Imagination makes things perfect

Donna Lee Rollins

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"Imagination Makes Things Perfect"
(An Animated Film)

by
Donna Lee Rollins

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MFA PHOTOGRAPHY PROGRAM
SCHOOL OF PHOTOGRAPHIC ARTS AND SCIENCES
ROCHESTER INSTITUTE OF TECHNOLOGY
ROCHESTER, NEW YORK

Erik Timmerman, Chairman
Associate Professor
School of Photographic Arts and Sciences, RIT

Edward Kinney
Instructor
School of Fine Art, RIT

Martha Leinroth
Instructor
School of Photographic Arts and Sciences, RIT
Title of Thesis: "Imagination Makes Things Perfect"

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Donna Lee Rollins
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Basic Principles of Animation

At the core, animation relies on fundamental principles of motion and mechanics, plus the comprehension of effects and techniques associated with the operation of the animation camera and crane. (see glossary)

Film animation is a visual communication method with the potential to both clarify the complex as well as reveal the unseen. It differs from live-action film, which records a scene at either 18 frames (silent) or 24 frames (sound) per second, in that it uses a frame-by-frame (single-frame) cinematographic style. In this technique, the camera is stopped after exposing one frame or several frames to allow for adjustments or replacement of the image to enhance the illusion of the next frame's movement. This method requires considerable conceptual thinking, basic manual dexterity, and highly intensive and skilled labor to achieve the required or desired effect.

Animation has its own characteristic ways of "stylizing" nature, of simplifying events or situations, and exposing their component parts for better understanding. By employing a series of live-action, motor-driven film stills in an animated style, identification with and recognition of reality appears more immediate for the viewer and is more easily coupled with the presentation of an analytical viewpoint.

The use of a variety of graphic styles to illustrate different principles imbues animated film with highly symbolic powers. This factor, in and of itself, serves to lift animation from a representational level to a more complex artistic mode. Any such demonstration of the innate nature of an instance or event is almost always more interesting, and more important, than a mere de-
tailed rendering of content or appearance. This is at the heart of animation as it is used as an art form.

**Animation Techniques**

The essence of frame-by-frame filmmaking is the creation of the illusion of movement, or action, through the sequential exposure of individual images or artwork. Full animation is described as using 10 or more (up to 24) complete and distinct drawings per each second of film. In limited animation, the number of key positions assumed by the artwork is proportionately increased (to, say, 5 images per second of screen time), and consequently, the viewer sees these main postures or poses for a longer time, while 'in-between' drawings or images are fewer in number. The use of rapid-advance photographic images is well suited to the idea of limited animation, especially since the quality, or resolution, of the artwork used and seen on the screen is more photo-graphically correct and complete.

It is apparent that 'timing' is one of the factors from which the handmade medium of frame-by-frame film derives its visual flexibility and control. Since time operates on several levels, including the gestures and movements of individual objects, the pace of action within a scene, and the rhythm of scenes within a segment, time and timing may be considered the foremost element (and most technical consideration) of animation. Timed gestures help define the character, accentuate important action, and establish the balance between the movement and activity necessary to communicate the substance of the situation. In order that the film avoid becoming staid or appear static, pacing, or the rate at which the action unfolds, is employed to achieve a sense of equilibrium between active
and passive scenes. Conceptual or ideological sequences may be separated and delineated by readily discernable linking segments, or transitional scenes, that serve to order and set the rhythmic tone of a film. That the piece builds on and increases in intensity from scene to scene adds to the complexity and poignancy of the piece as a whole.

Speed in animation operates in direct relation to the number of frames occupied by images in the film, compared to and in combination with the speed of projection. The more frames a movement takes, the slower it will appear on the screen. Conversely, the fewer the frames, the faster the action. Since the standard speed of a cinematic soundtrack is scaled to 24 frames per second of film, and since this can also be expressed as a calibrated relationship between the number of frames to the parts of a second, the opportunity exists in animation for a wide range of possibilities for action and movement. In order to achieve the appearance of natural motion in limited animation, a subject under normal circumstances will fall within the range of 2 to 4 frame exposures per image. It should be pointed out, however, that the speed of an animated subject is of necessity determined with respect to a variety of factors, including the size of the subject in the frame, its position in the frame, its relationship to other objects in the scene, and the specifics of the movement to be performed. Needless to say, the apparent speed of the subject may not always be the same as the actual speed the animator is attempting to convey.

**Design Factors**

In animated film, images in front of the viewer pass in rapid succession, requiring that they be reproduced a large number of times
Because this artwork is subject to some distortion (which is actually inherent in the medium), their comprehension is strongly influenced by the composite effect of the speed at which they appear, the type of action they present, the development of successive imagery, and the tone or mood of the setting. With this in mind, I began defining an approach to visually represent the internalized and (usually) emotional state of 'imagination'. Using recognizable scenes taken from external experience, the mental pictures of the imagination rely on a kind of logic, even though scenes are manipulated and ordered to fulfill certain wishes or desires. In adopting a similar, logical premise, I rejected the mastery of complex or sophisticated imaging devices in favor of a synthesis of aesthetic and expressive manners.

The choice of materials and tools was crucial to the experience and required interplay between fundamental perceptual skills and new exploratory exercises. By identifying options and considering some alternatives, the project was delineated into discreet operational portions, each utilizing a different process or technique that was to necessitate different specialized equipment:

1) Preparation of artwork or images, including shooting, and processing techniques;
2) Pre-production work, including sequencing, timing, etc;
3) Camera work, or rephotographing of artwork on the crane;
4) Audio track definition, including scripting, music, sound effects recording;
5) Post-production editing and mixing.

In effect I was to assume the role(s) of artist, designer, cameraman, goof, director, lab technician, custom printer, layout artists, retoucher, cinematographer, editor, sound technician, audio engineer, playwrite, prop manager, talent scout, vocal coach, public
relations manager, and executive producer (not necessarily in that order!).

**Film and Material Tests**

The search for appropriate materials to produce the visual impression needed to evoke the desired response from the viewer lead me to examine the properties of several still films for both their graphic appeal and perceptual expediency.

Kodalith Ortho Type 3 Film is an extremely high-contrast, orthochromatic film designed primarily for making line and halftone negatives or positives for reproduction of drawings. Available in both sheets and rolls, this film has a wide exposure latitude, requires a 1A (red) Safelight for handling, exhibits an exposure speed of about ISO 5 to ISO 15, and may be processed (depending on the effect desired in any of five different Kodak developers (including paper developer) for 2½ minutes at 68°. Pre-loaded in 35mm, 36-exposure cassettes by Kalt Corporation, this film was initially attractive for its bold, gestural descriptiveness. By reducing the subject to broad areas of light and shadow, and by removing suggestive (i.e. distractive) detail from the scene, movement and expression could be emphasized. Although a seemingly ideal choice for the simulation of emotive representation the unusually slow film speed rendered it virtually useless for fast paced, motor-driven action - an underlying technical strategy of the project. The languid exposure index necessitated that tests with this film be conducted under extremely bright daylight conditions which would prove difficult to simulate or control in-studio. (The high contrast tests with this film were eventually employed as image props representing localized action within the context of an extended
major scene in the final presentation).

Kodak High Speed Infrared Film is an infrared sensitive, black and white film used primarily in scientific, medical, biological, and document photography, but is also suitable for special effects applications due to its extended sensitivity range. Available in 135 magazines and 50' 35mm rolls, this film must be loaded and unloaded in total darkness to avoid fogging, exhibits a recommended exposure index of ISO 20 to ISO 200 (depending on light source and filter factors), and may be processed in D-76 undiluted for 11 mins. at 68°. Rated at ISO 50 with the suggested Wratten 25 filter, I rated it ISO 100 without a filter for my rapid advance camera tests. The uncommon tonal shifts inherent in this film's visible and invisible spectral sensitivity served to exaggerate and enliven the transition from image to image. The appearance also seemed to suggest the addition of hand-coloring, a particularly appealing aspect to me and one rationale for an initial testing of this unusual emulsion. Unfortunately, the "High Speed" on the label of this film is a misnomer, since copious quantities of electromagnetic radiation are necessary for an image of distinct sharpness. An alternative and equally frustrating problem of infrared film stems from its sensitivity to heat, which produces unwanted density in the form of exposure fog along most edges and across the first few frames of most rolls. Obviously, for my purposed use of shooting action in sequence, each and every frame is not only independently important, but ultimately dependent on each successive image in order to sustain continuity. Since imagined visualization is ground in logical representation of ideas, readily apparent and clearly understandable information is required to convey the necessary essence of the scene.

Kodak Ektographic HC Slide Film is an extremely high contrast
orthochromatic film designed for AV titles and masking. A 35mm cassette was tested with a film speed of ISO 10 to ISO 20, with Kodalith Fine Line developer recommended for processing. Although increased speed was promised for this special purpose black and white reversal film when processed in Kodak D-11 developer, the effect was marginal. The graphic appeal I had hoped to obtain in an unusual emulsion proved inappropriate for recording motion above a shutter setting of 1/60 sec., forcing me to abandon graphic arts and specialty films as a primary consideration for the project.

Tri-X Pan Film, a Kodak work horse with deserved attributes of latitude and availability, is capable of excellent sharpness, full tonal rendition, and good resolution. Rated ISO 400, this film is recommended for dimly lighted subjects or fast action, and is also useful for scenes requiring good depth of field or fast shutters. Produced primarily for the 35mm format and easily developed in a wide variety of over-the-counter solutions, my tests required that I 'push' the exposure index to ISO 1600 and then 'reticulate' the emulsion in order to enhance its pictorial appearance while raising the image contrast through extended processing. This strategy worked well initially, but the graphic effect induced by reticulation was thwarted by the minimal amount of enlargement needed (no more than 3"x4") for use on the animation crane.

