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WITH PAUL KING AND THE RHYTHM SOCIETY ORCHESTRA:
DVD CREATION FROM CONCEPT TO EVALUATION

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Janice Catherine Miller

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SWING INTO DVD
WITH PAUL KING AND THE RHYTHM SOCIETY ORCHESTRA: DVD CREATION FROM CONCEPT TO EVALUATION

By

Janice Catherine Miller

A THESIS

Submitted to
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ABSTRACT

SWING INTO DVD
WITH PAUL KING AND THE RHYTHM SOCIETY ORCHESTRA:
DVD CREATION FROM CONCEPT TO EVALUATION

By

Janice Catherine Miller

The DVD medium is redefining the way consumers receive entertainment and information, transforming what was once passive viewing into a highly interactive user-defined custom experience. An original concert performance/instructional DVD title was developed to present a sample of the medium's versatility and to explore potential entertainment, instructional, and promotional applications. The creative thesis project entitled "Swing Into DVD" pushes the limits of the DVD specification, featuring multiple angles, different versions of the show, bonus features, and interactive dance instruction. This thesis study provides an in-depth overview of the production process involved in creating the disc, ultimately focusing on the diverse skills in audio, video, and computer programming required to create a viable DVD title. Through an evaluation process based on survey results, "Swing Into DVD" is considered successful as an entertaining instructional tool used for the promotion of swing music.

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To my doppelganger, Matt "the Hatt" Schuster
Five is the magic number.

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I want to thank the members of the Rhythm Society Orchestra, the phenomenal dancers, and my production crew for graciously giving of their time and talent in order to make "Swing Into DVD" a success.

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INTRODUCTION

The DVD format is an extremely powerful and diverse multimedia-publishing medium. Resulting from the convergence of audio, video, and computer technologies, it is revolutionizing the way consumers receive entertainment and information. DVD offers a high standard of broadcast quality video that outshines VHS or Laser Disc, and is capable of delivering impeccable audio in "theatre-like" 5.1 Dolby Digital Surround Sound. This digital medium bridges the transition from analog television to digital television and moves from passive entertainment to active entertainment. Its multiple levels of interactivity push DVD far ahead of its archaic counterparts, enabling movies to have chapter stops, menu pages, multiple angles, and a myriad of other user intensive features. The success of DVD draws on its ability to reach beyond the constraints of linear tape and expand these capabilities to create a unique user-defined viewing experience.

To explore the versatility of the DVD medium, an interactive disc entitled "Swing Into DVD with Paul King and the Rhythm Society Orchestra" was developed as part of this creative thesis project. The DVD features a 16-piece big band swing orchestra performing in a theatre venue surrounded by swing dancers on stage. "Swing Into DVD" offers different versions of the stage show, multiple angles, bonus features, and an instructional component featuring various styles of interactive swing dance instruction. The chapters that follow describe the production process involved in creating the disc, highlighting specific skills in audio, video, and DVD programming. "Swing Into DVD" evolved over a span of two years, as the required elements were produced and assembled

in stages along the way. It is important to note that for most projects of this scope, several company departments are responsible for each separate phase. This DVD is a unique case by its very nature as a thesis project, as all stages of the production process were implemented by the author. For non-commercial use and supplemental viewing of the DVD, contact the author at mille143@msu.edu for an on-loan copy. In accordance with the Fair-Use Statute (United States Code, Title 17, Section 107), the material presented on "Swing Into DVD" is not an infringement of copyright as per the Harry Fox Agency Client Services Department, based on research and educational usage.

This study in DVD creation begins with a brief tour of the history and development of the DVD Specification and continues on to detail the concept and design of "Swing Into DVD." The production components are broken down into audio production, video production, and DVD creation. The audio production chapter covers recording the orchestra in the studio, postproduction, and mixing for stereo and surround. The chapter on video production details the one-day shoot of the band and dancers live on stage, the dance instructional shoot, nonlinear editing, and postproduction. DVD creation is tackled in the chapter following, and includes the creation of assets, compression and encoding, DVD authoring and programming, and the final step of formatting the disc for playback. Furthermore, the last chapter explores the potential success of "Swing Into DVD" as a commercial title. The analysis draws on survey feedback collected from a group of media professionals, avid dancers, and lay people. The DVD is evaluated based on the lessons learned during the production process along with the questionnaire responses.

Ultimately, the research focuses on the diverse skills and the in-depth production processes required to create a viable DVD title. Broadcasters, digital satellite providers, and the Internet tend to use up the extra space provided for by digital compression to deliver large quantities of low quality material rather than focusing on specialized content of higher quality.

> In contrast, most DVDs are created by people who care passionately about the video experience—people who spend months cleaning up video frame by frame, restoring and remixing audio, reassembling director's cut versions, recording commentaries, researching outtakes and extras, and providing a richness and depth of content seldom seen in other media. DVD is not the ultimate in video quality, but it is the standard bearer for consumer entertainment (Taylor, 2001, p.2).

CHAPTER ONE:
History and Development of the DVD Spec

DVD History in Brief

The evolutionary path of today's multimedia colossus began when DVD burst upon the technological scene in 1996. It was born of two competing optical disc technologies headed by Sony and Toshiba. Fearing a potential format war, a group of ten consumer electronics companies created the DVD Forum, with the goal of establishing worldwide acceptance of DVD products. Original members of the DVD Forum included Hitachi, Matsushita Electric Industrial Co. Ltd. (Panasonic), Mitsubishi Electric Corporation, Philips Electronics, Pioneer Electronics, Sony Corporation, Thomson Multimedia, Time Warner, Toshiba Corporation, and Victor Company of Japan (LaBarge, 2001, p.3). Today the Forum boasts over 200 members, drawing from a wide range of companies offering a diverse number of DVD related products and services.

In 1996 the DVD Forum agreed upon a single unified set of technological specifications for each DVD format. Five "books" were written declaring the technical attributes of the first formats, that number having since been added to in recent years. The original five formats were DVD-ROM, DVD-Video, DVD-Audio, DVD-R, and DVD-RAM. For a format to be considered official, it must undergo a formal submission and review process to be approved by a vote of DVD Forum member companies. Formats added in recent years include DVD-RW, DVD-Video Recording, and DVD Stream Recording. Offering advanced interactive content, WebDVD is currently questing for Forum approval. This format, if approved, will be able to include links

between content stored on DVD-Video titles and content available on the web (LaBarge, 2001, p.7).

DVD's early years were plagued by unresolved copyright issues, causing many Hollywood studios to withhold publishing their content on the new medium. In November of 1996, a consortium of representatives from the motion picture, software, computer, and consumer electronics industries finally agreed upon a standard of analog and digital copy protection methods. DVD-Video is protected from analog copying to a VCR using the Macrovision System for NTSC models in the United States. This system of protection causes picture distortion and alternating light and dark waves affecting the screen, rendering the recorded image unsuitable for viewing. Digital copy protection utilizes the Content Scramble System (CSS) which is encryption applied during the DVD mastering process (Town, 1997, p.7). As an added copy protection feature, most DVDs are region-coded since most titles are released for a specific country. Six regional codes lock out hardware for regional release of movies, making it impossible to play the same disc in different countries. The six regions used for DVD-Video coding are: Region 1 – United States and Canada; Region 2 – Europe, Japan, Middle East, South Africa; Region 3 – Southeast Asia and Taiwan; Region 4 – Australia, New Zealand, Central and South America, Mexico; Region 5 – Russia, India, Pakistan, part of Africa; and Region 6 – China (Khurshudov, 2001, p.195). Only licensed DVD players of the correct regional code can play the designated DVD title. Region coding attempts to thwart the bootlegging efforts of other countries outside of the release area trying to sell commercial DVD titles at a fraction of their intended prices. For example, a bootleg DVD bought in

Japan will not play on a DVD player purchased in the United States; therefore it becomes pointless to buy DVDs in other countries outside of the specified region code.

After the copy protection standards were in place, the first DVD-Video players were released for public sale in Japan at the end of 1996. Following close behind, the U.S. market saw its first release launched during early 1997. Unfortunately, the high cost of consumer DVD-Video players coupled with the limited number of DVD movie titles caused sales to fall short of early projections. To add to the trouble, several major studios did not support the format, including Disney, Fox, and Paramount. They feared the possibility of DVD going the way of Laser Disc and becoming a "niche market only" format. However, by the end of 1998, all of the major motion picture studios had agreed to release their film titles on DVD, along with numerous smaller studios and independent distributors (LaBarge, 2001, p.4). The future of the DVD format was looking brighter with broader support.

In 1999, DVD had finally come into its own. By the year's end DVD had become "the fastest growing consumer electronics product ever" (LaBarge, 2001, p.5). In the U.S. market alone, over four million DVD-Video players were sold, with nearly four thousand DVD-Video titles available to choose from. 1999 also saw the collapse of DIVX, Circuit City's proprietary pay-per-view version of DVD. DIVX allowed consumers to purchase cheap DVDs at video rental prices and pay fees to "unlock" the discs for unlimited viewing during a 48-hour period. Due to stockholder and consumer pressure combined with a general dislike for certain technical aspects, DIVX was abandoned after a yearlong struggle for consumer acceptance (Taylor, 2001, p.66).

The year 2000 saw the growth of DVD's success as a format with over eight million new DVD-Video players sold in the U.S. market and more than eight thousand DVD titles available for purchase (LaBarge, 2001, p.5). DVD also found a home outside of the movie industry, becoming a mainstream technology for corporate, educational, and government applications. DVD-Video players were available for under $100, and DVD-ROM drives became a standard option on personal computers. 2001 ushered in even more advancements to bolster the widespread adoption of the DVD format, including the introduction of DVD-Audio and further developments bringing consumers one step closer to being able to record their own content onto DVD discs. It appears very likely that DVD will continue on its upward path towards possibly becoming the dominant media technology of the new millennium.

Technological Specifications

According to Jim Taylor, author of DVD Demystified, "DVD is not a revolution. DVD is just an evolution. It's the next generation of compact disc technology" (Serra, 2000, "DVD and Convergence"). DVD is an optical storage medium for read-only, recordable, and rewritable applications. It shares many similarities with CD technology, yet is much more sophisticated. DVD is close to CD in physical characteristic, with both discs sharing the same size and diameter, yet differing across several key features. The size and spacing of the pits on a DVD are much smaller and closer together than those on a CD, allowing for much more information to be recorded. The pit length and track spacing are both reduced such that a DVD contains about four times as many pits as a CD in the same area (Town, 1997, p.5). DVD uses specialized lasers sporting shorter

wavelengths than conventional CD-ROM devices. The shorter wavelength of the laser allows the pits and lands on a DVD to be much smaller and closer together, thus increasing the storage capacity by over seven hundred percent as compared to traditional CD-ROM media (Sturgill, 2001, "Types of DVD"). The laser bounces light off the DVD to read the information contained on it, never actually touching the surface of the disc. Therefore, a DVD will never wear out from multiple viewings. It can only degrade from handling.

DVD Configurations

DVD is the first optical disc able to read two layers of data on the same side, whereas CD can only access one layer on a single side. A DVD disc is constructed of two 0.6mm discs bonded together, allowing for data to be contained on one or both sides. DVD boasts both single-layer/dual-layer functionality and single-sided/double-sided options. The DVD player can focus on the second layer of data, or it can "look through" the second layer to read the first layer of data on a dual-layer disc. This semitransmissive material used on most dual-layer DVD discs is actually gold (LaBarge, 2001, p.11). Because of this dual-layer capability, it is possible to fit four hours of broadcast quality video on one dual-layer DVD. Broadcast quality standards can be roughly equal to 720x480 pixels per frame at 30 frames per second in NTSC, which is better than VHS or Laser Disc (Town, 1997, p.6). As a general rule of thumb, 120 minutes of broadcast quality video can fit on one layer of one side of a DVD disc. With video on both sides, eight hours of video can fit on one double-sided dual-layer DVD. The data on the first

layer starts at the inside of the disc and ends at the outside, while the data on the second layer starts at the outside, providing uninterrupted playback (Khurshudov, 2001, p.194).

There are several different configurations of these data layers, each designed to provide additional storage capacity, as shown in Figure 1.

