the Storyboard panels will form the foundations for the layout artist to develop and build upon.

Before any animation can be carried out on a film all the artists must know not only what the characters look like, but how they move and act. In an animated film the same character may be animated by a number of different artists and they

will all have to make that character behave the same way. The success of this *"consistency"* depends on the quality of the reference material at the artist's disposal. It is essential to have a number of well designed model sheets explaining all the artistic information about each of the main characters. Typical model sheets usually show views of a character from as many different angles as possible e.g. front, back and sides *(fig 9)*. There are also specialised model sheets explaining how a character is constructed so to avoid proportional mistakes and errors. Size comparison charts *(see figure22)* show all the main characters in relation to each other.

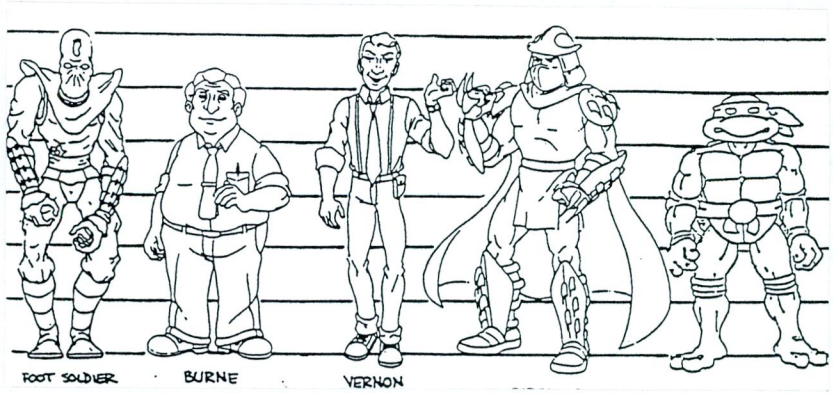


Fig 22. Above shows a typical size comparison chart set-up. From Murakami Wolf Productions Dublin.

Any frequently seen objects that appear throughout the film will also require model sheets. It is also useful to have a wide range of facial expressions, showing as many expressions as possible especially on the main or lead characters in conjunction with their relevant mouth positions for lip sync references *(fig 7)*.

At the *Layout* stage of production the layout artist uses these model sheets when transferring the story board panel into workable layouts drawings. The typical layout contains a minimum of two drawings, one for the background artist and

one for the animation artists. The layout artist in producing a layout must take into account perspective, the composition of the scene, all characters scales in relation to each other and their surroundings. The centre of interest and arrangement of drama. His or her drawings must express personality within a character drawing, through fluidity of line, gestures, and facial expression so creating "believability" in that character *(see figure 23, 23A)*. The background drawings must similarly portray "believability" in the mood and atmosphere of each scene i.e. *using light, shadows and architecture.*

Fig 23 above left and fig 23A above right from Disney's Snow White, are examples of such layout drawing capturing the overall effect etc.

The layout artist must decide the correct size of animation paper to use. Animation paper comes in two basic universal sizes. The smaller of the two is known as *(12 field)* and measures approximately *8 x 10* inches. The larger is known as *(15 field)* and measures approximately *10 1/4 x 14* inches. Both of these standard sized papers or cells can also be acquired in various length known as panning paper or cells. Apart from the size of field used the layout person must indicate the views i.e. *the camera positions needed to tell the story*. Camera detail are drawn up on registered animation paper, these are called camera guides and contain all camera instructions to shoot the scene. *(fig 8C left)*.

Layouts also contain details of where the animation comes into direct contact with the background i.e. *(if a character is required to walk behind an object in the background artwork, the layout person must decide on how best to achieve this).* This type of situation can be executed in one of two ways. Firstly the character can be matched to the object with a serious of match lines, giving the illusion that the character actually passes around the object when viewed, but in fact the character is drawn in sections i.e. *the part behind the object does not exist.*

Secondly this can also be simple achieved by means of an overlay. An overlay is where the object that the character must go behind is placed on a separate level above the background. The animation is sandwiched between both the background artwork and the overlay artwork. *(see video).* There are advantages and disadvantages with both systems. The decision to use one or the other of these techniques will depend on a number of factors i.e. '*will this animation be required elsewhere as a reuse?' 'Will this background need to be reused?'* it's these types of questions that layout artists constantly ask themselves.