Reviewing the literature provided by Kodak on their range of black and white films in Kodak Professional Black and White Films (publication F-5) lead me to test Kodak Recording Film 2475. Listed as a very high-speed, coarse-grain panchromatic film, it is recommended for photography in low light levels of existing light, or where very fast shutter speeds are coupled with small apertures. Available only in 135-36 magazines and with a useful exposure range
of ISO 1000 to 4000, this film seemed to fulfill the necessary prerequisites of high speed and pictorial distortion I sought for the bulk of my rapid-advance photography. With emulsion characteristics of coarse grain and a low degree of enlargement possible, contrast was readily increased through a 9 minute development time at 68° in Kodak DK-50. Recording Film 2475, then, satisfied the main technical concern of matching a compatible exposure index with sufficient subject movement.

**Shooting Procedure Tests**

In-studio tests with contrasty, uni-directional and (what I term) theatrical lighting produced mixed results. The subject lost substance (resolution) when moving out of the line of direct lighting, causing either blurring of the figure or insufficient exposure density, or both. In these first tests I used classmates and friends as models, resulting in a look of natural spontaneity and an unexpected, but welcome, sense of candor. The most important element of the studio tests was the recording of explicit facial expression, without precise detail, and subtle gestural posture needed to convey to the audience the desired emotional intent. This cinematic aspect of the shooting sessions, in which I attempted to capture feeling through extended-frame sequences, was critical to the subsequent development of both visual impact and narrative cohesion.

**Sample Test Shoot:**
- **Location:** Upperclass Lighting Studios, Gannett Building
- **Equipment:** 35mm camera with 3fps winder; quartz-halogen adjustable spotlight on overhead boom
- **Materials:** Recording Film 2475
Props: telephone receiver, seamless backdrop
Illumination: Direct, overhead spot with 20x24 foamcore reflectors on both sides and front of subject
Exposure: f/8 at 1/60th second in "sequence" mode
Action: Figure slowly turns while speaking into receiver

Processing Procedure Tests

Following Kodak's suggestions, and in an attempt to increase grain and contrast, I opted for extended development of my film in DK-50. One roll was processed in D-19 for 6 minutes, since it was predicted (by Kodak) that this would raise the apparent contrast of the image, but no appreciable increase or overall graphic enhancement was obvious.

The idea of making large, 16x20 contact sheets of each roll, instead of blowing up each exposure individually, was prompted by the availability of a Labrador 8x10 condenser enlarger located in the MFA Darkroom complex. Two lenses were on-hand for use with this venerable machine; one 300mm wide-angle and one 360 normal Schneider lens. On being advised that the slightly longer lens exhibited more apparent sharpness, my first set of large B&W contact sheets were made with rows of 2½"x3½" images. It was only later, after I had reacquainted myself with the rudimentary functions of the animation crane, that I remembered the minimum "field size" requirements for the compound bed were 3"x4". The shorter, 300mm Schneider lens thus proved more suitable for the enlarging task, although fewer frames per roll were capable of enlargement. Ultimately, rows of images 3 frames across and 4 frames down were prepared on double-weight, Kodak Polyfiber paper, G surface (for later retouching and coloring), with a #5 Ilford 6"x6" contrast filter inserted between the condenser
and heat-absorbing glass of the enlarger. The high-contrast filtration was employed to enhance the appearance of the melodramatic lighting and increase the graphic look of the subject.

The Labrador 8x10 unit is equipped with a glass negative carrier that required constant and continuous inspection and cleaning to reduce (since it could not be eliminated!) the amount of dust and particulate matter observable on the contact sheets. Freshly purchased and pristine negative sleeves were initially employed to allow precise positioning of the negative strips in the holder, but flaws in the acetate covering proved more pervasive than expected. Finally after much trial and error, a crude but satisfactory registration system was devised, allowing maximum use of the 16x20 dimensional area of the projection sheet.

Pre-Production Methodology

After amassing a set of 16x20 contacts from various test shoots, the individual sheets were cut, images numbered, and sequences prepared. For the early tests, a variety of coloring mediums were used, from artist oils, magic markers, and sparkle paints to colored mylar and photo toners, in order to determine the image enhancement generated by each. Most proved too harsh or garish, and the subtlety and scarcity of coloration in the final version tends to give it a more powerful look due, in part, to the bolder appearance and graphic aspects engendered by the predominant use of black and white images. Most films with this appearance are received as evocative, docu-dramatic works and present a readily identifiable 'look' to motion picture audiences.
Single-Frame Technique Explored

Equipment for the preliminary frame-by-frame filming included a Canon Super-8 movie camera, capable of single-frame photographing and macro focusing, loaded with a standard Kodachrome 40 (Type A) movie cartridge. Set up on a professional copy stand equipped with four quartz lights balanced for tungsten films with a relative color temperature of 3200°-3400°K, exposure controls were set to "automatic". A quick-and-dirty registration board for artwork, consisting of a sheet of plate glass taped to a piece of matboard (contact-frame like) proved unsatisfactory as a guide for placement of the figure/frames, but a refined version with plexiglass (although still crude) allowed more precise alignment.

In an attempt to define patterns, rhythms, and visual synchopations, notes were kept and various frame counts recorded, beginning with a minimum of 2 frames per image and progressing to a maximum of 6 frames each. Additional series were filmed using alternating sequences (such as 2 frames followed by 4 frames of successive images) and the length, or frame count, of each segment was transposed into time duration. Remembering procedures and transcribing notes while previewing test reels became cumbersome, so ensuing tests contained introductory shots of "frame-count cue cards" which enabled the easy identification of the number of frames assigned each image in different segments.

All Super-8 cartridges were processed through the camera and film department of the local K-Mart affiliate by Guardian Photo, a commercial lab located in New Jersey. The cost per reel was approximately $2.00 and turn-around time from drop-off to pick-up was only about 4 days. Analysis of these test films revealed that 3 frames
per image gave the appearance of normal, conversational action in medium and close-up shots, while full-figure long shots approached natural action at 4 to 5 frames per image. The rude registration system provided evidence that sufficient imagery was available to represent the figure in sufficiently important key positions, or poses, enabling the illustration of complete movements. The overall visual appearance and effect was judged compatible with the type and style of motion I intended to simulate.

**Pre-Production Preparation**

With the bulk of material and equipment testing accomplished, the broader areas of production were delineated: opening titles, sequenced segments, transition scenes, computer-assisted spot, audio track, dialogue, and ending credits.

To flesh out the discreet formation of ideas for individual segments that would eventually form the body of the piece, a search began for existing artwork that would enhance the visual metaphors presented, while also serving as type-cast, cliche imagery. Several recurring themes were identified and images were culled from 1950's advertisements of 'techno-deco' (my term) television sets, bulbous automobiles, and merry housewives clad in basic pearls and lacy aprons. My sources included attic stashes of "Better Homes and Gardens" and various out-dated publications located at the neighborhood Goodwill outlet.

Mediums of communication, in particular telephones and television sets, were chosen to symbolically illustrate how such instruments are employed as ambiguous tools - devices used to perform a desired task AND a contrivance used to achieve or evoke a desired effect - and how
their use is symptomatic of alienated intrapersonal relationships. Lacking applicable verbal skills to express emotional attitudes, many people turn to, and in fact are heavily dependent upon, indirect and ineffectual mass mediums and techno-shock devices. Daily conversational discourse, then, is reduced to innuendo and allusion. The implication is that our emotional or spiritual selves seek to alleviate a compelling sense of remoteness, or disconnectedness, by the adoption (and proliferation) of special tools that were created for the very purpose of being means of idea transference. This condition, or state, was to be a crucial aspect of the film's content.

Production Shooting - Location

The opening titles were created and prepared on a "Magic Etch-A-Sketch" screen, the glass covered frame of aluminum powder and plastic beads common to almost every children's toy box. My initial reaction to the use of a child's plaything as a graphic tool stemmed from its very subtle, but very appropriate nature, and included:

* the graphic appeal of its picturing device;
* its inherent simplicity and universal recognition;
* its similarity in appearance to a television screen;
* the cryptic and highly stylized graphics it produces;
* the unsuspected amount of skill it requires to "operate";
* the seeming outward channeling of internal ideas by technological means, etc.

Naturally, the idea that I was possibly the first to truly exploit this undiscovered aspect of the post-modern idiom did not escape my attention! (I briefly considered investigating the purchase of a
few shares in Ohio Art in hopes of cornering this emerging market!).

My "Etch-A-Sketch artist was a computer systems analyst by day, and an avant-guard artist only by request. With a Smith-Victor halogen lighting kit obtained from departmental sources, I recreated a standard 'copy stand' lighting set-up around a coffeetable, with two quartz units placed at approximately 45° angles to the 'magic screen'. Other equipment included a 35mm camera with winder, a 50mm f/1.8 lens with 49mm polarizing filter, tripod, and several rolls of Tri-X (36 exp.).

Shooting the scene from overhead (i.e.inverted) while the artist wrote "Etch-A-Sketch" script ('titles') right-side-up, we quickly produced several hundred frames, including the opening 'shaking' technique needed to wipe the magic screen clear of figures. Moderately fast (ISO 400) Tri-X was used instead of the extremely high-speed Recording Film 2475 because the lighting was both controllable and constant, plus the action being recorded was limited and unfolded at a relatively slow pace. It was also hoped that better resolution and sharpness would be achieved when photographing the thin, scratchy lines of the "etch-A-Sketch" letters. The technique of rapid-advance sequenced imagery was implied convincingly.