Name	**Media Structure**	**Capacity (GB)**
DVD-5	Single side/Single layer	4.7
DVD-9	Single side/Dual layer	8.54
DVD-10	Double side/Single layer	9.4
DVD-18	Double side/Dual layer	17.08
DVD-R	Single or Double side/Single layer	3.95/7.9
DVD-RAM	Single or Double side/Single layer	2.6/5.2

Figure 1. DVD Format Configurations (Khurshudov, 2001, p.190)

It is important to note that in the DVD Format books as defined by the DVD Forum, a Gigabyte is defined as one billion bytes, whereas a traditional computer Gb is actually 1,073,741,824 bytes (LaBarge, 2001, p.12), so the measurements differ significantly depending upon the system used. The disc capacities listed and discussed here reflect the Format book's definition of a gigabyte as one billion bytes.

Of these DVD types listed in the above table, only the DVD-5 can be burned in a conventional DVD-R drive or external burner. Since the DVD-5 has only one side and a single layer, it can be burned at home. All other DVDs with multiple layers or sides must be replicated and stamped out at a professional facility. The underside of any given DVD

disc reveals what type of media it is. A dual-layer DVD has a gold tint, while a single-layer disc appears silver. DVD-R discs that have been burned are more colorful, often purple in tint (Sturgill, 2001, "Types of DVD"). The majority of commercial titles available today are single-sided dual-layer DVD-9 discs.

DVD Formats

Just as CD-ROM and CD Audio are separate applications of the same technology, DVD can be used for both computer data storage and audio or video applications. A DVD-ROM drive functions to read computer data from a DVD-ROM disc, while a DVD player is more akin to a VCR or CD player, used to play back video and audio from a DVD. As computers become more sophisticated, this distinction begins to blur. But for now, there still remain the five major formats documented by the DVD Forum and mentioned at the beginning of this chapter: DVD-ROM, DVD-Video, DVD-Audio, DVD-R, DVD-RAM, and the newer sixth format of DVD-RW. DVD-R, DVD-ROM, DVD-Video, and DVD-Audio are recordable, but only able to be written to once. DVD-RW, DVD-RAM, and DVD+RW are rewritable DVD formats using essentially the same technology except that the disc is erasable and able to be used again (Serra, 2000, "Writable DVD").

DVD-ROM

DVD-ROM is mostly used for enhanced multimedia, computer games, interactive systems, and database applications. This format offers high capacity computer ROM storage and can replace multiple CDs, storing anywhere from 4.7Gb to 17Gb depending

on the number of layers and sides utilized on the disc. In addition to higher capacity, DVD-ROM provides higher throughput than CD-ROM technology. Across all DVD formats, the minimum throughput rate is at least nine times faster than conventional CD-ROM, with many capable of even higher transfer rates (LaBarge, 2001, p.10). DVD-ROM hybrid discs will play normally in a standard set-top player, but when inserted into a computer DVD-ROM drive the user's experience grows with the inclusion of links between synchronized computer content and video content.

DVD-R and DVD-RAM

DVD-R and DVD-RAM both offer direct access data storage. DVD-RAM must use DVD-RAM media, and can be thought of as similar in function to a Zip or Jaz drive, only much larger. In essence, DVD-RAM is a removable hard drive, the advantage being that any type of computer file can be stored on it. The current sizes offered in DVD-RAM are single-sided 2.6Gb or 4.7Gb, and double-sided 5.2Gb or 9.4Gb. However, it takes longer to copy files to a DVD-RAM drive because the data is written optically instead of magnetically (Ely & Block, 1998, p.4).

DVD-R comes in two types: General Media and Authoring Media. General Media can be recorded in any DVD-R drive and is only available in the 4.7Gb capacity. Authoring Media can only be recorded in the Pioneer S201 drive and is available in either 3.95Gb or 4.7Gb sizes. The two variations arose because an encrypted DVD cannot be copied on a General Media disc. These two types of DVD-R discs are not interchangeable in terms of writing, but are nearly identical from a playback standpoint. Both kinds of media can play back equally well in most players and drives; however,

some set-top players and DVD drives will not play back General Media DVD-R discs. The older generation players that were designed before DVD-R became popular typically cannot even read the discs, while most newer DVD players will have no problem at all. DVD-R discs should be tested on several different model players in order to determine any playback compatibility issues (Sturgill, 2001, "Types of DVD").

DVD-Video

DVD-Video is mainly used for delivering high quality feature-length movies on one disc, with the enhancements of navigation menus, still pictures, seamless branching, subtitles, closed captioning, and even parental management control. It provides quick random access to episodes or any chapter spot on the DVD without tedious rewinding, can be multi-lingual, and has copy protection built into the standard. The DVD-Video format supports up to nine different angles for switching between different camera perspectives, pieces of video, or versions of a particular scene. However, it is not universal, unlike a CD disc. Different versions of DVD-Video exist, including 4:3 aspect ratio and 16:9 widescreen format pictures, often found on the reverse side of the disc. NTSC (525 lines of resolution) and PAL (625 lines) versions appear in different countries. DVD-ROM applications may be universal across platforms, but DVD-Video is limited because it is played back on the medium of television. Local broadcast standards dictate the picture on the television, and the format must conform to the area in which it is played. DVD-Video supports normal, pan-scan, and letterbox formats for play on both standard and widescreen televisions (Khurshudov, 2001, p. 195).

DVD-Video supports up to eight tracks of mono, stereo, or multi-channel surround sound, which a VCR is not capable of delivering. The digital audio on a DVD can be played back in the chosen configuration on more sophisticated home theatre systems, but must be converted to an analog signal through input decoders on older, more traditional home components. Dolby Digital, also known as Dolby AC-3, is the format used for audio tracks on nearly all DVD discs. This multi-channel digital audio format was originally developed for the cinema, designed to envelop the audience with sound from the front and rear, drawing them into the film as if they were part of the movie. Dolby Digital consists of one to five channels with an optional sixth subwoofer channel (.1) for low-frequency effects (LFE) (Taylor, 2001, p.302).

DVD-Video is ideally suited for training applications as well. Instructional multimedia, defined as "applications designed to target specific learning objectives," is heralded in training environments because of its ability to combine the interactive elements of computer-based training with the benefits of high quality audio and video (Barron & Orwig, 1995, p.3). This is precisely the area where DVD reigns supreme. Training programs delivered on CD-ROM or via the Internet may contain extraordinary content, yet their audio and video quality flounder at best. DVD offers broadcast quality video and audio for effective instructional use, and is cheaper to produce, store, and distribute than videotape (Taylor, 2001, p.8). Lessons can be enhanced with the use of menus, multiple language soundtracks, additional angles, and other advanced interactive capabilities of DVD. Though Laser Disc, CD-i, and VCD are good for training applications, they require specialized players to view content. The wide proliferation of

DVD players in the consumer market and the DVD-ROM drives soon to come standard in home computers make DVD a cost effective platform for instructional usage.

DVD-Audio

DVD-Audio may replace the CD as the primary prerecorded music format in consumer markets, boasting longer playing times and interactive features. DVD-Audio shares many of the same architectural and navigational features as DVD-Video, but supports different data types and stores content in a separate audio zone on the disc. The discs can also include certain DVD-Video features like onscreen menus, motion video, and still graphics slide shows. DVD-Audio supports higher audio fidelity and offers more flexible multi-channel playback options as well. The format focuses primarily on uncompressed PCM (pulse-code modulation) audio, stored either in linear form (LPCM) or packed to provide for longer playing times without compromising audio quality using MLP, Meridian Lossless Packing (LaBarge, 2001, pp.38-41). DVD-Audio players output PCM and Dolby Digital, and may support optional audio formats like DTS and MPEG audio. However, advanced digital connections such as FireWire are required to take advantage of the full digital resolution of DVD-Audio, and most current receivers are not equipped with these high-definition multi-channel audio inputs. DVD-Audio players come in two varieties: audio-only players and video-capable audio players that can show onscreen information. Universal players, or DVD-Audio/Video players, that play both DVD-Video and DVD-Audio discs also exist. By including a Dolby Digital version of the audio in the video zone of the disc, it becomes possible to create a "universal disc"

that will play in all DVD-Audio and DVD-Video players and computers (Taylor, 2001, p.321).

File System Compatibility

All DVD formats discussed above utilize a single file system specifically designed for storing data on optical media. The Universal Disc Format, or UDF/ISO-9660 Bridge Format, makes DVD compatible across DVD players and computers, regardless of the processor or operating system. Most CD-ROM cross-platform compatible discs use the ISO-9660 format, while the UDF system is more recent. The UDF/ISO 9660 Bridge Format combines both the older and newer approaches, thus allowing for greater compatibility (Ely & Block, 1998, p.13). DVD is backwards compatible with all other current compact disc formats. Most recent DVD-ROM drives and newer consumer set-top players will read CD, CD-R, CD-RW, and VCD, although older DVD-Video players may have trouble playing DVD-R discs.

The Future of DVD Technology

DVD represents the perfect platform for the convergence of technologies delivering entertainment and information content in the form of audio, video, and graphics combined with interactivity. Jim Taylor comments on DVD as the emerging technology bridging the gap between the past and the future, "As we shift from analog television to digital television and high definition television, DVD is the bridge because it is right in the middle" (Serra, 2000, "DVD and Convergence"). However, DVD's ever changing form has led to confusion in the consumer marketplace, as many older set-top

players are now incompatible with some of the newer DVD formats. It seems the more capabilities and flexibilities DVD provides, the more opportunities that are opened up for mistakes to be made. In order to keep up with the increasing advancements in DVD technology, consumers must purchase a new "current model" DVD player nearly every two years! Eventually, the universal player will be developed, able to read every DVD format along with all other optical disc technologies. In the meantime, DVD technology continues to be improved and refined, and the tools for DVD development will continue to change over time.

CHAPTER TWO:
Concept and Design of "Swing Into DVD"

A Swingin' Affair

When the initial concept of "Swing Into DVD" was designed, several factors were taken into consideration. As a creative thesis project, it needed to go above and beyond a mere CD or video production. CD-Rom and web based applications were appealing, but after much deliberation and comparison, one medium stood out as the perfect synthesis of audio, video, and multimedia: the DVD-Video format. It seemed the logical choice and offered a formidable challenge, as the fledgling technology was still developing and had yet to establish industry standardization at the time. The interactive capabilities of DVD rose above standard linear viewing, allowing the user to personally customize his or her viewing experience. The potential to engage the user in active learning was also appealing, and DVD seemed custom-built for instructional applications.

At the time of the project's inception, there was only a limited number of DVDs on the market for musical groups. The initial idea for the project consisted of producing a DVD concert for a local folk rock group of female performers. The concept soon evolved from folk to big band swing, partly drawing upon the popularity of the swing dance craze at the time and also upon the classy appearance of a big band orchestra on stage, with dashing tuxedos and flashing brass horns. Once this new direction had been established, the focus then shifted to include an instructional or educational component, rather than producing a simple concert or stage show format. The addition of dancers to the concert performance not only made the stage show more visually exciting for

viewers, but also allowed for a dance instructional segment to be added, thus heightening the interactivity of the DVD itself.

After witnessing the newly formed 16-piece swing band, Paul King and the Rhythm Society Orchestra, perform at a Detroit area benefit dance, it was clear this orchestra provided the perfect musical backdrop for the proposed stage show. Crooner Paul King and bandleader Gary Herzenstiel agreed to the project, and were saddled with the task of suggesting lively tunes from their 1930's and 1940's era repertoire to be performed on the DVD. The songs needed to have suitable tempos for the dancers to swing to and also needed to appeal to the concert listener. The challenge presented here lay in the fact that the band had only played together for a few months since forming, and the charts selected were pulled from a small list of tunes the band had practiced well together.

The selection was limited, but five songs were finally chosen based on dance tempo requirements. Of these five, three were selected for the DVD: "Night and Day," "Four or Five Times," and "Let Me Off Uptown." "Night and Day," the most well-known and clear leader of the collection, was written by Cole Porter in 1932 and was introduced by Fred Astaire and Claire Luce in the 1932 film, "Gay Divorce." Considered to be one of the top standards of all American popular music, "Night and Day" had been recorded by hundreds of singers, orchestras, and smaller groups throughout the years (Lissauer, 1991, p.607). The selected arrangement of "Four or Five Times" was originally recorded by Jimmie Lunceford and his orchestra on May 29, 1935 with Sy Oliver on vocal (Rust, 1982, p.985). "Let Me Off Uptown" was originally recorded by

Gene Krupa and his orchestra, with vocals by Anita O' Day and Roy Eldridge on May 8, 1941 (Lissauer, 1991, p.482).