The layout artist is also responsible for continuity between corresponding scenes.

Continuity in animation can be maintained in terms of colouring, style and atmosphere with the reuse of background artwork. The disadvantage of this "reuse" is where the same background is used with different characters in concurrent scenes. If no adjustment is made in background positioning the viewer will see a change of animation without a change of its background, resulting in a visually uncomfortable *(jump)* of character from one scene to the next, rather then a smooth transition between both scenes. This situation can be avoided

simply by a alteration in the background registration or a change in camera viewing positions *(framing)*, in tandem with the change of character animation. Thus keeping a continuity in animation and background within concurrent scenes.

The animation process itself can be broken down into three different professional categories.

The Animator, this artist can be considered a movement expert and its not necessary for him / her to produce detail drawings of a character. The animation artist works in rough to express the movements in a series of *(key)* drawings. These drawings or *keys* as they are referred to are used as reference points, allowing other drawings to be added between them where indicated by the animator to smooth out the overall action / movement at a later stage.

The Assistant Animator will later take these roughed out key drawings, and standardise them e.g. redraws them in line with the model sheets etc. without altering the overall movement expressed by the animation artist. The assistant animator also transfer's all instructions and indication scale etc. to the new key drawings.

Finally the *In-between Artist* or in-betweener, takes the redrawn keys from the assistant animator and using the instructions given on the indication scale provided *(fig 10A)* draws all the in-between drawings needed to smooth out the overall action. Apart from supplying the key drawings the animator must record their position and their timing. Decide which level they need to be placed on and how the animation will interact with the other artwork such as the background etc.

The illusion of depth can be achieved in two dimensional artwork in a number of ways. Firstly, animating a character using the same lines of perspective as its background simply achieves an illusion of depths. Adjustments in the speed of that character i.e. *character seems to slow down as it goes into the distance,* will further strengthen this effect. If that same character were given obstacles to encounter i.e. *steps to clime and a door to open etc.* This combination of animation and background can results in a even more powerful illusion of depth. The illusion can be further enhanced using special effects photography such as lighting effects and shadows etc. *(see video).*

The more advanced the illusion the greater the need for control, in each individual element that comes together to create the illusion. All these separate elements need to be recorded on the dope sheet in their relevant columns that are designated for this purpose *(fig 13).*

Backgrounds may be broken down onto several levels *(layers)* of artwork. Additional sections of a background may be created on cells or simply cut from paper. These can be positioned over the animation as *'Overlays'* in various ways so to give the illusion of depth when a characters is seen going behind them. If an overlay or multi-overlays *(if more then one is used)* are moved at different speeds in relation to one another. The result when viewed is a very realistic illusion of depth. If these two simple techniques i.e. *animating in perspective and using overlays* are combined they can successfully create the illusion of three dimensional perspective *(see video).*

Effect's animation can enhance the animated film in two ways, firstly by the use of artwork effects, such as animated overlays etc. *(see figure 24)*

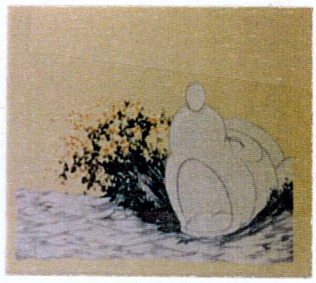


Fig 24. Above shows an example of animated water art work from Disney's Fantasia.

and secondly using optical effects such as aerial image techniques etc. Optical effects can enhance the visual content of a scene from almost unnoticeable effects i.e. *double exposed shadows*, through to spectacular dramatic effects such as *explosions. (see video).*

Chapter 5

The use of technical processes to enhance animation artwork can be broken down into three distinct areas mechanical, optical and digital. Individually and combined each of these areas result in firstly movement, *(bringing the illusion of life to a character making it believable).* Secondly, the illusion of depth *(within the environment that the characters inhabit),* and lastly definition in the story telling process.