The Search for Talent

Musical, vocal, and acting talent is abundant in a large college community like RIT, but finding a committed cast who could devote time and energy, plus take direction from a slightly confused independent filmmaker narrowed the possibilities considerably. At first friends filled roles mainly as warm bodies for light and film tests, and some later served in minor aspects of the production. Most of
the acting roles, in fact, were cast after coincidental meetings which resulted in the recognition of an individual's ability to emote facial gesture, body movement, or vocal style as was consistent with my impression of the character.

Ms. Deborah Neisel, who figures prominently in the film, showed not only a natural ability, but a true affinity for the emotive situations described to her in my directions. Her portrayal throughout the film was of a completely professional nature and this lends the piece an increased sense of authority.

**Production Shooting - Studio**

Unlike the opening titles, which were shot on location with portable lighting units at the home of the artist, the majority of the photo-visuals for the project were exposed in the studio. In order to produce contrasty lighting and dramatize my actress, a single-source, overhead boom was used. The focus was to be the subject's facial expressions and their transformation during the scene through the use of multi-layering of imagery, reinforced with dialogue or sound. The voice-overs were undefined at the time of this original shoot, so the visuals needed to be clearly expressive and somewhat exaggerated in order to represent a variety of feelings. Melodrama was coupled with pantomimed action to produce a useful range of behavioral patterns.

For one session, the subject was directed to slowly turn while simulating a phone conversation. The action was framed as a medium close-up shot and the only prop was a telephone receiver. After discussion of the emotive quality desired and several rehearsals to insure that the action would be contained within the time frame of a
motor-driven 36-exposure roll (20-25 seconds), the scene was shot.

The next segment required a more elaborate set-up and auxiliary lighting to illuminate a larger section of the studio. Pressboard flats and a neutral gray seamless backdrop were arranged to effect the appearance of a small, totally enclosed space or room. The makeshift walls were to serve as a metaphor for psychological barriers causing the subject to react with a myriad of emotional expressions - surprise, despair, fear, anger, realization, etc. The action was framed within a long shot and from an elevated camera angle. The subject was directed to attempt to leave the confines of the claustrophobic space and exhibit dramatic bodily gestures. Following a few rehearsals to confine the activity within the threshold of the rapid-advance technique, the scene was photographed. (This sequence was pulled from the final version for various reasons, including a lack of continuity with other scenes and what was perceived as minimal emotive impact.)

A segment consisting of the subject interacting with a selection of television spots began with the appropriation of a large TV monitor from the Film/Video Department, RIT. The 27" set was to serve not as a prop, but as a varying light source for recording the action of the subject. With this magic flickering device in place in a darkened studio, metered exposure readings indicated that the cathode ray tube was emitting insufficient luminance for capturing action, even with my extremely fast film. Realizing that the inverse square law of "... illumination diminished by distance ..." was thwarting my attempt at realism, I resorted to a makeshift simulation technique. A photoflood equipped with light-directing barndoors was secured to the bottom most, floor level mount of a light stand and aimed at a studio assistant who held a 20x24 foamcore reflector. As my actress was being photographed, the assistant was instructed to randomly
swing the reflector back and forth, causing the light to increase and decrease in intensity as it fell on the subject, and thereby create the appearance of a flickering television screen. Additionally, a backlight was positioned directly behind the figure and aimed at a backdrop in order to produce contouring of the subject when she was thrown into silhouette by the changing lighting pattern. Props included a TV-watching easy chair and a high-tech wireless remote control for channel switching. The subject was directed to occasionally point the remote at the camera position, while registering increasingly disgusted facial expressions. The action was framed as a medium shot (upper torso), and no time limit was imposed since successive rolls could simply be edited together to create continuity.

In a departure from so-called realistic situations, in which the subject projected, received, and reacted to emotion-laden stimulus, I proposed an aesthetically inspired sequence of images seen in tandem and designed to coincide and mesh visually with one another. The scene involved "heads and hands", expressive facial poses, and the superimposition of a mysterious luminous sphere.

The "circle of light" sequence was concocted from an overhead ceiling light fixture that was taped over a photoflood head. This served as the main subject as well as the sole light source for the scene. My actress was directed to approach the sphere, reach out for it, and caress the outer aura created by the radiating light. The glowing orb, as a manifestation of energy or a form of power, was intended to represent a source or sense of lucidity as is found in personal understanding and realization. (Also known as enlightenment). This was an interpretive attempt at conceiving and presenting internal, intangible, and intimately held impressions of an inner state or condition. The brilliant light ultimately emitted a series of
changing facial features, which were photographed separately as a succession of backlit head shots for the completed version.

Production Processing

The darkroom phase of the project incorporated all the techniques of my earlier tests, including extended processing and contrast filtration to dramatize the expressive content of each scene. Even with newly acquired familiarization of required processing methods, several weeks of printing lay before me. My attention was divided between concentrating on refinements in registration and obtaining consistent results in development. Increasing the size of the projected images to a minimum of 3"x4" on a sheet of 16"x20" photo paper necessitated the alignment of relatively short lengths of film in the large, glass negative carrier. The thick estar base of Kodak Recording Film 2475 produces a tight, characteristic curl in the direction of the emulsion, exacerbating the precise positioning and ordering of the cut strips. The ensuing lengthy and involved system I was forced to devise for printing each series of photo-visuals required more patience and manual dexterity than formal procedures or calculations. Surprisingly, at an enlarging distance of almost 5', the resolution and image characteristics retained their impact and content, rewarding my diligence with a freshness and charm that had been unanticipated. Well into my second 50 sheet box of 16"x20" polyfiber printing paper, the whole of the piece took on a descriptive and intentionally subtle form.
Pre-Crane Preparation

Compilation of scene content and progression required the examination and comparison of both compatible and divergent elements of the prepared visuals. In order to verify the order and then arrange them in proper sequence, each contact sheet was cut and labeled as the collation process began. An exposure log was created to contain the final arrangement of images and included directions and instructions for use during filming on the animation crane.

Consisting of over 200 pages and covering the action contained in over 10,000 frames that would be individually exposed, this filming chart identified:

1) the scene being photographed;
2) the position and direction of the camera;
3) the field size and focus necessary;
4) the identification of the image to be filmed;
5) the number of frames allotted each visual;
6) the total number of frames for each segment;
7) the transitional filming device used in each scene;
8) descriptions of the sound effects or dialogue used; etc.

In this manner, the progression of photo-visuals and cut-out artwork was delineated and each scene was plotted. Additionally, a footage and timing chart was devised that equated screen time to frame count (ex. 12 frames = 0.5 seconds, 24 frames = 1.0 seconds). By using this informal outline I was able to denote the segment, its length in both seconds and frames, the transition vehicle (cut, fade, or dissolve) I intended to use, and cues for audio accompaniment. By employing this procedure, over 20 complete and distinct sections of the film emerged, containing 7 major scenes that included 8 auxiliary segments, offset by 5 transitional ploys. The sections occupied...
anywhere from less than 20 frames to more than several thousand, and appeared on screen for anywhere from a few seconds to several minutes. A series of supplementary xerox images were produced with hand-drawn embellishments in order to expand specific situation into generalized experience. Still in its conceptual form, the bulk of the visual were transported to the animation lab for frame-by-frame assembly.

The Animation Crane

The animation stand, the camera, and single-frame filming techniques all work in conjunction to blend the artistry of the animator with the craftsmanship of the crane operator. Many hours of work are necessary to photograph even a few seconds of an animated film, with almost 1500 frames required for every minute of viewing time.

Artwork for animation is prepared to be shot within the borders of a 12½"x10½" field guide, which serves as a map for the position of the camera and the angle of view. The largest dimensions that can be photographed on a standard animation bed is 12"x9", designated as "field 12" on the guide. This largest field is divided into separate rectangular areas which correspond in shape and size to the format of motion picture film and television screens. The smallest standard field size is 1"x½", called "field 1", but most animation work is gauged to "field 4" which measures 4"x3". The various field sizes allow for considerable flexibility in both camera movement and the creation of artwork. Photographing artwork at field size 9 and then changing to field size 4 will produce the effect of zooming in on the subject, or allow for a close-up of an object in a scene. Even when the minimum sized artwork is employed, shooting at a lower field position allows the figures to fill the frame, producing the look of
full-sized characters.

Since every element in the visuals must look like it begins, or takes off, from the same position in each successive frame, animators must use a system for registering each image. Marks or crosshatches can suffice, but the most precise system involves "punching" the artwork with holes that are aligned to "pegs" installed on the bed of the animation crane. An alternate method involves the use of animation "header strips" which are appropriately punched and can be easily attached to the top or end of each visual so they coincide with the registration pegs. Normally a light table is employed to assist in exact positioning, or an animator's pegboard (composed of a thick sheet of frosted plexiglass) is available which incorporates the same peg system for exacting alignment.

An animation stand can be as simple as a bare table with a sliding column for mounting a camera, and two photo floods on either side for illumination. A professional animation stand, like that in figure 1, is a highly sophisticated piece of equipment designed not only to be extremely stable (to avoid blurring during exposure), but to allow the greatest extent of movement for specific motion effects. Such an animation crane allows the artist to incorporate tilts, rotations, panning, trucking, zooms, dissolves, fades, and superimpositions into the animated film without having to draw the individual images needed to produce such an effect.

To provide for maximum adaptability of action for animated photography, professional animation tables are mounted on a "compound", which is a platform that rests on two parallel rails running in both an east/west (back and forth) direction and a second set fixed in a north/south (up and down) direction. With a series of mechanical handwheels, the animation bed can be moved in all directions, and even rotated in a circle around the center of the chosen field. All
FIGURE 1

The Animation Crane
movements are calibrated in 0.01 units (either inches or centimeters, depending on the scale desired) to allow for the smallest advancement of action necessary for movement in any horizontal or vertical direction.