The number of songs was limited to three in order to reign in the scope of the project and to better accommodate available resources. Three tunes, each clocking in under four minutes in duration, allowed for a near twelve-minute concert highlight. Twelve minutes provided ample time to showcase all the appropriate features of the proposed DVD without losing the interest of the audience, which could be a danger with a lengthier show. Additionally, given only one day to record with all the musicians in one studio, several takes of three songs just about stretched the limits of the orchestra's stamina. Any more than three songs, and the last tunes recorded would not have sounded "fresh," as tired lips and limbs showed their exhaustion. After the band was secured and the tunes were settled on, the DVD itself took shape.

Multi-Angle Functionality

Since the advent of MTV, music videos have been a staple of every music lover's entertainment diet. With standard videos, the viewer was only able to passively sit and watch one complete edit as it appeared on television or VHS. With DVD, the viewer could take control of the content presented, selecting from multiple edits and angles, and choosing the order in which to view the segments. This thesis project wanted to take full advantage of such DVD interactivity, and the romance with DVD's versatility began.

"Swing Into DVD" was designed with multiple angles in mind. In traditional film and television viewing, the audience was only able to see what the director intended. Utilizing the multi-angle functionality of DVD, the user could then view isolated camera

angles, alternate shots, or different takes previously unavailable to the audience. The original plan for this thesis gave the user power to view the master edit and to switch seamlessly between one of four available camera angles, such as a stage cam, balcony cam, or overhead cam. Each camera perspective was a constantly rolling, unedited shot, so users could almost tailor their own sequences by pressing the "angle" button on the DVD remote. In addition to multi-angle functionality during the concert itself, it was proposed that this feature be utilized during the dance instructional segment as well.

Instructional Ability

The educational ability of the DVD medium was borne out in the dance instruction. Designed for both the beginning and the advanced dancer, the instruction involved basic steps to the most common forms of swing as well as advanced moves for greater mastery. Since the music for the project was big band swing, three swing dance variations were included as part of the instructional segment. The first and simplest of the three was East Coast Swing. ECS, or "jitterbug," originated in the late 1930's as a simplified variant of the Lindy Hop. ECS was included on the DVD for viewers new to the world of dance, as the basic single-step and triple-step count patterns proved easy to grasp for beginners. The second and third swing styles taught on the DVD were both forms of the Lindy Hop. Classic Lindy Hop, known as Savoy Style, was rooted in African movements and danced with the knees kept bent and elastic. It was popularized at the Savoy Ballroom in Harlem in the late 1920's and early 1930's, with the dancers' feet making six-count and eight-count rhythm patterns. Hollywood Style Lindy Hop, a

more recent variation, was a smoother style trademarked by Los Angles dance teachers Sylvia Skylar and Erik Robison a few years ago (Pener, 1999, pp.67-90).

Because body positioning emerged as the key element in live dance instruction, the instructional feature on the DVD needed a way to communicate this to the viewer. Since the Lindy Hop moves taught were very circular in nature, viewing the instructional couple from straight on at every moment did not prove very helpful to the learner. Therefore, an overhead camera depicting shoulder, torso, and foot positioning provided the best solution. A close-up foot camera showing just the dancers' feet was also proposed to focus in on where the leader and follower's feet were in relation to one another. With the viewer able to seamlessly switch between three angles (frontal, overhead, and zoomed-in foot camera) the DVD almost simulated what the learner saw in a live instructional setting, with the added benefit of the overhead camera to aid in body alignment.

The decision was made to include twelve intermediate level dance moves along with the four basic steps taught in the instructional portion of the DVD. This number gave viewers the opportunity to explore a variety of new moves, and see them broken down for learning without becoming too overwhelmed. The moves were presented so the viewer could either view all sixteen in a row, or select between the individual moves in any preferred order. After a period of refinement, the proposal included several different dance couples of varying abilities, each teaching two or more dance moves. The multiple instructor approach was added in order to give the viewer a greater exposure to variations in teaching styles. This enabled the learner to develop his or her own signature style of dancing, rather than merely imitating the one style presented. For the participants in the

shooting of the instructional segment, this also made for a shorter time spent in front of the camera, rather than shooting one couple all day teaching all moves. Changing up the instructors allowed for teacher rotation, greater variety visually, and fresh or livelier performances from the instructors.

The "White Rabbit" Feature

In addition to the format's obvious benefits stated previously, the driving force behind "Swing Into DVD" being developed on the DVD medium was an idea introduced in 1999, affectionately nicknamed the "white rabbit" feature. This brilliant concept was introduced with the release of the Warner Home Video DVD title The Matrix. That DVD was not only visually stunning in layout and design, but also offered a new twist on the versatility of the DVD medium. While viewing the movie, viewers could select to view a piece of behind-the-scenes footage whenever a white rabbit icon appeared on the screen. By pressing "enter" on the DVD remote, the viewer could select this icon and activate it. The viewer was then able to watch a short behind-the-scenes clip from the making of the production. After the clip was over, the movie resumed in the same spot it left off before cutting to the extra clip.

To incorporate this "white rabbit" interactive feature into "Swing Into DVD," a "dance version" of the three songs was developed. This dance version was a separate edit the user could select to view. The option was to watch either the "band version," focusing mainly on the Rhythm Society Orchestra punctuated by the dancers onstage, or to view the "dance version" which featured the same three songs, but focused on the dancers and stage show with the band merely as a backdrop. For each song, four or five

couples were designated as the "spotlight dancers," and each couple rotated to the center of the stage, performing dance routines each in turn until the end of the song. During their performances, each couple performed a "signature move" that was taught later as part of the dance instructional segment. When the couple came to their signature move during the concert, an icon of dancing footprints appeared on the screen for a few seconds. Upon selection of the icon by pressing "enter" on the DVD remote, the viewer was then transported into the studio for dance instruction. The featured couple taught the signature move, and then the viewer was returned back to the concert in the same place they left off. The dancing footprints icon then appeared on the screen again in case the viewer desired to see the move demonstrated in the studio once more. The addition of the "white rabbit" functionality added variety to the instructional portion of the DVD, allowing viewers to either select moves to learn in the studio or to learn the moves alongside the dancers while immersed in the concert experience.

Bonus Material

The menus effectively set the tone of the DVD, giving it a very polished and professional yet fun look and feel. The DVD menus needed to convey a strong sense of continuity between them while appearing different enough to be visually stimulating. Rather than simply using photographs as blurred backdrops for the text, an artistic approach was employed. The success of the menus relied on techniques applied in Adobe Photoshop, which made the images appear as if they were half photograph and half painting. The subjects appeared to be coming to life out of their artistic backdrops, as the line between reality and art blurred around their edges.

Besides the stage show and dance instruction, the DVD needed to include extra material separate from the concert. A section for bonus material or "DVD extras" was designed to give the viewer access to still photo galleries, production notes, credits and thanks, information about the band, and a behind-the-scenes short documentary on the making of the project. During the audio recording session and stage show video shoot, footage of the production process was recorded for use in a brief "making of" documentary. However, the documentary format idea was benched due to limitations on time and space, and refined into a behind-the-scenes still photo gallery. The still gallery contained pictures taken throughout the production, including everything from formal band photos to shots of the cast and crew during the shoot. Due to the proposed volume of photographs, the gallery was broken up into subsections to prevent the viewer from becoming overloaded with too many pictures that never seemed to end. Each category contained fewer than twenty images and returned the viewer to the main gallery section after displaying all of the images in the chosen group. The categories included the band, the dancers, the audio and video crew, and the dance instruction.

The section providing information about the band was kept very brief. One page of contact information for booking the band and the link to the Rhythm Society Orchestra's web page was displayed. Originally the DVD was proposed as a hybrid DVD/CD, to enable links to web addresses directly from the DVD if played in a computer DVD-Rom drive. With this hybrid design, the user could link directly to the band's website and access current information regarding upcoming performances.

Due to the nature of the DVD content, rolling credits as seen in theatrical films did not make sense. Instead, the credits were presented on static pages that the viewer

navigated through at whatever pace desired. The section for conveying thanks was displayed in a similar fashion, much like the acknowledgments and thanks listed on the liner notes of music CDs. Production notes also required static pages for viewer perusal and included such items as the original project treatment, diagrams, and equipment specifications.

Surround Sound

Because of the sophistication of many home stereo configurations, the producer of "Swing Into DVD" wanted to present the audio in 5.1 Surround. By utilizing the rear speakers in a surround system, the viewer was virtually transported into the stage hall where the band was playing with the addition of ambience and atmosphere. The audio for this project was technically not a true 5.1 mix, as the band did not require the LFE channel. Also, the rear speakers (left surround and right surround) were fed the same signal, resulting in a "dual mono" rear signal. Realizing that not all potential viewers possessed systems capable of delivering surround sound, the option to hear the audio in Dolby Stereo was also needed. A DVD menu was added where the viewer could change the audio setup by selecting either Dolby Stereo or Dolby 5.1 Surround. The player then read the chosen format for the duration of the DVD, until changed again by the user.

The "Easter Egg" Bonus Feature

This initial design phase resulted in a proposed DVD to be created for Paul King and the Rhythm Society Orchestra. The planning stage allowed the vision of "Swing Into DVD" to take shape on paper, defined the scope of the project and made realistic

projections based on resource availability. The DVD was both entertaining and educational, featuring a multi-angle band stage show complete with dancers, a dance version including an interactive "white rabbit" studio feature, and plenty of bonus material for the user to access in addition to the concert footage. The audio was offered in Dolby 5.1 Surround with the option to listen in Dolby Stereo. The educational realm of DVD was showcased through in-studio dance instruction for both beginning and advanced dancers, with the option to view the moves from overhead for body positioning and partner alignment. To round out the package and to further capitalize on the diverse functionality of the DVD medium, one additional feature was proposed: an "Easter egg." An Easter egg on a DVD refers to a hidden bonus feature, concealed somewhere within the programming of the disc, that has to be discovered by the user. For example, a hidden button can be invisible to the viewer, but can be programmed to access special footage if discovered and activated by the DVD remote. For this DVD, an Easter egg was hidden on one of the menus, and was activated by navigating to the invisible button and pressing "enter" on the remote. The viewer was then taken into the studio to learn an advanced aerial move, which was extremely tricky to perform. The demonstrated aerial was the "hip flip," where the leader actually flips the follower up off the ground, returning her to her feet after spinning her head over heels. With audio, video, animation, and bonus and hidden features, "Swing Into DVD" was ready to begin production.

CHAPTER THREE:
The Audio Production Process

Studio Selection

Recording the band's audio presented a number of logistical challenges, and several approaches were considered. If the orchestra was recorded live during the video shoot the sound would be authentic, and the energy of the live performance could be captured. However, the acoustical difficulties presented by the theatre suggested another route. A live recording also seemed unsuitable due to the high number of takes required during the shoot, considering the fatigue of the musicians. Also, the appearance of microphones among the instruments on stage affected the composition of the band shots and was deemed unappealing. Therefore, it was appropriate in this instance to first record the three songs in a controlled studio environment, with the band pantomiming to the recorded tracks during the video shoot. A video production studio located within the Communication Arts and Sciences building on the campus of Michigan State University was ideally suited to accommodate the entire orchestra and provided acoustical dampening on the walls for greater sound control.

Because the facility was not equipped for an audio recording session, the recording studio gear needed to be assembled in the video studio control room. A "portable studio" was created by audio wizard Gary Reid to solve this dilemma, mounting three Tascam DA-88 recorders chained together in a rolling rack beneath a Yamaha O2R 24-track digital mixing board. The DA-88 format had been widely adopted by the video post-production community, and was the format required for ultimately encoding the audio for use on the DVD. Capable of recording eight tracks of 16-bit

digital audio each, the three Tascam decks worked with the Yamaha console and formed a fully functional 24-track "studio in a box." The first DA-88 deck was the sync leader communicating time code, and the other two machines slaved to the master, locking time code for all 24 tracks. Before recording, the metal particle tapes used in the DA-88 recorders were formatted. During this process absolute time code data was laid down, enabling the synchronization of multiple DA-88 machines. Formatting also repacked the tapes to help maintain a consistent tension while recording, thus allowing for a better signal recording during the session with less threat of signal damage (Brooke, 2002, "The Day Before...").