The mechanical process itself may be broken down into five parts i.e. peg pans, multi peg pans, animation table movements, zooms, and multi-plane photography *(see video).* A pan in animation terms refers to a movement of artwork on the camera table in the horizontal plane i.e. *(left to right).* Therefore the term peg pan refers to a movement of the pegs during the filming process to further enhance the illusion.

Note: The standard animation camera table has inset into it four sets of animation pegs *(fig 12)*. Each set of pegs can move left or right *(west or east in animation terms)* and vica-versa, simultaneously, in synchronisation or independently if required. Pegs can be removed and relocated if necessary i.e. *to accommodate unusual sized artwork etc.*

Multi peg pans as the words suggest are where more then one set of animation pegs are moved. This is used where multiple overlays are needed to achieve the illusion. This system of mechanical enhancement is commonly and extensively used to achieve the illusion of depth of field. "*as apart from just enhancing the artworks perspective with the use of overlays as described in chapter four".* Depth of field for example, is when one is travelling in a train and looks out the window. It is observed that objects in the distance that are further from the train seem to pass by slower then objects that are closer to the train i.e. *distant hills, mountains pass slowly and telegraph polls positioned along by the track pass quickly.* The further away an object is the slower it seems to travel. Using this idea of different speeds for different distances and relating it back to the animation pegs on the camera table, in term of small and large increments of movement per frame of film exposed. The pegs containing the various levels of artwork can successfully generate the illusion of depth of field in two dimension artwork .

This illusion may be further enhanced during filming by rotation of the camera table and using camera moves. *(A camera move refers both to an optical zoom in or out "pullback" and also the actual physical movement of the camera along its vertical axis in relation to the camera table).*

If a camera move is used with a rotation of the camera table, the technique is referred to *as a (twist zoom or a twist pullback).* The rotation of the camera table in tandem with peg movements and a camera move can be regarded as the first stage where mechanical and optical processes interact to create an illusion.

This concept of creating the illusion of three dimensional enhancement of two dimensional artwork was fully brought to fruition within the Disney animation studios with the invention of the multiplane animation camera *(see figure 25),* during the golden years of animation.

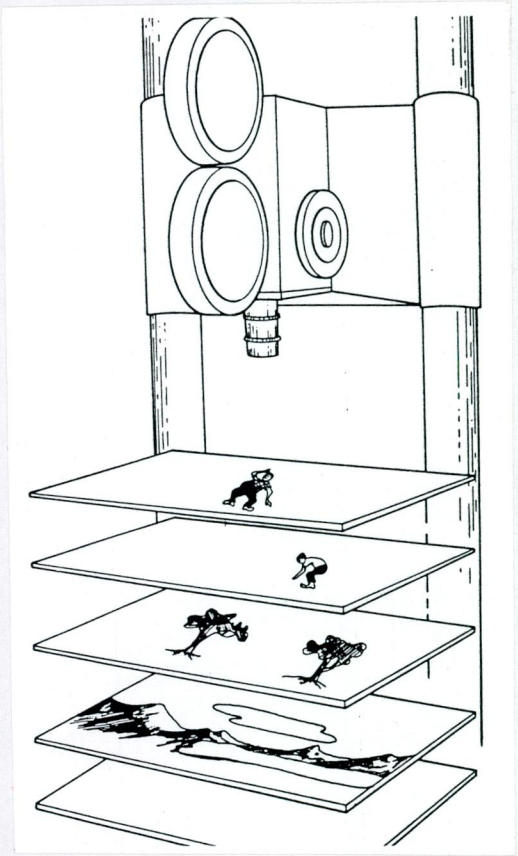


Fig 25. Above shows a schematic arangement of the multiplane camera.