In order to maintain exact alignment for artwork that progresses across the screen, the compound is fitted with "travelling peg bars". These bars are fitted with the moveable pegs that keep the visuals registered under the camera during, and between, exposures. There are several peg standards, but a common one uses a round central peg flanked on either side and at equal intervals with rectangular pegs. Additional sets of moving pegs may be used to allow one visual to be animated while another (like a background scene) remains stationery. Also included in the compound set-up is a "pantograph", or pointer, which is positioned over a field guide immediately to the right of the compound bed, showing the camera operator the exact position of the artwork under the lens. Acting as a kind of mapping device, the pantograph allows the precise tracing of directional movements of the visuals with respect to the area actually being filmed.

To keep artwork perfectly flat while in position during exposure, a hinged sheet of heavy plate glass is lowered over the visuals, extending to all sides of the largest field size. This "platen" not only aids in registration of the images but prevents cut-outs and other artwork from casting unwanted shadows. (Note: When an animator needs shadows, allowing their appearance behind some cut-outs will increase the sense of weight and volume behind the figure, causing a 3-dimensional effect.) The top of the compound bed is covered with foam padding to absorb the pressure of the heavy glass platen, but it may be removed and replaced with frosted glass for bottom lighting.
Movements of the Compound

An animation crane equipped with travelling pegs and elaborate movements of the bed is requisite for single-frame films both for effective mobility and versatility. Working in conjunction with the tracking movements of the camera, several basic functions of the compound may be employed to produce differing visual effects.

1) Using the sliding camera carriage, the animator may approach or recede from the surface of the compound bed, covering a smaller or larger field size. The effect is similar to a Zoom in or out.

2) The bed itself can be moved sideways (east/west direction) or up and down (north/south direction), or in any other oblique direction by a combination of these movements.

3) The travelling peg bars can be moved in a sideways direction while the bed remains stationery, producing a panning effect.

4) Auxilliary floating peg bars enable movement independent of the motion of regular travelling pegs, allowing different artwork to move in opposing directions or at different speeds.

5) Some animation compounds allow for rotation around a vertical axis of the center of a field size.

The juxtaposition of differing compound features enables the animator to direct the viewer's attention through the course of the film.

The Animation Camera

A motion picture camera to be used for animation should exhibit several distinct characteristics, including:
1) the capability of exposing one frame at a time;
2) the capability of feeding film in reverse;
3) a fading, twin blade shutter;
4) a lens capable of focusing down to small field sizes;
5) a frame counter;
6) through-the-lens viewing (desirable, but not mandatory).

The ability to shoot one frame at a time under controlled conditions should not be underestimated. Whether the camera is mechanically or electronically driven, starting up and advancing, then stopping for each frame must be extremely precise to avoid small, but easily noticed, differences in exposure between frames. Such variations, even if very slight, will result in a visible flicker when viewed on screen. Modern animation cameras are fitted with electronic motors which can alternately start, stop, or run at a constant and accurate speed. The motor is designed to operate consistently whether running in a forward or reverse direction.

A fading shutter consists of two blades, one of which may be moved relative to the other to allow more or less light to pass through. When they are directly over each other, moving in unison, the angle of the shutter opening is equivalent to a half circle, or approximately 170°. Moving one blade in relation to the other allows the shutter angle to be changed in increments of only a few degrees in order to fully open or fully close the shutter. The shutter is half open at 85°, a quarter open at 43°, and fully closed at 0°. (Note: Other methods of varying the exposure include varying the lens opening, or aperture, or altering the intensity of the illumination.)

Since the field sizes used in animation are often quite small, close proximity of the camera to the artwork being photographed requires close-focusing capability. For the rigid requirements of
single-frame filmmaking, the camera lens is specially mounted to expand the focusing scale. Additionally, adjusting the camera head up or down along its calibrated support column is designed to correspond to specific field sizes.

A frame counter is more than a luxury on an animation camera - it is an essential component. Ordinarily, a revolving counter, capable of being set to zero when necessary, is connected to the single-frame mechanism allowing it to count both forward or backward, depending on the direction the camera is set to run. The counter indicates the number of the frame just shot and is necessary for backing up the individually exposed frames for shooting dissolves and superimpositions.

The functions of an animation camera allow for gradual changes in a scene or from one scene to another. A "fade" is the reduction or increase in the shutter angle over a specified number of frames during filming. A "fade-in" consists of gradually opening the shutter angle during exposure, producing a progressively brighter picture. A "fade-out" requires gradual closing, or reducing the shutter angle during filming to slowly darken the picture. A "dissolve" is merely a combination of these two techniques, and is accomplished by first reducing the shutter angle during exposure of a specific number of frames, rewinding the film by the same number of frames, and then re-exposing the scene as the shutter opening is gradually increased.

Another common use of variable exposures is the technique of "superimposition", which requires splitting the total exposure between two passes of film through the camera. The first run of film exposes the scene at a reduced shutter angle, say 45°, and after rewinding, a second pass of another scene is made at a shutter angle of 55°. The overall picture has thus received 100% exposure, but the various elements in the scene will appear in varying degrees of density on the
film. An exact count of exposed frames must be kept as the film passes through the camera, for any frame out of sync with its alternating exposure will cause either an under- or overexposed frame that will appear as a flicker or blank spot in the final scene.

**Lighting for Animation**

Lighting for flat animation is normally required to be even, constant, sometimes color corrected, and often polarized. This type of lighting can usually be provided by two photoflood lamps of equal wattage, placed at 45° angles to the animation bed. Placement is critical in order to achieve balanced illumination as well as to reduce the occurrence of glare and reflections on either the surface of the glass platen or from artwork on acetate. Additionally, a polarizing filter is positioned between the camera lens and compound bed to correct or eliminate light reflected back from artwork. Sometimes sheets of polarizing acetate, or gels, may be placed over the light source as well. Since film stocks designed for artificial lighting are designated by their color temperature, some modification of the lighting conditions, such as the use of color correcting gels, may also be necessary.

**Animation Filming**

Once assigned an animation studio (a.k.a. "crane room") the full-function animation camera was loaded with 50' of 16mm Kodak film. I opted for short reels of film, which would require later splicing, over one long 400' roll because I was familiar with the shorter stock (having used it previously for other animated shorts), because it was
available over-the-counter (the long reel required special ordering) and because the short spools allowed more control over the whole of the filming process. Fifty feet of film is approximately 4000 frames, but the unique operations of the animation camera requires the advancement of at least the first 100 frames during the loading process to insure proper positioning and feeding of the film as it passes through the film gate. During exposure of the next 400 frames or so the take-up (or "torque") motor requires manual tightening in order to avoid having the film buckle, which would trip an automatic shut-off mechanism of the camera.

A checklist of crane functions and operations, including setting the shutter angle, lens opening, zeroing the frame counter and other compound controls, adjusting the light voltage, etc. are all required before filming can actually begin. With a field guide in place under the platen, a final visual check is made through the viewfinder of framing and composition prior to actual shooting.

**Shooting Sequence**

The opening titles, which were originally hand-colored, arrived in the crane room prepared with individually cut, red acetate overlays (like templates) designed to cover each "Etch-A-Sketch" image exactly. The transparency of the acetate, as well as its saturated color, imparted a 3-dimensional effect to the visuals. Forty individual photo images spanning over 1000 individually exposed frames, lasting less than 60 seconds on screen, were recorded at Field 5 with a full shutter setting. Motion was created by shooting at 5 frame intervals, while "pauses" were filmed at 15 frames per image, and "holds" at 24 to 48 frames (approximately 1-2 seconds on screen).

The awkward appearance of the "Etch-A-Sketch" script suggested
the imperfect, and incomplete, nature of the visual medium - one of
the main ideas of the film. The theme of 'mechanism as communicator'
was introduced as a preface for the use of other more sophisticated,
but equally defective, communication formats that were to be used in
later segments of the piece. The symbolism was deliberately low key
and restrained - even slightly playful!

The titles dissolved to a visual of a "video glitch", or inter-
ference pattern common to TV, as a forward to the concept of discord-
ant and static filled messages. The opening close-up, which filled
the screen with diagonal and jagged lines, slowly trucked back to
Field 9, revealing a circa 1950's television set. This scene featured
a parody of the television medium, mimicking its latent power, author-
ity, and so-called sophistication. This transition scene is brief,
but it serves to introduce the premise of communication failure as a
symptom of imaginary invention and describes the device-dependency
of most forms of interactive messages.

In a cut to the first major scene involving a characterization,
a female figure appears facing the camera position. The subject is
photo-real (i.e. a continuous-tone image) and is depicted with a TV
remote control device, switching channels. Simulated broadcast voice-
overs consisting of innane, gimmicky, and formula-laden views of
reality form the audio track. (See APPENDIX C for complete dialogue).
Over 50 individual photo visuals were arranged to illustrate the
channel changer's increasing disillusionment with the medium's highly
stylized message. The scene ends abruptly with a cut back to the
interference pattern, serving as noisy, confusing comments on the
video caricatures.