Microphone Placement

The visual nature of the DVD required that the audio match the stage environment where the band performed. Rather than hoisting a stereo microphone up on a boom pole and recording the entire orchestra at a distance, mics were positioned for each instrument or section. Although this technique allowed for greater control of each track during recording, the spatial positioning of the instruments or stereo spread across the stage was lost. However, the illusion of this sonic space was recreated during the mix phase with the aid of signal processing. Generally in a studio recording, the drier the recorded signal the better. Any modifications to the sound should be made in postproduction, such as adding reverb, delay, or compression, discussed later in this chapter. If the incoming signal is already reverberant, that cannot be subtracted from the recorded track. Similarly, if the original signal is clean and dry, reverb can then be added to varying degrees with an effects processor to achieve the desired result. Placing the mics near the

instruments was beneficial because "the closer a microphone is to a sound source, the more detailed [and] drier...the sound; the farther a microphone is from a sound source, the more diffused, open, and reverberant the sound" (Alten, 1994, p.379). Pickup patterns determine whether sounds can enter the microphone from the front, sides, or rear when pointed at a given source. Omnidirectional microphones pick up sound from all angles and therefore are not used often during music recording. Using microphones with directional pickup patterns, such as the heart-shaped cardioid, reduces the track leakage of the surrounding instruments.

The rhythm section consisting of drums, acoustic string bass, electronic keyboard, and rhythm guitar, arrived early on the recording date in order to set up gear and microphones in sufficient time for the rest of the band to assemble. Mics were placed around the drum set so the individual drums were heard and also blended together as a unit. Four directional microphones were used for this studio recording to best capture the dynamic range of the entire kit. Two overhead mics were placed in an X-Y pattern over the left and right sides of the set, the third at the kick drum for greater bass control, and another was placed near the snare drum to complete the balance. A pillow was placed inside the kick drum to dampen the sound and reduce vibration and ringing. Moving-coil microphones were used for the kick and snare, each with cardioid pickup patterns that recorded sound primarily from the front and a fraction from the sides. No sound was picked up from the rear of the microphone, making it ideal for the live recording situation attempting to isolate the particular instrument with minimal bleed through of other tracks. Large diaphragm moving-coil mics were chosen because they were better able to handle the longer bass wavelengths of the low-end instruments and helped to smooth out the

level differences in the orchestra mix (Alten, 1994, p.383). For the two overheads, condenser microphones were used because their thin sensitive diaphragms worked best to reproduce the characteristic sounds of the cymbal's high-end shimmer. The mics were placed a few feet above the cymbals to avoid picking up too much cymbal ringing and for easier blending during mixdown.

For the keyboard and acoustic string bass, two possible recording options presented themselves. Each instrument could either be plugged into an amplifier and the mic placed in front of the speaker, or the instrument could be plugged directly into the mixing board itself. Because of the limited number of input channels, both techniques could not be employed. Therefore, the instruments were plugged in directly to provide a cleaner sound and to allow for greater control at the console. Due to differences in impedance between the instruments and the mixing board, a device called a direct box was used to make them compatible. The direct box transforms the impedance differences between a source and its input channel and matches them. Recording the acoustic bass direct was preferable to obtain a cleaner sound from its commanding low end. For this purpose, an electric pickup was mounted on the bass and plugged into the direct box. Without amplifiers on the bass and keyboards, leakage to other tracks was eliminated; however, the other players could not monitor these instruments so had to rely on the drums and guitar to provide the rhythm and tempo that kept everyone together. The rhythm guitar rounded out the rhythm section, but was not plugged in through a direct box. A moving-coil microphone was placed in front of the guitar's amplifier in order to add body to the sound with added punch and acoustic texture.

Because brass instruments can be loud by nature and possess wide dynamic ranges, it was not necessary for each individual horn to have its own microphone. In order to enhance the blend of the trumpets and trombones, only one mic was used for each section, with each horn angled in towards the mic pickup. This also conserved track space, and left room for solo tracks and additional parts to be added later. Leakage between instruments became a problem with the trumpets especially, since their volume carried throughout the entire studio. Music stands were employed to flank the trumpets and help corral the directional sounds in an effort to minimize the leakage effects on other tracks.

The saxophones and clarinets are not nearly as boisterous as the brass instruments due to the shape of the horns and their diffuse sound radiation. In order to best capture the sound of each horn, every saxophone had its own individual microphone: two altos, two tenors, and one baritone sax. The clarinets were added during the overdub session, as the musicians who covered clarinet were playing saxophone during the primary recording session. The proximity of the microphones had to be much closer to the saxophones than the brass instruments since woodwinds produce lower levels and more diffuse sounds coming from the bell and keys of the instruments.

The vocalist only provided a scratch track for the band to follow as a reference for placement. The actual vocal track was recorded at a later date during the overdub session, where the vocalist was perfectly isolated. Recording the actual vocal track live at the initial session would have yielded unusable results due to the large amounts of leakage that occurred from the instruments in the studio. During the session, the entire band was recorded together at one time to best preserve the essence of a live orchestra

recording. To embrace the living breathing qualities of a live concert, a click track for the rhythm section was not used, so the natural ebb and flow of the pieces was allowed to develop from the energy of the performers. Certain variations in tempos and tonal qualities were also allowed to surface in order to preserve the live feel.

The Recording Session

The instruments were arranged in a semi-circle on the studio floor so that every musician maintained visual contact with the bandleader. The bandleader, also playing alto saxophone, counted the tempos out loud at the beginning of each piece, signaled the band when to end, and generally kept everyone together. This half-circle configuration also allowed the musicians to hear each other better, since monitor speakers normally used during live performances were not practical in the studio recording environment. The setup was similar in structure to a concert band orchestra, with the conductor in full view of all players and the sound projected across the stage for monitoring purposes without speakers. The recording engineer in the control room also communicated with the bandleader via headset to ensure the recording session ran smoothly and efficiently.

. Track assignments were written out on a track sheet to aid in assembly during mixdown. 24 tracks were available, and tracks were skillfully assigned in order to accommodate such a large band. The track placement varied slightly from song to song depending on instrumentation variances and solos, so careful records were kept. Initial recording levels were set on the mixing console as close to zero on the meter as possible without danger of going over or distorting. Each instrument was set accordingly,

regardless of its relative prevalence in the mix. Once the instruments were all recorded at good solid levels, their position in the mix could then be adjusted during the mix phase.

Three to five takes were recorded of each of the three songs, with a good take defined as one with the fewest number of mistakes and a solid energy of performance. The time code position on the tape for each take was recorded on the track sheets, and notes about the quality of the take were written down for reference. If necessary, a composite track could then be edited together during postproduction to ensure the best possible take.

After the multiple takes of each song were recorded to satisfaction, the rhythm players were released to break down their equipment and leave the session. The trumpets and the trombones remained to embellish the brass by adding double parts on the open tracks. Doubling created the illusion of a larger brass section and helped add a fuller sound. To round out the saxophone section, the third and fourth parts were added, played by the musicians that read the first and second parts during the initial recording. The saxophone solos were also recorded after the brass players were released from the session, with the clarinet and bass clarinet parts added last on a remaining open track.

The Overdub Session

Overdubbing refers to recording tracks separate from the initial recording session at a later time, or may even involve rerecording certain parts. Overdubbing makes it possible to record various parts and voicings separately and at different times, provides a greater degree of sonic control over each track, and allows a small number of musicians to do the work of many (Alten, 1994, p.421). Some overdubbing was already recorded at

the first studio session with the entire band. This included the doubling of the trumpet and trombone parts, adding the third and fourth parts to the sax section, recording the sax solos, and adding the clarinet and bass clarinet tracks. The remaining parts were added during the overdubbing session in the Communication Arts and Sciences audio production studio at Michigan State University. This studio was specifically designed for audio recording, providing sound isolation and allowing for much greater acoustic control over the recorded signal. The disadvantage to recording in a different studio from the original session was that the acoustics of the video studio had to be recreated during postproduction in order for all the parts to sound like they were recorded in the same room.

During overdubbing, the performer listened to the band's rough mix via headphones and played along with the recording to preserve timing. Quality headphones with tight fitting ear cushions were used to prevent the microphone from picking up the playback sounds coming out of the headphones. The trombone players added a third trombone part, since only two of them were at the original recording session. The trombone solo was also re-cut, and the performance was so much better than the original recorded track that the decision was made to completely record over the initial tracks with new material from the overdub session. The trumpets mirrored this situation, with the fourth trumpet part recorded over the original trumpet track, and the rerecording and doubling added on two additional tracks. Trumpet solos were recorded for the appropriate songs, completing the brass section overdub. Rerecording the brass in this manner resulted in a much cleaner, crisper sound, and overall more satisfying performance energy.

Vocalist Paul King was featured at the last and most crucial overdub session, recording over scratch tracks with actual vocals. A studio condenser microphone was selected to best represent the vocalist because of its wide frequency range and good transient response. Since the vocalist was alone in the studio, he tailored his performance strictly to his liking, without the bandleader there to tell him how it should be done. This gave the performer the freedom to feel the energy of his performance and to play around or embellish when inspired. The vocalist was given two tracks to record two separate takes. If not satisfied with a particular take, the track was recorded again. Another technique utilized during the overdub session was "punching in," or rerecording any portion of any track without affecting the rest of the recording (Alten, 1994, p.427). In other words, if only a certain verse contained a mistake while the rest of the take was good, the recording engineer simply punched in to the track at the point desired and recorded over only that portion of the track, rather than rerecording over the entire track with the vocalist singing the entire song from start to finish again. Once the appropriate takes were recorded and both vocalist and producer were satisfied, notes on each take were made and the overdub session ended.

Postproduction: Mixing

During mixdown, the individual tracks were balanced, combined, and recorded into stereo and surround sound for final use on the DVD. Postproduction involved much more than just mixing, and included adding signal processing to enhance existing audio, utilizing panning to create stereo spread, establishing aural perspective, and creating

acoustic space (Alten, 1994, pp.558-9). The final mix needed to be delivered on a DA-88 tape for encoding into the DVD authoring program.

Mixing was accomplished on the same Yamaha O2R console used for the recording phase. This particular console was chosen for its ready availability and its versatility. All of the input channels on the O2R feature independent four-band equalizers for each track, dynamics processors including compressors and expanders, and a "view" function that enables the producer to monitor all information about one selected channel onscreen. The O2R includes a vast preset library featuring stored settings for the functions listed above, and also allows for custom settings to be altered and stored in memory-preset banks. The console also houses onboard signal processors capable of enhancing any track with multiple reverbs, delays, or other effects, and boasts full automation of all faders and mixing parameters, meaning the console can be programmed to automatically "mix itself."

The rough mix was assembled track-by-track starting with the rhythm section, configuring a basic balance, and then adding the instrumental voicings and the vocals. The raw tracks from the original three DA-88 recorders were brought through the console inputs and monitored through the mixing board channels. These original source tracks remained unaltered during mixdown, while the signal processing and level balancing occurring in postproduction were remembered by the O2R and stored in memory locations. Because a good mix cannot be accomplished in only one day, storing these settings allowed the producer to listen to and build upon the mix from the previous day.

Postproduction: Sonic Perspective

The original recordings made during the big band era were mono, which was considered good quality at the time. Today however, these recordings would be delivered in stereo at the very least. For output to DVD, the full sonic spectrum can be utilized, and even taken beyond the stereo realm through the use of surround sound. Basic stereo spread was established through the use of panning. Each track was positioned in the stereo field through panning, or placing the sound on any point in the stereo continuum from left through center to right. Panning some tracks to varying degrees to the left or right helped to create a sonic space, in this case the feel of listening to performers on stage as a member of a theatre audience. To determine which instruments needed to be panned to what degree, the orchestra on stage was visualized. The panning followed the brass and saxophones according to their relative positions across the stage, while the rhythm tracks were placed within the stereo spectrum to maintain balance. As is often the case with audio recording, the rhythm section was positioned first. Not wanting to bog down any one side with the powerful thrust of the bass and kick drum, both remained dead center along with the sharp attack of the snare drum. These supporting rhythm voices were essential to the pulse and energy of each song, and because of their dominance were not panned in order to avoid a lopsided mix. The two overhead tracks from the stereo mic above the drum set were respectively panned hard left and hard right to preserve the natural stereo output of the recording and to open up the sonic space. The guitar and keyboard were panned opposite each other to add further breadth to the mix. These remaining two rhythm instruments complimented one another nicely and injected a sense of even balance among the rhythm section. They

were each panned a little over half way between the center and their respective sides, with guitar to the right and keys to the left, filling in the gaps and rounding out the rhythmic perspective.