The multiplane camera was designed so that all the separate levels of artwork that made up the background were placed and fixed on separate and independent planes below the camera. Each level of artwork with the exception of the first level, furthest from the camera could now be moved independently or in relation to each other vertically *(away from the camera lens or moved closer to the*

camera lens) rather then horizontally *(with the use of peg pans)* as previously mentioned. In reality as an object moves closer towards you two things happens, firstly it seems to speed up as it gets larger and secondly your eyes will adjust to keep the object in focus. As well as using rate of speed the camera also used the idea of focus to enhance the artwork. The camera lens could be set in focus on all the combined levels of artwork, when they were placed closely together in contact with the furthest first fixed level, as the artwork is filmed *(photographed)*. These levels move towards the camera in relation to each other at their relevant speeds. Due to the focus being fixed on the furthest level from the camera, this level stayed in focus. As each level moved towards the fixed camera the distances between each changed. This variation in distance and its position in relation to the camera causes an automatic different of intensities of focus, e.g. *the nearer the camera the more blurred the image. The further from the camera the clearer the image.* Each level of artwork now acquired a different intently of clarity that contributes immensely to the illusion of depth being created. Disney's *"The Old Mill"* of 1937, was the first film to use the multiplane camera system. This short film made spectacular use of the camera to distinguish between background and foreground detail *(see figure 26 and video)*.

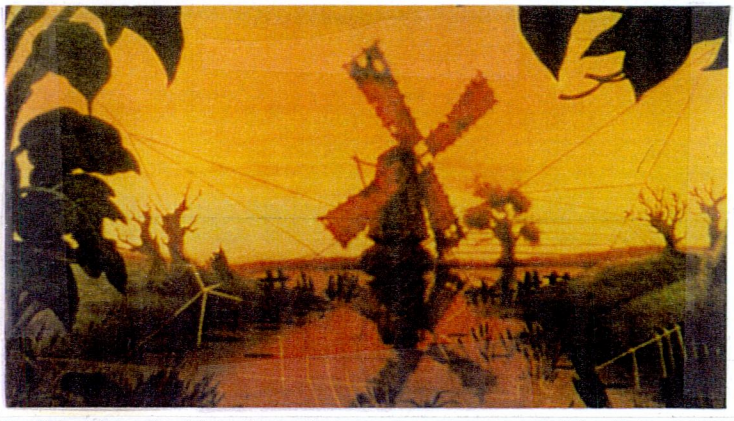


Fig 26. Above is taken from the opening sequence of the "The Old Mill"

The use of technology such as the *"Aerial Image Projector" (fig 12A)* developed in the 1960s is an alternative way of reusing and manipulating artwork in both the horizontal and vertical planes. Full advantage of artistic detailing, content and atmosphere can be exploited in this system. This is achieved because the system uses a photographic image of the background rather then the actual background artwork itself. As the background artwork is photographed onto film, camera moves such as pans and zooms can easily be incorporated. After processing the footage of the background is projected onto the camera table from underneath. This projected image now replaces the artwork. The system allows the camera operator to manipulate even further the photographed background. The animation can now be placed as usual onto the camera table using the projected image as the background.

With the development and introduction of computer graphics and animation using digital technologies many new effects can now be carried out after filming. These technologies allow finished animation to be modified if needed *i.e. colour alterations and painting mistakes can be easily corrected without the need to re-shoot scenes.*

Conclusion

The art of animation has progressed and developed alongside the continuous motion picture camera. The animation camera has developed in response to the demands of the animation artist, in bringing to life toughs, ideas and dreams. From the birth of animation, art and technology have always been interactive and this is still very much the case. For the success of the animated film relies more then ever on the combined skills of all the artist and technician involved in production. Their knowledge, understanding and appreciation of not only the interactive processes between art and technology, but each others problem's, limitations and strengths. For its this understanding of animation that is the key to success in animated film production.

Animation is unique in terms of an art form, for its success cannot be fully appreciated with out the use of technology. For it is the interaction of art and technology that allows the illusion of life to be successfully portrayed.

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