This test pattern video image also served as a transition visual,
leading the viewer into the next scene for an 'imagination mode' rebuttal. As the camera is drawn slowly back from the zig-zag pattern on the monitor, the action cuts to the first in a series of cut-outs of female figures taken from '50's era magazine art. Housewives in dated fashions, complete with lace aprons and high heels, are seen in front of vintage television sets (See APPENDIX B for illustration examples). The voice-over broadcasts serve as a stark contrast to the images, presenting strikingly relevant, political views on a variety of topics pertinent to contemporary women viewers. It is the contradictory depiction of feminist opinion in so nostalgic a setting that parallels the unlikely use of the airwaves by women for such pertinent issues. The evidence of the employment of the imagination for this scene is established through the presumption that such a thing will probably not occur ("... not in your wildest dreams...") because it is considered 'fantastic'.

The improbability of the availability or access to television as a medium of communication on topics considered significant to women in the current population is emphasized by an end scene featuring a cut-out male characterization. His image is stylized in a standard old-fashioned mode, reflecting the out-dated male views of dominance and control. Echoing the action of the previous scenes, the subject is depicted in a large easy-chair with his back to the viewer, casually switching channels with a remote control device as he attempts to tune-out the female-oriented telecast. The satirical nature of the commentary on the audio track underscores the observation that the power of the 'technological button' remains with the male, and the image on the screen can easily be interrupted through the timely intervention of the mechanical-control device. The use of a handheld remote unit to thwart incoming channels and thereby intercept attempts at communication serves as a metaphor for the underlying nature of
most interpersonal conversation in general, and psycho-sexual interaction in particular.

Linked by dissolves, the four separate segments of this sequence required a series of smaller images to be cycled continuously through the screen of the television cut-out, while the full-figure cut-outs in the foreground responded or reacted to the voiceovers. Almost 1300 individually exposed frames were shot at Field 9, and short 50 frame dissolves were inserted between each setting. The animation camera's variable shutter capability was integral in the creation of the transitional nuances of this segment.

Another, more unusual transition scene was developed using this same camera technique to present an alternate aspect of the use of the imagination as a means of communication and conceptualization. By utilizing the unique attributes of single-frame filmmaking, a continuous dissolve of a sequence of facial close-ups was superimposed over a slowly tracking background. Lasting only 20 seconds on screen, this scene nevertheless required precise planning, exacting calculations, perfect execution, and literally hours of filming time to expose, and then re-expose almost 500 individual frames. In preparing the background, a panoramic ink drawing depicting telephone lines traversing a mountainous landscape was transferred by hand to a 10"x30" sheet of clear acetate with a technical pen. Attached by header strips to traveling peg bars and bottom lighted through frosted plexiglass, the scene was slowly panned beneath the stationary camera by minute turns of the east/west handwheel controls of the compound. Exposure for each frame was set for a shutter opening of only 85°, or half open, in anticipation of the second exposure pass of "head shots" which were exposed in short dissolve sequences of 0° to 85° shutter settings. The combination of exposure sequences were determined to add up to full shutter illumination of the various artwork.
In the resultant segment, a female character's changing facial expressions are superimposed over the telephone-lined landscape. The tone of the scene is muted and somber and serves to set the stage for the upcoming emotionally charged segment that exploits the use of this alternate instrument of communication, the telephone, in an attempt to dispel a sense of separateness and disconnectedness. Like the television, the telephone is another 'device' that was created to enhance or expand our ability to communicate or connect with others, but which has become strangely symbolic of the discomfort we feel when faced with communication anxiety.

As the segment begins, a photo-realistic shot of a female figure with her back to the camera fades in. The action begins as we hear telephone-stylized, one-sided conversational dialogue while the character begins a slow turn toward the camera. This 'eavesdropping' continues as the subject completes one turn and, upon resuming the opening stance of having her back toward the audience, undergoes a visually graphic transformation from a continuous-tone subject to a xeroxed image, from unauthoritative familiarity to unavoidable starkness. The visual connotation is reinforced as the dialogue also switches from remarks steeped in gamesmanship to earnest expressions of inner desires. The mundane photo-real images, being composed of shades of gray, are analogous to the real-life vagueness and banality of the opening dialogue, while the bolder, high-contrast, black and white impression of the xerox visuals, representing the subject as areas of important highlights and shadows, accompanies the more internalized discourse of the audio track.

The third representation of the subject is as hand-drawn, highly graphic figures against a dark background. This is the character's most wishful manifestation, whose intentions and conversation are
openly expressive rather than suggestive. In this imagined form, the subject appears direct, fragile, and vulnerable. The implication now becomes cumulative: the continuous-tone imagery and corresponding conversational dialogue represent the social 'norm', the usual patterned response indicative of sanctioned interaction; the photo-copy imagery, being once removed from reality and stressing stronger visual impact, contains dialogue that the subject wishes to actually express, but which cannot be spoken under 'normal conditions'; and the hand-rendered drawings convey the underlying essence of the subject, the authentic feelings of the character.

The conclusion of this sequence shows a reversion to temporal photo-reality, with the formula conversation serving to further suppress any significant communicative exchange. The attempt must remain unresolved, the subject remains unconnected, and the relationship remains uncommitted. By resorting to instruments originally intended to enhance our understanding and assimilation of reality, we have only succeeded in creating a device-dependency that serves to contribute to our sense of inadequacy and disjointedness. This is the impetus behind the creation of the film - the perfection and completeness of the imagination versus the impotency and incompatibility present in reality.

Continuing with the theme of internalized emotional duress, another segment similar in its visual effect to the faces passing over the bleak landscape was created as a transitional scene. A perpetually changing series of facial features was superimposed over an abstracted pen and ink drawing of stylized faces and hands. An elongated sheet of clear acetate with the illustrations was attached by header strips to traveling peg bars and bottom lit. The background drawing was slowly trucked beneath the stationary camera by minute turns of the north/south handwheel controls of the animation
compound, producing a vertical pan of the artwork. The resultant superimposed images were meant to signal the viewer that reality and fantasy were in flux, changing with regard to influences or conditions not fully understood and that may or may not persist through time.

This abstracted face-hand motif was expanded by the next film segment, which derives its impact strictly from the special features of the animation camera. Lasting almost a full minute on the screen and covering well over 1200 frames, this scene displayed continuous dissolves of over 70 separately photographed images which were recombined and assimilated into almost 40 individual action shots. The emotive drama illustrated by this, the 'circle of light' sequence, took over 4 hours of single-frame filming and, because the entire visual effect depended on the superimposition of continuously dissolving images, required painstaking planning and execution in order to assure that each frame received the correct amount of exposure. An error in even one frame results in a shift that causes a visible 'flash' whenever the overexposed frame appears on screen.

A normal dissolve technique is often called a mix, since its purpose is to show a gradual scene change or shift in setting or mood. In the 'glowing orb' segment, splitting the total exposure between two runs of film through the camera served to illustrate action, or movement, in the figure and enabled the subject to exhibit emotion through alternating facial expressions. The overall visual effect was ambiguous, allowing the viewer to attribute more intimately held interpretations to this scene than any that had come before it. By applying the underlying theme of imaginative vision, the audience was offered sufficient opportunity to construe, decipher, or identify with the character(s), the action, or the sentiment portrayed on the screen.
Computer-Aided Imaging

Artists have used graphics and symbols for thousands of years to record and transmit ideas, but the introduction in the late '60's of computer-aided images has literally transformed animation methods into "child's play", with many programs capable of being completed by 10 year olds! The advent of technologically complex systems for self-expression allows a conscious exploration of new approaches within the medium, and computer-programmed animation represents the cutting edge of visually created motion. Obviously, these imaging systems allow an important degree of freedom of expression not normally available to artists and animators.

Computer systems programmed for imaging allow and accept input from the operator-artist that are analogous to image descriptions or other information about the picture being created. When enough information about an idea or object is available in a computer file, it is no longer necessary to produce and reproduce complete illustrations for animation through tedious drawing and layouts. It is the computers ability to recreate an image or object on command, to store information in a data bank for later use or refinement, and to visually display such images with additions or variations that make it a remarkable and influential imaging medium.

Working with a system called CAST, or "Color Animation and Scene Transformation", I was able to create the illusion of dimensionally perfect and correctly oriented forms and configurations by utilizing pre-programmed geometric shapes such as a simple "point" or "line" of any length, or more complex shapes like a cylinder or pyramid. Information concerning the location, dimensions, or color characteristics of these object-shapes enable the system user to input subsequent operations, or commands, in order to affect a "transformation"
(i.e. to animate them) either by moving the location of the object, changing the viewers (camera) position, or altering both within the confines of a Cartesian coordinate system. Since it is from the camera position that the computer animator and the audience view the scene, the effectiveness of the animation can be increased when the user assigns coordinate designations or movements, like rotations, tilts, zooms, or spins to individual visual parts of the object or shape, to the objects within a scene, and/or to the camera itself. "Field of view", then, is controlled in the same manner as live action camera angles are used.

In addition to precise dimensional creation of shapes and forms, the CAST system features the ability to understand and execute a series of scripted actions under computer control. In much the same way as a director instructs actors to behave in a scene, objects or shapes are animated by attributing actions to them that imitate motion in the physical world. "Scripting" the action of the subjects serves to define not only object motion, but also the scope of the action, its duration, the direction in which it will occur, and what the visual conclusion will be. By careful regulation of subject size and placement, the system user can link the motion of discreet object segments with other visual components, allowing them to move in tandem. This unique joining operation establishes an interdependency between objects, termed a "parent-descendent" relationship, in which actions attributed to the parent object affect its descendents, but the movement of a descendent remains independent of the consequences for the parent.

While the objects perform their scripted transformations, they are subject to the same timing cadence and sequencing logic that any flat artwork would be restricted to on the crane bed. Just as
the standard speed for cinematography applies to a 24 frame interval, so a computer-generated transformation covering that length would equal one second in duration. The entire mainframe computer-generated segment consisted of almost 3500 individually created frames, or the equivalent of a little over 2 minutes running time on screen.