In order to create a sonic map of the stage (Figure 2), the brass and saxophones were panned to assemble sections. In other words, Alto 1 was panned just under 90 degrees right, Alto 2 began to shape towards center at 70 degrees right, followed by Tenor 1 continuing to spread the section at 50 degrees right, Tenor 2 at 30 degrees, and so on. The sax section completed its acoustic travel with the baritone sax panned off near 30 degrees on the opposite side. This spreading out of the section across the sonic stage attempted to mimic the feel of listening to a section of players live, where they were positioned in seats across the stage. Continuing in this manner of building sections in acoustic space and mirroring a live stage setup, the trumpets and trombones were positioned on opposing sides of the stage to add both contrast and compliment. On the right, the lower sounds of the trombones contrasted with the higher sounds of the trumpets on the left, and when played together created an entire range of brass across the spatial continuum. Since vocals were the dominant focus of the songs, they were kept dead center in order to maintain an even balance, much akin to the center positioning of dialogue in a motion picture. Any added reverb placed on the vocal from a signal processor would return in stereo through the board, further rounding out the acoustic space.

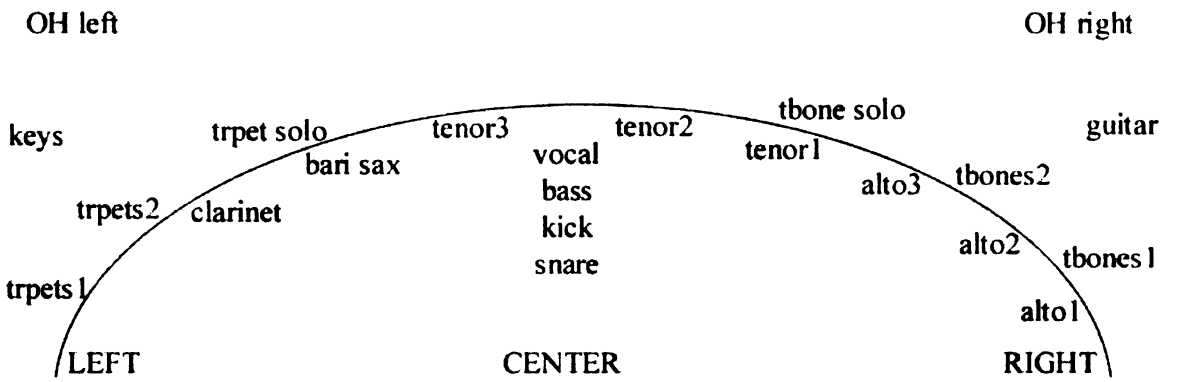


Figure 2. Sonic placement of instruments within the stereo field

Postproduction: Equalization

While panning created breadth across the perceived "stage," depth could be recreated utilizing signal processing such as reverb and delay. But before embellishing the sounds further, certain tracks needed to be equalized. Equalization, or EQ, alters the frequency response of a given track. The O2R has a built-in signal processor called an equalizer that allows a selected sound to be raised or lowered across four frequency bands. These bands cover the frequency ranges of low, low-mid, high-mid, and high. Each section can be boosted or cut over a range of plus or minus 18 dB and can be swept over a frequency range from 20 Hz to 20 kHz. The bandwidth of the actual EQ curve can also be altered, making the O2R's parametric EQ very versatile and flexible. As a track is equalized, a graphic representation of the sound curve is displayed on the console screen, providing a clear visual aid for reference. Each input channel can be equalized independently, making it easier to achieve a specific sound.

Equalization should be used sparingly, and only to improve a sound or to better incorporate sounds together. For example, if two instruments and the vocals share

roughly the same frequency ranges, the vocals may appear buried in the mix even with a level increase. EQ can be used to alleviate this problem and make the vocal track stand out above the rest. By boosting certain frequencies in the vocal track and similarly cutting back on those same frequencies in the instrumental tracks, the producer may "cut a notch" in the overall frequency spectrum for the vocals to rise above the competing instruments, thus achieving greater clarity in the lyrics. Each instrument has its own specific frequency range, and knowing what part of that range best represents the instrument sonically helps determine which frequencies to boost or cut with the equalizer.

Paul King was blessed with a rich male vocal range that only required slight equalization to enhance his sound. To add fullness to his vocal, the lows near 200 Hz were boosted up a fraction, while the high-mids and highs were slightly cut back to reduce any nasally sounds. The rhythm section and drums were equalized moderately to add punch and brightness to the mix. The kick drum got a substantial boost at 53 Hz on the low end for added power and support, another large increase near 315 Hz for a more robust sound, with a complete roll-off on the high end eliminating noise from frequencies above the drum's range. For added crispness of attack, the snare drum received a boost on the high end near 5 kHz. To reduce dullness in the overhead cymbal tracks the lows and mids were reduced, while the highs around 10 kHz were inflated to showcase the brilliance and brightness. The bass guitar found a complete attenuation near 445Hz to add clarity, permitting the attack of the strings to add punch and accent. The keyboard did not require any EQ, while the rhythm guitar received adjustments across all ranges, cutting the lows and highs while boosting the mids to highlight the rhythmic quality enhanced by the clarity of attack when strummed. For the woodwinds, equalization

varied slightly depending on the type of saxophone or clarinet, but the entire section shared a common roll-off at both the extreme low and high end frequencies to smooth out and mellow the overall sound. The high-mids between 3 to 4 kHz got a boost to add brightness in the upper harmonics. Trumpets increased their fullness with a slight boost in the low end near 200 Hz, while edginess and bite prevailed with a boost near 5kHz. The trombones appeared to already have a satisfyingly full yet edgy sound on the original recording, and therefore did not require any equalization.

Postproduction: Compression

The compressor is a processor whose output level increases at a slower rate as its input level increases (Alten, 1994, p. 234). Four main elements are controlled through the compressor: ratio, threshold, attack, and release. The compression ratio is the proportion of the input and output signals, and the compression threshold is the point at which the compressor is set to take effect. Attack time refers to how long it takes the processor to react to the signal, while recovery time is how long it takes the processed signal to return to normal. Adjusting the attack time can accentuate percussive attacks and add crispness to a sound, while modifying the release time can smooth or round out an otherwise shaky signal.

Here the kick, snare, and vocal were compressed to achieve different effects and to enhance the overall sound. The O2R has onboard dynamics processing capable of compression and gating, or shutting down the track if the signal falls below the set threshold. The gate was utilized for both the kick and the snare, producing a tight sharp drum sound by reducing the decay time on both. As a result, the drums became more

punchy and precise and less boomy or diffuse. Compression was used for the vocal track with a ratio of 3:1. This setting, along with the modified attack and release times created a thicker or "meatier" sounding vocal. The vocal compression balanced out the levels so the quieter portions were not lost in the mix and the louder portions were not overpowering.

Postproduction: Signal Processing

Some tracks still sounded one-dimensional and dry even with both equalization and compression. To simulate a live environment with spatial dimension, room acoustics were added to the tracks through reverberation. The ensemble needed to sound as if every instrument was playing in the same acoustic space, and reverb was added to the tracks in varying degrees to construct the feel of a live theatre venue. Panning, as discussed earlier, positioned the musicians on the stage. Adding reverb created a sense of depth by placing the listener in an acoustic space. Reverberation is created by "random, multiple, blended repetitions of a sound or signal" (Alten, 1994, p.222). Similar to echo, which refers to only one reflection of a sound, reverb attempts to imitate how sound behaves in a reflective environment. Most reverb units allow for the selection of various "room sizes" in which to place a recorded signal. For example, a "large room" reverb imitates the acoustics of a concert hall with vast delayed reflections, while a "small room" reverb mimics a more intimate setting with less reflections. However, adding too much reverb across all tracks may result in an extremely muddy sound where all detail is lost and diffuse.

The O2R contains dozens of reverb presets in its internal signal processing library. Two types of reverb can be selected from the console's signal processor, and one additional effect will be brought into the board from an outboard reverb unit. This configuration occurs because the O2R has two effects return channels where signal processing can be applied to multiple selected tracks. If additional processing is needed, it becomes easiest to bring outboard equipment into the board through open auxiliary channels. For this project, a Lexicon reverb unit was employed to furnish additional reverb options. A "large room" reverb was chosen on the Lexicon to feed the trumpet, keyboard, kick, and snare drum tracks. This served to liven the mix, and added spatial dimension to the tracks. The reverb on the low frequencies of the kick drum gave the instrument a larger and more encompassing sound. The keyboard appeared fuller in tone without dead spaces between each note, and added life to the performance by letting the tones ring out. The trumpets sounded like a fatter and bolder section, and the reverb on the snare filled out the sharp attacks nicely.

The key to selecting good reverb settings was to make the instruments sound as natural as possible. A room reverb was chosen from the O2R internal processor for the vocal, along with a chorus and a slight delay to add meatiness to the sound. Delay, the length of time between reflections of a sound, was manipulated to achieve a chorus effect on the vocal. This chorusing was similar to the track doubling repeated by the brass section during the recording session. A similar effect was created here, but to a less obvious extent. Choosing a very brief delay time opened up the vocal reverb and added spaciousness while enhancing the original punch or meat of the sound. A fraction of the

internal room reverb was also added to the trombone tracks, fattening up their sound to blend better with the bright fullness of the complimentary trumpets.

After adding reverb effects some tracks needed level readjustments in the overall mix. Adding reverb to certain tracks either increased their volume or changed their perspective. Adjusting levels helped to complete the depth, or front-to-back perspective of the mix. Tracks that were louder appeared closer in the aural environment, while tracks that were quieter seemed more distant. The vocal, drum set, and bass guitar remained the dominant voices up front. The rest of the instruments were brought up to support, compliment, and fill out the newly created acoustic space to add further perspective and dimension to the recording.

Stereo Mixdown

The Yamaha O2R includes an Automix function that proved particularly useful when mixing so many tracks. Automix allowed the producer to program track-by-track such components as fader position, channel muting, panning, and amount of signal processing. For each individual track the producer followed the music score and made channel adjustments as necessary. In Automix, the O2R wrote this data to memory and kept track of where and when each change was made. Additional adjustments were made on multiple passes of the song, as the O2R added to but did not overwrite the existing data. The entire 24-track mix was built section-by-section and fully automated for final mixdown in this manner.

To aid in programming the Automix, fader groups and mute groups were assigned. Once balanced, sections in the band were placed in the appropriate fader group

for woodwinds, trumpets, trombones, and rhythm. Once an instrument was assigned to a particular group, its position relative to all other faders in that group was locked. This aided the mixdown because it enabled the producer to adjust the entire group with only one fader. In other words, an entire section was raised or lowered in the mix by only touching one of the faders in that group. Fader groups were very helpful when sections needed to be modified, but if an instrument within the group had a solo and needed to be showcased, it had to be taken out of the group before it could be adjusted individually. The instrument was then returned to the grouping upon completion of the solo. Mute groups functioned in a similar fashion and were assigned as above. Mute groups either turned on or turned off the channels assigned to them, and were very helpful when entire sections were resting. When a particular instrument or section was not playing the channel was muted to block out any excess noise picked up on the track. Muting the channel when no audio was present cleaned up the overall mix and eliminated the extraneous sounds of musicians breathing, counting, or moving around.

Following along with the music score, the producer first programmed channel mutes to remove excess noise leakage between tracks. Detailed notes were made on the track sheets and in the score, indicating what additional adjustments needed to be made and where they occurred. The producer used groups and individual faders to build an active mix track-by-track and section-by-section. Two vocal takes appeared on two separate tracks, and care was taken to turn on and turn off the correct track at the perfect time. One vocal line was better in the beginning, and then turned off and switched to the second line for the second lyric phrase. With careful monitoring and precise timing, the

composite vocal line sounded like only one complete track, even though the original source was comprised of a combination of two takes.

Pass after pass of each song revealed where sections or instruments needed to be brought up or down in the mix, or whether a certain segment sounded sparse and needed to be filled in, or if an instrument sounded too prevalent. Balance was maintained during mixdown, aiming for a full, lush sound without becoming too heavy or cluttered. Solos were raised in level to shift focus to the highlighted instruments, and reverb or delay was increased at the end of the solo to better round out the horn's transition back into the section. Increasing the reverb slightly at the end of instrumental solos or vocal phrasings and sustained notes smoothed out the brief gaps of air and polished the shape of the overall sound. At the very end of each song, the master fader controlling board output was pulled down for a board fade to complete silence. This guaranteed that no extraneous studio noises appeared after the song ended.

When a satisfying mix was achieved, it was recorded to CD for performance evaluation. For a proper evaluation the mix was played back in the studio environment with calibrated equipment and well-positioned speakers. However, it was also important to listen to the mix in a variety of different consumer sound systems, including a car CD player, as different parts of the mix would sound different depending on the environment. After submission to the vocalist and bandleader for approval, adjustments were fine tuned in preparation for the final mix. Special attention was paid to tonal balance, sonic perspective and balance, clarity, and dynamic range. When all of these requirements were met to the best of the producer's ability, the stereo mix was complete. The mix was

laid to time code for reference audio during the video shoot, and the board was prepped for the surround mix.

Mixing for Surround

In order to take advantage of the surround sound capabilities of DVD, a multi-channel mix of the audio was created. On the DVD, the center channel contained the vocals, the front left and right channels consisted of the conventional stereo mix, and the rear surround channels contained the reverb returns of the processed signals. This configuration was selected to reproduce the "concert hall" sonic perspective of an audience member watching the band on stage. Placing the reverb returns in the rear speakers gave the listener an added room dimension by hearing the slight sound reflections behind them. In order to create the surround mix, the individual components were broken out from the stereo mix and fed to a Fairlight digital audio workstation in the above described channel configurations. The Fairlight was chosen because of its ability to nudge track timing with sub-frame accuracy in order to ensure that the surround audio matched the video footage. In order to maintain sync with the picture, a rough edit of the three-song stage show was imported into a DoReMi digital video recorder. Playing the video back off the DoReMi provided a visual reference for cuing purposes and allowed for the time code syncing of the audio from the 02R into the Fairlight. Once in the Fairlight, the five audio stems were rebalanced to create the surround mix and recorded to a DA-88 tape for DVD encoding.

CHAPTER FOUR:
The Video Production Process

The Location

The video shoot was designed to capture the 16-piece Rhythm Society Orchestra big band performing three recorded songs on stage surrounded by couples swing dancing. Ideally, the video could be shot inside a television studio equipped with professional cameras and video switching capabilities for live shot construction; however, the more commercial look of a studio setting was discarded in favor of a classic theatre venue. The location for the shoot needed to fulfill some basic requirements, such as a raised stage area for the bandstand along with an open dance area in front of the stage. The venue needed high ceilings and a loft or balcony to accommodate lights and to support cameras for angle variances and overhead shots. Because the DVD offered multiple angles for variety, variations in camera placement and height were essential.

The Redford Theatre in Redford, Michigan was chosen as the location for the shoot, due to its classic design and appealing art deco bandstand on stage. The Redford offered a real stage with curtain flies, stage lights, lighting technicians, and even a functional mirror ball for added effect. No outside light was allowed into the theatre, which provided a perfectly controlled environment in which to shoot, regardless of the time of day. In addition to meeting all of these requirements, the theatre allowed the Rhythm Society Orchestra to use the venue for one full day free of charge, though a one-day video shoot would be mentally challenging and physically demanding on all involved. With the financial requirement thus fulfilled, the Redford Theatre appeared the perfect choice.

A site survey of the Redford identified such features as available power and outlet availability, lighting, sound system, and balcony and stage measurements. The diagram in Appendix B was drawn for reference to aid in the placement of cameras, stage blocking, and determining cable lengths. The venue supplied sufficient lighting for a stage show, including overheads above the stage of varying wattages, a tri-color strip of footlights at the base of the stage providing color washes, two side lighting trees, and an array of balcony lights that could be aimed at the stage. Although adequate for a live performance, this configuration required additional lighting for the video shoot. With additional lighting rented from Mid-America Cine Support in Troy, Michigan, the performers were bathed in light so no shadows were visible across their faces during close-ups. However, the orchestra pit made lighting the dancers difficult, as the lights from the pit were not high enough to provide the desired illumination. Overhead lights on the theatre grid were positioned to provide backlighting for the band and dancers, setting them apart from the background and to adding dimension to the shot. The Redford also had a moveable spotlight that was set at a fixed location in the center of the stage for the dancers to step into when showcasing moves.

Cast and Crew

To reach the largest variety of dancers, an open casting call was posted on six local dance newsgroups via the Internet to area dancers in the Detroit, Ann Arbor, Lansing, and Toledo communities. The posting called all dancers to volunteer and perform, regardless of skill level, and also asked for those willing to dance in the spotlight and to teach the moves presented. The casting call can be found in its entirety

in Appendix D. Each couple that performed could then instruct their own signature dance move, instead of one set of instructors teaching all moves presented. Instructor variation showcased a variety of stylistic differences and approaches to teaching, thus benefiting the viewer through exposure to different techniques. In order to participate on the day of the shoot, each member of the dance cast was required to mark his or her attendance on a call sheet and to sign a consent form as outlined by the University Committee on Research Involving Human Subjects (see Appendix E). The band members signed the same form at an earlier rehearsal.

The Internet played a key role in contacting potential crewmembers as well via email. Camera operators were largely selected from a pool of graduate students and local television station referrals, while grips and setup crew were drawn from local postproduction companies. A still photographer was also chosen to take production photos throughout the shoot.

Production Methods

Five cameras were utilized to shoot the performance from different perspectives. Three studio quality professional Sony DVCAMs were positioned; one on the center balcony for a straight-on shot, one on high scaffolding above the left side of the stage, and the last above the stage door on the right. The fourth camera, a studio grade Panasonic DVCPro, was placed in the orchestra pit on a wheeled dolly for smooth freedom of movement when tracking across the floor. In addition to the four studio cameras, a smaller balanced hand-held steadicam rig was used for roaming shots of

dancers across the dance floor and for capturing interesting angles and intimate shots of the musicians.

An Electronic Field Production (EFP) style was chosen for the shoot over live directing with a video switcher. Live directing would be advantageous in a television studio with live switching functionality, but was not a viable option for this shoot without a mobile equipment truck. The logistics of connecting five cameras to a portable switcher were too complicated to be cost effective, so the camera operators were instead given shot books to guide their shooting without director intervention. In this instance, it was deemed more productive to have the cameras constantly rolling and to assemble the multiple tracks into one cohesive edit in the nonlinear editing process. Multiple takes from each camera provided more material with which to edit, and advances in nonlinear editing technology allowed several tracks to be edited simultaneously.

The shot books assembled for each camera detailed specific instructions for each individual take. Each shot book contained five take sheets that told the camera operator what kinds of shots to compose. Instruction for the specified take included shot composition, what subjects to focus on, how long to hold the shot, and what type of camera movement was required. Each take sheet depicted an outline of the stage with the area to shoot shaded in color so the camera's boundaries were clearly defined. An example of a shot book can be found in Appendix C. The takes, broken down by camera movement, assured a plentiful variety of dynamic footage to work with during the edit phase, and consisted of static cover shots, zooms, pans, close-ups, dancers, and band-only scenarios. Each camera operator was also provided with a field monitor to better view shot composition and to guide framing decisions.

To provide matching time code reference to the cameras, a Tascam DA-88 deck acted as a time code generator. Special cables were constructed to feed time code from the Tascam deck in the center of the theatre to the cameras above. Since the music the band pantomimed to was not hard synced to time code, the matching time code on the cameras would make the reassembly and editing easier for each take. Audio was also fed to the cameras to provide a further reference for syncing tracks in postproduction. A detailed log was kept during the shoot, recording which take occurred at what point in the time code. It would have been ideal if all the cameras used were identical, so matching time code could be sent to each. However, the DVCPro camera did not accept external time code, and could not be synced with the other cameras. A clapboard was utilized as a visual cue for syncing purposes before each take, although some camera operators failed to record the marker. Despite the efforts made to ensure synchronized time code for ease of editing, discontinuities in time code from camera to camera resulted from operator error.

Shooting the Stage Show

The director used a microphone plugged into the theatre speaker system to talk to the performers on stage and also to communicate instructions to the camera operators. The band's three-song CD recording was played over the house speakers in order for the orchestra to hear the tracks and play along. In essence, the musicians pantomimed to their recorded performance, fooling the cameras by fingering along to the prerecorded notes. The vocalist had to deliver the most convincing performance, perfectly matching his timing and enunciation to that of the CD tracks. Repeating the tunes several times

over the house speakers let the band familiarize themselves with their recorded parts and solos before the shoot, and allowed the dancers to practice at the correct tempos.

The first take was the cover shot. The cameras were locked down in fixed position with the band and dancers filling the entire frame. This static shot established the size of the stage and covered everything from the top of the band cart to the bottom of the nearest dancer's feet. Take number two involved camera zooms. The cameras slowly zoomed in or out on a particular subject, mainly focusing on the band. The vocalist and instrumental soloists were the main focuses of the zooms in take two. The camera operators were instructed to hold the zoomed shot for a few seconds before zooming back, which gave the editor greater freedom of shot assembly in postproduction. The third take covered panning shots. The cameras slowly panned from one side to another in smooth sweeping motions, across sections of the band or dancers across the stage. The fourth take consisted of close-up shots. Cameras framed close-ups of the vocalist and instrumental soloists, holding the shot for a few seconds before composing another close-up on a different subject. Camera operators were instructed to shoot a close-up of every band member at least once, and to shoot the spotlight dancers when they performed their special moves at the front of the stage. The fifth and final take involved the band only. The dancers left the stage in order to provide an unobstructed view of the musicians so the cameras could get clean shots with no extra bodies in the way. Five takes of each song supplied sufficient material with which to construct an exciting collection of shots to produce an interesting performance video.

Shooting the Dance Instruction

The dance instruction was shot after the completion of the stage show recording. Only two cameras were used for shooting the instruction, one DVCAM set for a wide full-body shot, and another with a close-up on the dancers' feet. Due to the close proximity of the dancers, the shotgun microphones mounted on the cameras adequately picked up the audio instruction. However, after careful review the decision was made to stage a re-shoot at a different location.

Shooting the instructional segment in a different setting other than the theatre added variety to the DVD, taking the viewer away from the stage show and into the studio. Gretchen's House Dance Barn in Ann Arbor, Michigan offered a beautiful wooden floor and adequate space at a reasonable price. It was a newly built and nicely furnished wooden structure with a 30' x 18' dance floor that provided an intimate setting for instruction and carried sound well for cameras in close proximity. The warm colors of the wooden floor and walls produced a friendly golden glow that contrasted nicely with the stark blacks and whites of the Redford Theatre set.

Most of the original instructors were able to attend the re-shoot, and for those that could not, another couple took their place and taught their moves so that all featured steps were still covered. Three crewmembers were contacted, two camera operators and one grip, plus the director. The dance space was already lit quite well, and three additional lights on stands proved adequate to illuminate the dancers. A key light, the fixture providing the most light, was placed off to a slight angle in front of the dancers. Another light was placed at an equal offset to the couple to provide the fill, eliminating any shadows across their faces. Both lights were bounced off umbrellas and reflected back

on the subjects to reduce the harshness of direct illumination and to avoid a washed out look. The third light was bounced off the back corner of the wall, creating an interesting light pattern on the wood and splashing a small amount of reflective backlighting.

Three cameras were used for the shoot, two of the professional studio Sony DVCAMs from the Redford shoot, and one mini-DV camera. The studio cameras were positioned similar to the original instructional shoot at the theatre, with one composing a full-body shot and the other capturing a close-up of the dancers' feet. The mini-DV was mounted in a bracket and lashed to the ceiling trusses above the dancers with a ladder. This unique overhead vantage point provided a shot from above to showcase body positioning and shoulder alignment, crucial elements in defining a dancer's frame. The multiple angle functionality of the DVD allowed viewers to switch camera perspectives seamlessly while attempting to learn the dance moves presented. The instructors' audio was recorded with two microphones. The intimate dance space was enclosed enough for voices to pick up well on the camera's shotgun mic, and another directional shotgun microphone was placed on a boom stand and aimed toward the instructors. Both microphones were recorded into separate channels on the tape, and the channel with the clearest sounding signal was selected during postproduction.