For the main character-object, I chose a rudimentary square, in effect, a 'plane' of equal sides. Using an empty, black background setting served both a symbolic purpose, indicating the darkness of ignorance, and a perceptual function, representing the void of space. Central pivot objects, described as 'points', were assigned alphanumeric titles and identified as objects or groups of objects that could move in unison in either the same, or opposing directions in any given scene. Groupings of squares were isolated and directed to crisscross and rotate away from, and then toward, each other. The overall visual effect of this scripting of images moving effortlessly in perfect harmony was hypnotic. The subliminal impression left by the sight of the precise object-squares floating weightlessly and simultaneously implied and suggested a union of the conscious mind and the unconscious imagination.

A contrasting piece of stop-action animation of cut-out acetate squares was filmed as a companion for, and introduction to, the computer-generated scene. Stop-action, cut-out animation is achieved by positioning and repositioning shapes or figures that have been drawn on paper or other flexible material and then cut out. The animator moves the cut pieces across the background or through the scene by hand, stopping the filming process to alter the location of each piece in motion before resuming exposure. The halting and erratic motion of stop-action filming was employed to mimic and caricature the ultra smooth transitional flow of the computer's electronic output.
Adding to the random activity of the visuals was a haphazard soundtrack recording produced especially for this sequence on a "Kroog" keyboard synthesizer available in the Audio Lab of the Film and Video department. Far from being musical in nature, the accompaniment consisted of extremely high pitched notes that resemble squeaking noises when played. (Note: The period of my acquaintance with this highly sophisticated and specialized piece of sound equipment was unusually brief – about one hour.) The segment lasts less than 20 seconds on screen and the impression is meant to be chaotic and disjointed as the acetate squares attempt to coordinate their alignment in the same manner as their computer-generated counterparts.

The Soundtrack

For the audio portion of the film I collected literary excerpts of wit, wisdom, and analysis on the state of the human condition from newspapers, magazines, books, and talk shows! It was only after beginning the actual tests for the soundtrack that it became apparent how vital and integral the audio would be to the success of the piece. Being primarily a visual artist, I was soon aware of how ill prepared I was for the technical complexities of audio dubbing and mixing. Having previously edited voice-over scripts (See APPENDIX C for all dialogue) and chosen acting personnel, and since I was somewhat familiar with technical concepts of audio recording (like input, channel, gain, even dB), I opted for readily available amateur tools and low-tech equipment to begin the trial and error process of assembling the soundtrack.

The ease with which the original recording of characters voices proceeded was deceptive, since much of the initial tapping was done
on location, more for simplicity than for any sense of realism, and required only an omnidirectional microphone and cassette deck. In transferring these out-takes onto a work track during later editing, I became aware of the inherent problems with the reproduction of sound that is several generations removed from the original. Due to the hiss, rumble, and hum of equipment and background noise, I was forced to resort to last minute, quick'n'dirty vocals for the bulk of the film's dialogue, with the Master track requiring continual revisions, adaptations, and substitutions.

Audio Mixing

For re-recording and editing the audio track I utilized the resources of the Film and Video Department of the School of Photographic Arts and Sciences. Upon gaining access to the Audio Lab, which features a professional recording booth, I was quickly tutored as to how to patch various inputs to the audio mixing soundboard in order to allow over-dubbing from either (a) a cassette of previously recorded dialogue and conversation, (b) a cassette of previously recorded music, (c) acting personnel located in the sound booth, or (d) the Kroog keyboard synthesizer. Even with the array of professional equipment at my disposal, the process of assembling main characters voices, dialogue, sound effects, and incidental or background music proved unexpectedly arduous.

The use of natural, musical, or artificial sound to emphasize and reinforce the animated image relies on timing of audio cues and synchronization of the sound. Since this was an attempt at so-called 'real time' synchronization of separate audio tracks with a single
visual track, timing problems became the focus of the recording sessions. The final clarity and quality of the soundtrack was eventually sacrificed due to the short schedule allotted for re-recording and remixing of the audio portion of the film.

Upon finishing a (very) rough version of the Master track, I was suddenly overcome with a nagging suspicion of impending crisis! The combined components of the film produced a work with a running time of almost 10 minutes on the screen, long enough for timing errors to become not only evident, but grossly obvious. The variety of tools and equipment used in the editing phase of the soundtrack were very different in both feature and function (i.e. low-tech) from the state-of-the-art optical projector I was scheduled to use for the public screenings. After voicing my concern over equipment compatibility to my thesis board chairman, Erik responded:

"... I think you can take that (incompatibility of equipment) out of the realm of probability and put it in the realm of certainty!"

Projection - The Public Screenings

Having used an assortment of amateur and professional 16mm projectors to preview the animation and edit the audio track, it became necessary to experiment with different projector/sound equipment combinations during the week of public screenings in hopes of providing film continuity. The premier showing was disastrous, as the soundtrack lagged a full 7 seconds behind the visuals. For the second day of viewing, I laid several hundred feet of speaker wire from the Audio Lab to Screening Room A, hoping if the soundtrack was run on the deck used during recording that the playback would be more
synchronized. The lag time was considerably reduced, to 1 or 2 seconds, but not eliminated.

Needing still more control over the presentation, I abandoned the sophisticated Kodak Pageant optical projector in favor of a silent, manually regulated Kodak Analyst which allows projection speeds from 5 to 24 fps, plus reverse. In order to monitor the soundtrack from inside the projection booth, the volume of the soundtrack was set high (read 'loud') in order to provide audio cues as I manipulated the film's projection speed control to 'catch up' or 'wait' for visual segments to unfold. This labor intensive, if user friendly, arrangement proved remarkably suited to my needs for a simultaneous projection/playback system and became the standard presentation set-up for the remainder of the screenings. I became rather adept at anticipating projection speed variations, and the final two days of viewing went very smoothly as I ran the film on an Analyst from the rear of the Screening Room, not the projection booth, with the audio track feeding through the main speakers, not running from the Audio Lab next door.

(Note: The preview of the film drew crowds of 8 or 10 people each day and ran for a full week. The most appreciative crowd, however, proved to be a group of women who played recreational basketball with my housemate. Their private screening, which occurred spontaneously at a 'victory party' which was held in my living room, solicited the most unqualified praise and acclaim, and made it all seem somehow worthwhile!)

**Thesis Sharing**

Unable to reserve Screening Room A for a viewing and discussion
of the film, the Thesis Sharing was held in the Graduate Seminar Room. With my chairman and fellow graduate students in attendance, I stood ready to voluntarily admit my failure to understand or predict the enormous amount of time, energy, and resources necessary for an undertaking of this kind. But this aspect of the work proved superfluous to the conversation. That I had chosen to attempt such an exotic project at all seemed to placate even the harshest of the critics present. Several did express concern, however, over my commitment to bromide-based photography and wondered whether I had sufficiently utilized the resources of the MFA Program, with its emphasis on traditional still photographic technology.

Of pressing concern to several viewers was, as expected, the quality of the soundtrack. After struggling so hard to provide as clear and audible a soundtrack as possible by re-recording and mixing to reduce hiss and background hum, it was that very attribute that was at the heart of the criticism. One respondent even went so far as to quip, "It sounded like it was recorded in a sound booth", which of course it was! Obviously I had failed to detect the inherent simplicity and naturalness of the location recording, deeming it too 'rough' and sloppy for use when amplified during dubbing of the Master track. As it turned out, the re-mix came off too slick for this visually sophisticated crowd and I realized it was a classic case of being . . . "blinded by science" (i.e. technology)!

Some confusion also arose around the repeated use of the same actress, Ms. Neisel, to represent characterizations. Although in my directorial debut I wanted to differentiate emotional and imaginary states, the audience saw a recurring character engaged in distinct activities paired with interpretive anecdotes. Even though my intention had been to present discreet segments, or vignettes, the major-
ity of this cross-section of viewers felt it to be a continuing saga. This perception was so prevalent that the ending sequence of 'dancing squares' and computer-generated visuals stood in stark contrast to the preceding scenes. The point was well taken, and the discussion proved to be the most valuable criticism of the project as a whole.

**Conclusion**

The inspiration for this project came from many sources, including my affinity toward cinematography, a fascination with video personalities, questions about capacities for communication, and normal artistic ego gratification. The appeal of the process of animation lead me to choose 'graphic film' as my vehicle for expression and the attraction of exercising complete control over all aspects of the production prompted me to assume the role of 'independent filmmaker'. The driving impetus of this thesis project, however, was the incentive I felt for working in a new medium whose hallmark was self-paced exploration and experimentation. The last thing I wanted to do was yet another series of hand-colored or selectively-toned prints like the work that already filled my portfolio.

As the project proceeded, the magnitude of creating a single-frame film became painfully clear. I realized I was ill prepared for a task requiring major expenditures of time, large amounts of concentrated energy, and substantial capital investment. My student work-study wages, which already supported a bohemian, poverty-level lifestyle, were reapportioned again to include materials and lab costs for film production. The time constraint, however, was the main obstacle to professional quality work, as the project competed with
not only the remainder of the course work required for completion of my degree, but with my graduate fellowship duties in the RIT Photo Gallery, where I served as Exhibition Coordinator.

My biggest misconception was that the sophistication of the technology would compensate for inexperience with the process. While conceived as an entity, the film was actually treated, rendered, and recorded in isolated segments. An introductory period was necessary in order to become acquainted with each new piece of equipment used, whether it was microphones and projectors, editing equipment, audio tracking and mixing units, soundboard patch cords, etc. This initial phase was kept brief, but its necessity at each stage of the production process induced me to seek the path(s) of least resistance. No significant interval was set aside for comparison viewing of either shooting style or theme treatment, and with the filming schedule reduced to only several weeks, reshoots were virtually eliminated unless crucial to the story.