Video Postproduction: Nonlinear Editing

During postproduction, the producer gathered all available footage from the stage show and instructional shoot and assembled a final edited video for use on the DVD. Beginning this lengthy process required detailed logging of every tape's contents. For the theatre shoot the written logs listed the order of each take and outlined which shots

were usable. If certain shots were out of focus or contained shaky camera movements, they were considered unusable. Notes made in the log indicated the best segments in the footage, saving countless hours during the editing process. Special attention was paid to which cameras captured instrumental soloists and vocal lines, especially during zooms and close-ups.

Each usable camera take was digitized in low resolution and stored on a hard drive using an Avid Express nonlinear editing system. Avid Express boasts broadcast standard image output, four video tracks, offline (draft mode) and online image quality, SMPTE time code support, eight audio tracks, timeline editing, digital effects plus graphics and titling, and much more to aid the postproduction process. The footage was first digitized at a low offline resolution to conserve storage space on the hard drive. The final video would later be redigitized at a high online resolution when the editing process was complete. The audio from the CD was digitized to use as a reference for syncing the video tracks to time code, but would later be replaced during the encoding process for DVD creation. Each camera take was placed on the Avid timeline and synchronized with the audio track to ensure all takes lined up perfectly. Guided by the notes made in the written tape logs, the producer cut out all unusable portions until only the good pieces remained on the timeline. Switching from shot to shot, decisions were made regarding which shots to use over others, and when to cut to the next shot. Cutting between shots when editing to music commonly occurs on the beat. Whether this happens on the primary, or downbeat, or on an accent such as a horn stab or drum syncopation, remains the producer's own aesthetic decision.

For the band version, shot placement was determined by what instruments were playing and whether or not the vocalist was singing. For example, when a trombone line was showcased in the music, the viewer would usually expect to see all or part of the trombone section on the screen. Likewise, when a soloist was playing the producer took care to assemble varying shots of that soloist for the duration of the solo. While the vocalist was singing, most shots were intercut with different angles, zooms, and close-ups of the singer. The producer attempted to edit together an exciting piece comprised of images the eye would expect to see based on what the ear was hearing. In certain instances the musicians were either off sync with their performance, or there was not one good usable shot across all five camera movements. In this case, the static cover shot was used. The cover shot was used sparingly, as its apparent lack of dimension proved uninteresting if used too often. But positioned correctly for brief periods of time, the cover shot helped the producer out of seemingly dead end situations and aided the flow of the piece.

When the rough-cut version of the song was assembled to satisfaction, the producer then added transitions between the shots where appropriate. The most common transition was the dissolve. A dissolve occurred where one image blended or faded into another, making the transition much softer than an abrupt cut. Dissolves were added to create visual variety in the piece and were placed to accentuate phrasings in the music or to ease the shot changes during camera movements so they were not so jarring to the viewer. Another convention, the fade, was used at the beginning and ending of each song. Fades occurred whenever video dissolved from or into black or another solid color. In this case, the video faded up from black at the start of the song and faded into black at

the end. Adding fades to bookend each piece gave the video a more polished look. Once the rough edit with transitions was acceptably complete, opinions were solicited from professors and students unattached to the project. Feedback from outside persons helped the producer to step back and take a critical look at the edited piece for unbiased evaluation. The cuts and transitions were reworked and refined until a final version was developed that would ultimately appear on the DVD.

Video Postproduction: Color Correction

Once the editing was finalized, the color correction process began. Color correction was necessary for a host of reasons. Colored lights made some skin tones appear too red or too blue, contrast levels between different cameras did not match, and one camera operator set exposure incorrectly. The video shot with the DVCPro camera in the orchestra pit exhibited strikingly different contrast levels than the three Sony DVCAMs, while the steadicam shared the same problem to a lesser degree. Color correction techniques were employed in an effort to mask these differences and to make each shot match the next.

The Avid system offered color correction in an effects palette that was added to any shot as needed. The producer had the option to adjust color characteristics including hue, saturation, color balance, contrast, lightness, and black level (setting and determining the darkest point in the shot). The tedious task of checking each shot against the next and adjusting the above color properties took weeks to perfect. The over exposure problems of the balcony camera could only be minimized, not corrected

completely, and so the producer was forced to achieve a satisfactory result with the material given.

This process of editing, refining, and color correcting remained identical for all three songs in the band version and the dance version as well. Because the dance version only showcased the dancers and the featured spotlight couples, there were fewer opportunities to cut to different shots since footage of the musicians was not used. This being the case, the cuts did not occur as rapidly as in the band version, and so the pacing was slowed. However, since the viewer was focusing on the engaging dance routines presented, the dance version appeared to move quickly and the change in pacing was hardly perceived.

The construction of the multi-angle versions proved even simpler, as the static cover shot for each song was used, which allowed the viewer to switch seamlessly between angels during the band version on the DVD. To prepare the different angles, one continuous shot from each camera was synced to the audio and placed in the timeline. The only transitions that occurred were the fades at the beginning and ending of each song. Color correction was applied to the entire segment, without having to compare strings of different shots to one another. When all angles were in order for each song, the editing process was complete. The producer now had three separate timelines featuring the band, the dancers, and the multi-angles, one for each version presented on the DVD.

Video Postproduction: Multi-Angle Instruction

A fourth timeline was assembled for the dance instructional portion. Each different move taught was digitized separately for individual encoding purposes during the DVD creation. As detailed earlier in this chapter, the instructors' audio was recorded directly onto the tape with two different microphones. This made syncing easy since the video was digitized into the Avid with the audio intact. Digitizing both audio and video together eliminated the painstaking process of lining up the two tracks separately in an effort to match lip sync with recorded speech. Once all of the moves were placed on the timeline, the overhead camera footage was digitized and lined up with the original pieces to match their time code positions. The shots from the camera shooting close-ups of the dancers' feet were eliminated due to their striking similarity to the full body shots. With two pairs of feet moving around each other, the camera could not get in a tight enough shot to justify adding the close-up as an additional angle for the viewer to select. Fades were added at the start and finish of each instructional segment, and the names of the dance instructors were inserted at the introduction of each move with the Avid title tool. When these finishing touches were added to both the full body and overhead angle shots, the fourth and final timeline was complete.

Video Postproduction: CineLook

Even with the aid of color correction, the sequences still retained what can only be described as a certain "video" look. Footage shot on a video format appears drastically different than material shot on film. Film has a softer grainier feel with deep contrasts in the image, while video possesses a harsher more hard-edged feel that almost

appears staged or fabricated. Since the band and dancers were lit with full illumination casting no shadows, the video look was further exacerbated, marring any sense of depth in the image. Stephen Schleicher, a video production professor at the American InterContinental University in Atlanta, Georgia, explains that "with the limitations of video, you can get close to a 'shot on film' look, but the footage still lacks the subtle nuances that comes from film" (Schleicher, 2001, "CineLook"). For those producers lacking the time or money to enhance their footage at a postproduction house, multimedia company DigiEffects created CineLook.

CineLook was a software plug-in that partnered with Adobe AfterEffects to simulate the look of film for video footage. CineLook allowed manipulation of countless presets including type of film stock, amount of grain, contrast, motion blur, time slur, or even options for adding defects such as light damage or stain to the simulated film. Short segments of the band version were exported from the Avid and imported into AfterEffects to experiment with the different attributes. The key problem here became rendering time. It took hours just to render the effects on a short test segment, only to discover that the test did not look good anyhow. After nearly a week of seemingly fruitless experimentation, the decision was made to stop fumbling with CineLook and take the footage to a professional postproduction house.

Video Postproduction: Tape-Tape Transfer

The final timelines were then redigitized into the Avid at high resolution and laid off to tape. Each version was laid off to a different BetaSP tape at the same time code position. In order for the multiple angles and dance versions to sync up with the music

on the band version, the time code had to exactly match when encoding for DVD. This essential step allowed the DVD viewer to switch seamlessly between angles during the performance. At the end of the session, eight tapes were ready to send to the postproduction facility: band version, dance version, four separate angles, and the studio dance instruction plus overhead angle.

At postproduction house GTN, Inc. tape-tape transfer was utilized to soften the "video" feel of the sequences. The DaVinci color corrector was engaged in order to achieve this look. The image on the tape was digitized into DaVinci, which then marked the shot changes automatically. Going shot-by-shot, it changed color, contrast, luminance, and focus, making the image the best it could be. During the transfer, GTN assistant colorist Tracy Mobley emphasized, "No matter what you bring in, we can always make it better." After completion of the process the footage was laid off to D5, a high quality professional digital video format used for broadcast work. When the last tape-tape transfer finished, the video footage was now prepped for the encoding process of DVD creation.

CHAPTER FIVE:
DVD Creation of "Swing Into DVD"

Creating a DVD is a daunting task. There is much more to producing a successful DVD title than simply using a DVD authoring program. The actual authoring of a DVD disc becomes one of the many steps involved in the DVD premastering process, or taking the video and audio assets and turning them into a final DVD disc image. This begins with the project's concept and design, following all the way through to the release of the DVD title into the consumer market. Since "Swing Into DVD" was not intended for commercial wide-release, this discussion traces its evolution up until the stage of distribution.

Content Creation

There are five basic steps to DVD creation that can be loosely grouped into the following categories: project planning and content creation, compression and encoding, authoring and multiplexing or formatting, replication and distribution, and an analysis step added for this thesis production. With so many options available through the DVD medium, the planning phase was critical in outlining the scope of the project. Covered in the chapter on Concept and Design, that stage answered the fundamental questions concerning the degree of complexity, proposed use for education and entertainment, and level of interactivity, among other issues. This outline identified what the DVD was supposed to do and expanded upon how to use DVD technology to achieve that goal. For content creation, all video, audio, and still image assets were acquired. This involved recording and mixing the audio, shooting and editing the video footage, and creating

graphics, still photo files, and menus. All of these assets were fully prepared in final form before committing them to disc.

A DVD menu is a 24-bit still image file converted to an MPEG-2 still with a subpicture overlay file associated to it that allows the user to interact with the content presented (Forrester, 2001, "Motion Menu Tutorial"). Subpictures are graphics that are overlaid on top of the video image and are used to create the button highlights in menus (LaBarge, 2001, p. 99). Colors and transparencies of highlights are determined during the authoring stage, to be discussed later in this chapter. Menus can also consist of full motion video along with the subpicture information, identical in function to static menus. This thesis project utilized still menus in order to conserve disc space to make room for more audio and video content. Navigating the menus enabled the user to access each song version, select specific dance instruction, view bonus features, or specify which audio track to listen to. The menus were designed and created in Adobe Photoshop using still photographs of the band and dancers taken at past events.

With Adobe Photoshop's vast array of image modification tools and effects palettes, the menus were carefully constructed using a combination of text and graphical elements. The menu navigation had to be clear and the text or instructions displayed needed to be succinct. When constructing the menu text and deciding button verbiage, multiple commercial DVD titles were consulted to gather a sense of their common structure and composition. To maintain a strong sense of continuity across the menus, similar design principles were employed on each page. This sense of consistency became important to the polished presentation of the disc. After all, the menus were the first elements a viewer encountered when watching the DVD, thus establishing the tone of the

disc. Thirteen unique menus were developed for use in "Swing Into DVD," reproduced in black-and-white in Appendix A. The main menu featured four categories from which to choose: Stage Show, Dance Instruction, Bonus Material, or Audio Setup. The Stage Show menu branched into two additional menus, one for the band version and one for the dance version. The menu featuring dance instruction lead to two select-a-move menus, one listing basic fundamentals and the other offering advanced moves. The Bonus Material menu offered paths to four sections: Behind-the-Scenes Still Galleries, Credits, Special Thanks, and RSO Info. The only stand-alone menu was the Audio Setup, which did not branch to another screen.

The pixel dimensions for a screen image for DVD are 720 by 480 in RGB color mode with a screen resolution of 72 dots per inch (Forrester, 2001, "Motion Menu Tutorial"). A "safe title" template is used in Photoshop to indicate what portions of the image a television monitor can show in order to keep text visible on the screen (Figure 3). The menu image is assembled within the boundaries of the safe title box and saved as a tiff file for encoding purposes. Each menu has two files: the actual menu image and the highlight information for the subpicture overlay on top of active buttons. This overlay image only consists of the text, images, or areas to be highlighted in the form of white highlights on a black background (Figure 4). Anti-aliasing is not allowed, as the image must be clean in order for the subpicture to produce an accurate highlight in the authoring stage. The final tiff files must be flattened in Photoshop, with no additional layers or channels saved to the file. Any extra elements present will cause image errors on the DVD, and the tiffs will have to be corrected and re-encoded.