Filmmaking is uniquely designed to deal with the unknown relation: between things through the metaphorical process of using images to suggest and represent ideological thought. Animation, however, excels at presenting personal stories or ethereal ideas, especially when the characters or locations are based in fantasy. In this thesis film, actors, characterizations, portrayals, and metaphorical symbols were employed to reveal the connotations of entering the "imagination zone." Comparisons and contradictions were presented and illustrated in melodramatic style by tapping the emotional elements of communication devices that dominate interpersonal discourse. But the pervasive impressions of communication icons and television-molded symbols were a favorite imaging motif even before the idea of a theme revolving around imagination arose.
The imagined world and the real world are based on an equivalent premise - that the fact of each is only known through perception. What we perceive is more interesting when it is related to another perceiver, making that interaction more real and important than the perception being related. All perceptions really act and are acted upon according to a latent structure which usually results in a regrouping and/or subsequent redistribution of power and control. Such psycho-political concepts are difficult to represent visually, and were implied rather than articulated in the film. This sense of disparagement was symbolized through the use of nostalgic design elements (the '50's imagery), with its companion connotation of the persistence of misinformation as a guiding force in interpersonal relationships, communication, and perception.

The main regrets I have about this project are tied to the obvious limitations of time and resources necessary to produce a single-frame film of any consequence. Normally, animated films require a team effort, with select individuals gathered for particular tasks according to their expertise in a specific filmmaking area. This procedure, however, is antithetical to the creation of independent animation by visual artists who, like myself, approach the medium as a uniquely expressive format for the presentation of aesthetic ideas. Unable to truly hone my animation skills with this project, the piece nevertheless allowed me to cut my filmmaking teeth and convinced me that the variety of photo-sensitive imaging methods available to visual artists requires a multi-faceted approach. The confidence gained by merely surviving the task of meeting an artificially imposed deadline for the submission of a creative work should hopefully serve me in other professional applications.

I would like to thank my thesis board for their support and
guidance throughout the production of the film. My deep appreciation goes to Erik Timmerman for his nuts and bolts advice on all technical procedures and processes, to Martha Leinroth for her storyline suggestions, and to Edward Kinney for his faithful cheerleading. I would also like to acknowledge the assistance and patience of the staff of the Film and Video Department, and especially Russ Lunn and all the crew at the equipment cage. Their help and understanding was invaluable for the completion of this project and is indicative of their professional attitude and approach toward frenzied and exasperated students in need of access to SPAS facilities. Finally, I would like to thank my fellow graduate students for their sustained interest and often unspoken support which served as an incentive to pursue the idea and attempt the project in the first place.
Glossary of Animation Terms

**Animation**: A general term that describes a range of frame-by-frame filmmaking techniques in which the illusion of motion is created rather than recorded. Derived from the Latin "anima", meaning "life" or "soul".

**Animation Camera**: A motion picture camera with single frame and reverse capabilities for animation work.

**Animator**: An artist who uses the techniques of frame-by-frame filmmaking to give artwork the illusion of movement. (Independent Animator implies the animator is generally responsible for all phases of production, not just artwork.)

**Compound**: The flat, moveable bed of an animation stand on which artwork is positioned before it is photographed.

**Crane**: The versatile and flexible, usually heavy steel mounting that supports the animation camera over the animation compound.

**Computer Animation**: The use of a computer to direct and generate a video image based on preprogrammed commands.

**Cut**: 1) A direct or immediate transition from one scene to the next; 2) in editing, the splicing of footage together.

**Cycles**: A series of images that are photographed over and over again to simulate continuous motion; first and last images must logically move into each other to create repetitive action.

**Dialogue**: The portion of the soundtrack that is recorded as if it were spoken by characters in the film.

**Dissolve**: An animation camera filming technique in which one scene gradually fades out as another simultaneously fades in to replace it.

**Edit**: Arranging the various shots, scenes, and sequences, or the elements of the soundtrack in the desired order.

**Exposure Sheet**: The frame-by-frame instructions for the operation of the animation camera during the filming of the artwork.

**Fade**: An animation filming technique in which the image gradually disappears to black (fade-out), or gradually appears on the screen (fade-in).

**Field**: The area that will be photographed by the camera for a given shot and the area in which the image is bordered. Largest field in standard use is Field-12 (measuring 9"x12") and the smallest is Field-4 (3"x4").

**Field Guide**: A punched sheet of heavy acetate printed with the standard field sizes; when placed over artwork it indicates the area where the camera is to photograph the action.

**Footage**: A method of calculating film length and, consequently, screen time. (1 foot is approximately 80 frames of 16mm film).

**Frame**: An individual photograph on a strip of film, seen only 1/24th of a second on screen.

**Frame-By-Frame**: Filming in which each frame is exposed individually. In animation, the subject of the filming is altered in some way between exposures in order to create the illusion of motion.

**Frame Counter**: A digital counter calibrated to an animation camera in order to automatically record the exposure of each frame.

**Hold**: To stop or halt the movement of an animation subject by filming a particular image or drawing for several frames in succession.
Interlock: A post-production system that electronically links a film projector with an audio recorder in order to view the composite, edited film and soundtrack for synchronization.

Key Image: An image or drawing that shows the most indicative or emotive pose or stance of the subject within the context of a sequence.

Limited Animation: Describes the use of key poses only to illustrate essential motion.

Magnetic Soundtrack: Describes the transfer of the audio track from 1/4" audio tape to magnetic film stock for synchronization.

Mix: The combination of various audio tracks, such as dialogue, music or sound effects, etc., into a single, comprehensive soundtrack.

Ones, Twos, Threes: Refers to the number of frames each image or drawing is held during filming.

Pan: A camera move simulated by movement of the compound bed beneath a stationary camera either horizontally or vertically, used to scan a scene or follow action.

Pantograph: A pointer positioned over a field guide located directly to one side of the compound bed which indicates the position of the artwork as it lies beneath the camera, or as the bed is panned in any direction.

Pegs: Registration pins fixed to calibrated, moveable peg bars that hold artwork during filming, and corresponding to punched holes in artwork for exact positioning.

Peg Board: A heavy sheet of frosted plexiglass, somewhat bigger than a field guide, equipped with a standard peg system for punched artwork or animation cels; used over a light source to aid in registration.

Punch: An animation punch provides the holes for use on the corresponding peg bars; punched artwork and acetate animation cels are secured to pegs for registration during filming.

Punched Header Strips: Detachable strips of bonded paper punched with peg holes that can be adhered to flat artwork to assist in registration.

Platen: A heavy glass cover used to hold artwork flat and in position on the compound bed.

Registration: Alignment of sequential artwork in relation to one another, made possible by the peg system.

Soundtrack: The audio portion of an animated film, consisting of dialogue, voice-overs, sound effects, and music.

Truck In/Out: An animation camera move in which it seems to move toward or away from, respectively, the scene or subject. Also referred to as a zoom effect.
Glossary for Computer Animation

**Command:** When a computer system user enters a request of the computer to perform some function it is in the form of a command, usually typed in on the computer console keyboard.

**CRT:** A term used to designate computer monitors and terminals that display images by means of a Cathode Ray Tube (a.k.a. television "picture tube").

**Cursor:** A marker that appears on the screen of the CRT monitor to inform the user where the next character or graphic entry will be placed.

**Data:** Information provided to a program, either in numerical values, character information, status data, or program modes.

**Edit/Or:** Programs that allow the user to write or modify programs or text.

**File:** A block of information that is organized in a specific, often unique, manner. Files are used to store information.

**Hardcopy:** Produced when a terminal's output is printed on paper.

**Input:** Information typed into a computer system to be used later to perform functions or other types of operations.

**Interactive:** Implies a step-by-step process of computer questions and responses performed for system use.

**Keyboard:** Used at a computer terminal to type in data, functions, and commands for system use.

**Monitor:** A CRT designed for computer information and graphic display.

**Pixel:** A single point on a computer screen that can be identified by an X coordinate and a Y coordinate.

**Terminal:** A computer console that allows user access to input and output of a computer system.

**Vax:** "Virtual Address eXTension", refers to the mainframe computer system in use at Rochester Institute of Technology.
APPENDIX D

Voice- Overs and Dialogue

1. Excerpts from . . . "remote control broadcast" sequence*

". . . when eighteen Air Force F-111's, authorized by the White House and on the advice of the National Security Council, attempted to culminate a 5-year clandestine effort by the Reagan Administration to force the removal or elimination of the leader of Libya, who the President referred to as the 'mad dog of . . .'"

- The New York Times

". . . discovered that the Defense Department had created the Advanced Research Projects Agency and announced the Strategic Computing Program in order to renew budget requests for more than $300 million already spent on the project as previously authorized under the National Security Advisory Council's head as presented by the senior member of the Office of the Chiefs of Staff and the Under-Secretary of the . . ."

- TIME Magazine

". . . the creation of the possibility of artificial intelligence, desperately needed by President Reagan's Strategic Defence Initiative (the so-called 'Star Wars' program) which will require the instantaneous recognition, tracking, and ultimate destruction of enemy nuclear warheads by a myriad of artificially controlled spaced-based weapons from an unmanned command center on the . . ."

- Newsweek

". . . in tests on sites at Martin Marietta, a major military contractor, the Environmental Protection Agency found trichloroethylene in amounts of 300,000 parts per billion of water, in excess of the agency's regulations of 5 parts per billion which is considered a maximum safe level for this toxin as found in drinking water . . ."

- TIME Magazine

* Male broadcast voice-over actor was Mitch Moxley.
APPENDIX D

2. Excerpts from . . . "50's male cut-out broadcast" sequence

"... the concept, debated in female intellectual circles for almost a century, took the form in the 60's and 70's as a revolutionary idea - that the art of women needed to be created and judged by different standards than the art of men and . . ."
- The New York Times Book Review

". . . the dilemma of the female artist is that she is used to making certain assumptions based on male models, and these assumptions may not only be inappropriate, they may also be antithetical to her artistic existence . . ."
- Art Forum

". . . efforts to eliminate the economic gulf between male and female artist's - who remain disadvantaged even though working in a political system that has, legally, claimed to be gender-blind for little over a generation, have been . . ."
- The New York Times Book Review

". . . a woman artist may need to be estranged somehow from the dominant artistic culture, and in turn, be never truly 'successful' in any sense that has significance in critical circles dominated by male orators, curators, . . ."
- The New York Times Book Review

". . . has proved less than satisfying for a majority of major women artists who still lag far behind their male counterparts as recipients of grants and fellowships . . ."
- The Boston Globe
APPENDIX D

3. Excerpts from . . . "telephone conversation" sequence

". . . is this Murray's Bar'n'Grill . . . (laughs) . . . how the hell are you . . . it's been so long I've almost forgotten what you look like . . . how was your trip . . . and your new job at . . ."

(spooken by "photo-real" figure into phone)

". . . I've been wanting to talk to you . . I've thought a lot lately about you and I . . . remember my fortune said to 'guard your heart and obey your head' . . . well, I've had to decide to . . ."

(spooken by "xerox-styled" figure)

". . . I can't believe how much I've really missed you since you walked out of my life . . . I'm thinking about the two of us . . . going over and over in my mind all the things we said to each other . . ."

(spooken by "line-drawn" figure)

". . . well, it's been nice to hear your voice again . . we'll have to get together next time . . . yeah, just give me a call when . . . I can be hard to get a hold of sometimes, but if you leave a message on my machine . . ."

(spooken by "photo-real" figure, again)
APPENDIX E

Computer Animation Sequence

ROTATE CENTER X, -80 FRAME 1,25
ROTATE LEFT X, -80 FRAME 1,50
ROTATE RIGHT X, -80 FRAME 1,50

MOVE LEFT 7000,5000,5000 FRAME 51,100
MOVE RIGHT 3000,5000,5000 FRAME 51,100
MOVE LEFT 3000,5000,5000 FRAME 101,150
MOVE RIGHT 7000,5000,5000 FRAME 101,150

MOVE LEFT 7000,5000,5000 FRAME 151,250
ROTATE LEFT Y, 3600 FRAME 151,250
MOVE RIGHT 3000,5000,5000 FRAME 151,250
ROTATE RIGHT Y, 3600 FRAME 151,250

MOVE LEFT 7000,5000,5000 FRAME 251,350
ROTATE LEFT Y, 3600 FRAME 251,350
MOVE RIGHT 7000,5000,5000 FRAME 251,350
ROTATE RIGHT Y, 3600 FRAME 251,350

MOVE LEFT 7000,5000,5000 FRAME 351,450
ROTATE LEFT Y, 3600 FRAME 351,450
MOVE RIGHT 7000,5000,5000 FRAME 351,450
ROTATE RIGHT Y, 3600 FRAME 351,450

MOVE LEFT 3000,5000,5000 FRAME 451,550
ROTATE LEFT Y, 3600 FRAME 451,550
MOVE RIGHT 7000,5000,5000 FRAME 451,550
ROTATE RIGHT Y, 3600 FRAME 451,550

MOVE LEFT 7000,5000,5000 FRAME 551,650
ROTATE LEFT Z, 3600 FRAME 551,650
MOVE RIGHT 3000,5000,5000 FRAME 551,650
ROTATE RIGHT Z, 3600 FRAME 551,650

MOVE LEFT 3000,5000,5000 FRAME 651,750
ROTATE LEFT Z, 3600 FRAME 651,750
MOVE RIGHT 7000,5000,5000 FRAME 651,750
ROTATE RIGHT Z, 3600 FRAME 651,750

MOVE LEFT 5000,5000,5000 FRAME 751,800
SCALE LEFT .25 FRAME 751,800
MOVE RIGHT 5000,5000,5000 FRAME 751,800
SCALE RIGHT .25 FRAME 751,800

MOVE LEFT 7000,5000,5000 FRAME 801,850
SCALE LEFT 4 FRAME 801,850
MOVE RIGHT 3000,5000,5000 FRAME 801,850
SCALE RIGHT 4 FRAME 801,850

MOVE LEFT 5000,5000,5000 FRAME 851,900
SCALE LEFT .25 FRAME 851,900
MOVE RIGHT 5000,5000,5000 FRAME 851,900
SCALE RIGHT .25 FRAME 851,900

MOVE LEFT 3000,5000,5000 FRAME 901,950
SCALE LEFT 4 FRAME 901,950
MOVE RIGHT 7000,5000,5000 FRAME 901,950
SCALE RIGHT 4 FRAME 901,950

MOVE LEFT 7000,5000,5000 FRAME 951,100
ROTATE LEFT Y, 3600 FRAME 951,100
MOVE RIGHT 3000,5000,5000 FRAME 951,100
ROTATE RIGHT Y, 3600 FRAME 951,100

MOVE LEFT 3000,5000,5000 FRAME 101,1250
ROTATE LEFT Y, 3600 FRAME 101,1250
MOVE RIGHT 3000,5000,5000 FRAME 101,1250
ROTATE RIGHT Y, 3600 FRAME 101,1250

MOVE LEFT 3000,5000,5000 FRAME 1101,1250
ROTATE LEFT Y, 3600 FRAME 1101,1250
MOVE RIGHT 3000,5000,5000 FRAME 1101,1250
ROTATE RIGHT Y, 3600 FRAME 1101,1250

MOVE LEFT 7000,5000,5000 FRAME 1251,1400
ROTATE LEFT Y, 3600 FRAME 1251,1400
MOVE RIGHT 7000,5000,5000 FRAME 1251,1400
ROTATE RIGHT Y, 3600 FRAME 1251,1400

MOVE LEFT 3000,5000,5000 FRAME 1401,1550
ROTATE LEFT Y, 3600 FRAME 1401,1550
MOVE RIGHT 3000,5000,5000 FRAME 1401,1550
ROTATE RIGHT Y, 3600 FRAME 1401,1550

MOVE LEFT 7000,5000,5000 FRAME 1551,1700
ROTATE LEFT Y, 3600 FRAME 1551,1700
MOVE RIGHT 3000,5000,5000 FRAME 1551,1700
ROTATE RIGHT Y, 3600 FRAME 1551,1700

MOVE LEFT 7000,5000,5000 FRAME 1701,1850
ROTATE LEFT Y, 3600 FRAME 1701,1850
MOVE RIGHT 3000,5000,5000 FRAME 1701,1850
ROTATE RIGHT Y, 3600 FRAME 1701,1850

MOVE LEFT 3000,5000,5000 FRAME 1851,2000
ROTATE LEFT Y, 3600 FRAME 1851,2000
MOVE RIGHT 3000,5000,5000 FRAME 1851,2000
ROTATE RIGHT Y, 3600 FRAME 1851,2000

MOVE LEFT 3000,5000,5000 FRAME 2001,2150
ROTATE LEFT Y, 3600 FRAME 2001,2150
MOVE RIGHT 7000,5000,5000 FRAME 2001,2150
ROTATE RIGHT Y, 3600 FRAME 2001,2150
MOVE LA 7000,5000,5000 FRAME 2151,2300
ROTATE LA X, 360 FRAME 2151,2300
MOVE RB 3000,5000,5000 FRAME 2151,2300
ROTATE RB X, 360 FRAME 2151,2300

MOVE LB 7000,5000,5000 FRAME 2301,2450
ROTATE LB X, 360 FRAME 2301,2450
MOVE RA 3000,5000,5000 FRAME 2301,2450
ROTATE RA X, 360 FRAME 2301,2450

MOVE LA 3000,5000,5000 FRAME 2451,2600
ROTATE LA X, 360 FRAME 2451,2600
MOVE RB 7000,5000,5000 FRAME 2451,2600
ROTATE RB X, 360 FRAME 2451,2600

MOVE LB 3000,5000,5000 FRAME 2601,2750
ROTATE LB X, 360 FRAME 2601,2750

MOVE RA 7000,5000,5000 FRAME 2601,2750
ROTATE RA X, 360 FRAME 2601,2750

MOVE LA 3000,5000,5000 FRAME 2751,2900
ROTATE LA X, 360 FRAME 2751,2900
MOVE RB 3000,5000,5000 FRAME 2751,2900
ROTATE RB X, 360 FRAME 2751,2900

MOVE LB 7000,5000,5000 FRAME 2901,3050
ROTATE LB X, 360 FRAME 2901,3050
MOVE RA 3000,5000,5000 FRAME 2901,3050
ROTATE RA X, 360 FRAME 2901,3050

MOVE LA 3000,5000,5000 FRAME 3051,3200
ROTATE LA X, 360 FRAME 3051,3200
MOVE RB 7000,5000,5000 FRAME 3051,3200
ROTATE RB X, 360 FRAME 3051,3200

MOVE LB 3000,5000,5000 FRAME 3201,3350
ROTATE LB X, 360 FRAME 3201,3350
MOVE RA 7000,5000,5000 FRAME 3201,3350
ROTATE RA X, 360 FRAME 3201,3350
HOLD FRAME 3350,3450
APPENDIX F

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