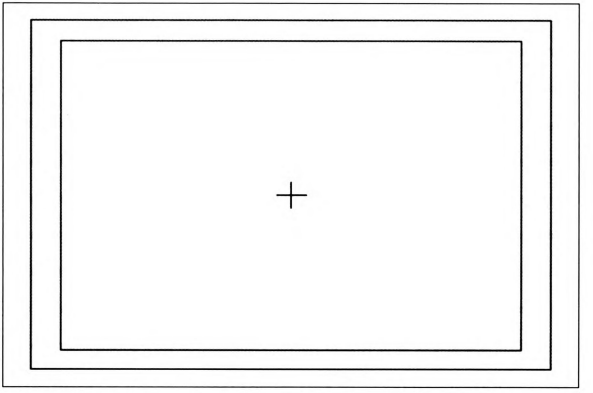


Figure 3. Safe Title borders for DVD menu creation

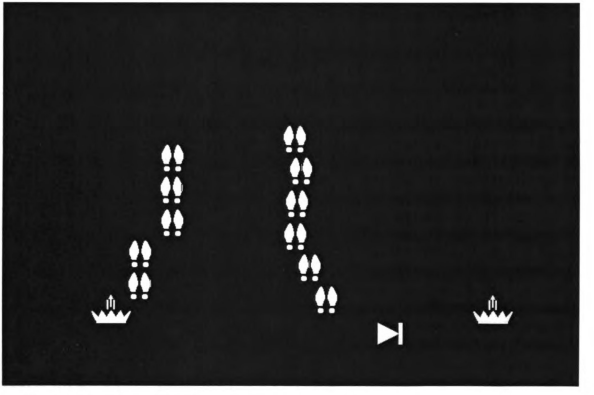


Figure 4. Subpicture Overlay Image for menu button highlights

Every photograph appearing in the still photo gallery segment needed to be prepared as a tiff file as well. Once a suitable background was designed, each photo was cropped, positioned, and bordered to make the gallery more visually appealing. The photos were flattened and saved as tiff files for encoding. However, unlike the menus that had individual highlight files, the entire photo gallery only required one highlight tiff for all images. This was because the photos were placed upon the same background when viewed in turn. Since the background and navigation controls remained unchanged as the images changed, only one highlight file was required for use with every image. Due to the large volume of photos, the still image gallery was broken up into five subsections featuring a handful of shots from the different areas of production. The viewer selected to view the series of stills featuring the orchestra, the dancers, the setup, the crew, or the instructional shoot. Dividing the images in this way broke up the monotony of scrolling through dozens of pictures before returning to the menu.

Compression and Encoding

The prepared video and audio assets must be compressed in order to fit onto a DVD disc. The second step of the DVD creation process is encoding, or moving assets from tape format onto a hard disk to become computer assets used in creating the DVD. Using Sonic Solutions DVD Creator 2.1.6 the video footage was captured from D5, a broadcast quality professional digital video format preferred for encoding at GTN Inc., fed into the Encode application, and converted in real-time into MPEG-2. MPEG-2 is the standard required by the DVD specification, and is able to be copy protected and region coded. MPEG-2 compression analyses the repetition in the incoming video signal and

eliminates this redundant information viewers would not see anyhow, squashing it down so it takes up less space. This compression algorithm can sort out 97 percent of the data in a video signal without a significant loss of picture quality (Khurshudov, 2001, p.195). Besides encoding, the compression process can also be done through software transcoding, taking a computer based video source on a hard disk such as a QuickTime or AVI file, and converting it into MPEG-2 for DVD use. However, transcoding can be an extremely lengthy process, often taking fifty minutes to compress only one minute of video. Encoding is completed in real-time, and was the process used for this project. Before entering the Encode application, the footage was run through a Digital Video Noise Reduction processor used to clean up noisy video signals prior to compression, maintaining the quality of the original source (LaBarge, 2001, p.86).

To begin the encoding process, a clear estimate of how much data storage space needed for each asset was required. Since "Swing Into DVD" was created on a 4.7G disc, this figure was necessary to ensure all elements would fit onto the disc. A mathematical process called bit budgeting calculates the total storage space required of all assets and determines whether it meets or exceeds the total capacity of the DVD disc. "The goal of bit budgeting is to determine an optimal combination of compressed video and audio asset quality as well as total data storage capacity required" (LaBarge, 2001, p.72). Once the storage requirements for the audio, video, static menu, subpicture, and still image assets are determined, an extra five to ten percent is added on top of that figure to allow for overhead and late revisions. Projects like this one that include multi-angle video and multiple audio tracks require extra allowances for overhead. The bit rate for encoding the assets can be determined when the bit budget is calculated.

The bit rate regulates the picture quality and the amount of video on the DVD. Set as an encoding parameter, a higher bit rate results in a higher quality compressed picture. However, higher bit rates decrease the amount of video that can be stored on the disc. Most major motion pictures can fit on a single layer 4.7G disc using an average bit rate of 4.5 megabits per second, where only 60 minutes of video can occupy the disc at the highest quality setting of 9.8 Mbps (Sturgill, 2001, "Compression"). 9.8 Mbps tops out as the maximum allowable bit rate in the DVD spec, yielding the highest quality picture and taking up the most amount of space. Ideally, the bit rate set on the encoder should be the highest possible value that still allows all assets to fit on the disc.

The encoder also needs to be set for either a constant bit rate or a variable bit rate. With a constant bit rate, or CBR, video is encoded in a single pass using the chosen bit rate for the entire piece. A variable bit rate, or VBR, varies the amount of data used per frame of video to meet the demands of the source video. VBR will accommodate the situation, allocating less bits for less action, and more bits for areas of rapid motion that prove more difficult to encode. The advantage of a VBR encode is that the video results are perceived as the same in quality and appear smooth; whereas a CBR encode risks source quality drops when the video requires more bits. A VBR encode is preferred for lengthy source material because more video can be packed on a disc than with CBR (Sturgill, 2001, "Compression"). For this project a two-pass VBR encode was selected, where the encoder analyzed the entire source with the first pass and allocated bits accordingly on the second pass.

The target bit rate calculated for "Swing Into DVD" was 4.8 Mbps, setting a minimum at 2.8 and a maximum at 7.8. The bit rate remained relatively low during band

cover shots and musician close-ups, and spiked sharply higher to accommodate the swift motion during shots involving dancers. During the studio dance instruction, significantly less was happening in the shot, so a lower bit rate was maintained throughout without a perceived loss of quality. However, because the maximum allowable bit rate for titles with two to five multiple angles could not be greater than 7.8 Mbps additively, including video, audio, and subpicture data (Ely & Block, 1998, p.36), the bit budget had to be recalculated. Upon recalculation for the four proposed angles, the bit rate dropped to an unacceptable 2.0 Mbps. To gain a higher bit rate, the decision was made to cut two angles, still granting the viewer access to two remaining angles on the DVD. Bringing the bit rate up to a target of 3.8 Mbps, tests were performed and checked for image quality. Still unsatisfied, the decision was made to cut the multi-angle feature from the main video in order to deliver the best presentation possible. This revision proved worthwhile, and the resulting bit rate climbed to 7.8 Mbps. The multi-angle feature was limited to use during the dance instructional segment, and with less action occurring in the studio, both angles were preserved without a drastic reduction in quality. Motion menus, an intro animation, and audio transitions between menus were also cut from the original project due to disc space limitations.

Just as the video encode parameters are set in Sonic Solutions' Encode application, the audio settings can likewise be specified. Delivered on DA-88 digital audio tape, a format widely adopted by the video postproduction community, and the format required for ultimately encoding the audio for use on the DVD, eight channels of audio were routed to the encoder. The application was configured for encoding 5.1 surround, and the separate channels were assigned to match the configuration on the tape:

left front, center, right front, left surround, and right surround. The Dolby Digital setup was selected with an audio bit rate of 256 Kbps. Dolby Digital is an efficient high quality perceptual audio coding system covering a wide range of data rates originally developed for multi-channel digital sound in the theatre. "Perceptual coding is a compression technique that eliminates data in the audio signal that can't be perceived by the human brain" (LaBarge, 2001, p.89). It is generally recommended that the data rate for encoded audio should not exceed 448 Kbps in order to play back correctly on all DVD-Video players. The selected audio bit rate of 256 Kbps for this project allowed for disc space conservation, while still delivering high quality audio to the user. The Dolby Digital audio was encoded as the video assets were, with time code exactly matching that of the video clips. After the 5.1 encode, the audio settings were changed back to a standard stereo configuration, and the stereo mix on the remaining two channels of the DA-88 was then encoded to include on the DVD for users not possessing a surround system setup. The thirty-second music loops that played behind the menus were also encoded in stereo one at a time from D5.

DVD Authoring

DVD creation moves to the third step of authoring and formatting after all assets are encoded to the hard disk. Authoring in a DVD sense can be defined as the process of assembling all of the video, audio, subpicture, and graphical elements and building interactivity into a final format to create the DVD disc image. Each of the encoded files is brought into the authoring environment and compiled along with navigation to comply with the DVD spec. The greater the degree of interactivity involved, the more complex

the project. Authoring defines how the elements are going to be linked together and which portions will have interactivity. A software program is required to create this structure, and can range from consumer applications with limited functionality to professional programs like Sonic Solutions' Author application used here which offers access to system and general parameters for building complex navigation and interactivity (LaBarge, 2001, p.185).

Upon launching the authoring program application, the parameters of the project were defined and were used to define the structural elements of the layout. "Swing Into DVD" was outlined as a movie title on a single-layer disc with no region coding restrictions placed upon it. Graphical representations of the video objects were assembled here to visualize the tree-like branching structure of DVD interactivity and to indicate how media files related to one another through navigation. The media assets were imported into the program including all MPEG-2 files along with multiple angles, all Dolby Digital surround and stereo audio, and all graphic files for the menus and still galleries. Graphic tiff files were imported individually, and encoded as MPEG-2 still images.

In the authoring environment, presentation objects were utilized to create a graphical layout of the DVD structure. Examples of this layout can be found in Appendix F. Each media element was placed inside one of a variety of presentation object types. This project was comprised of Program Chain, Video Manager, and Title Set constructs to define functional interactivity. The first Program Chain did not contain any media elements, but was the essential starting point for control when the DVD disc was first inserted into the player. With multiple angles and different video segments to

choose from, three Video Manager objects were needed to direct the navigation among the various Program Chains. The Video Manager contained the DVD's menus and functioned as a table of contents for all data elements on the disc (LaBarge, 2001, p.177). The Title Sets included the video and audio media elements, and acted as chapters the user selected to view. All of the above objects and information were stored within the DVD Volume, the top level of organization on a DVD disc.

Program Chains, or PGCs, direct the way in which a DVD plays back video and dictate navigation through the data on the disc. Each PGC consists of a Pre-Command, a group of programs, and a Post-Command. These commands put together a script to perform an operation. When control is passed to a given PGC, the Pre-Commands are executed immediately before accessing the contents of that PGC. Pre-Commands set conditions such as which audio stream or video angle will be played or whether the "play all" option has been selected that determine the behavior of the program presented. After the program contents are played, Post-Commands can be included to return to a main menu, automatically jump to another clip, or perform any one of up to 128 different navigation commands (LaBarge, 2001, p 200). PGCs can also store general and system parameters, or variables, in the DVD player's memory.

Every button on each menu must be programmed to achieve the intended result when the user presses "enter" on the DVD remote. In order for the correct selection to take place, the developer must combine navigation commands with system parameters and general parameters, scripting lengthy program chains of instructions. When the subpicture has been defined, the developer outlines the button area regions with the cursor. "A button highlight is defined as a rectangular region of the screen which can

have a color and transparency for both a selection and an action" (Ely & Block, 1998, p.20). The assigned buttons are then linked together by drawing arrows between them to correspond with the arrows on the DVD remote control for on-screen navigation. The button areas themselves are made transparent so they are invisible when viewed, and colors are selected for the button's selected, activated, and normal states. Each button area can then be assigned one navigational command, most commonly instructing the DVD player to jump to the media element corresponding to the button.

Advanced Authoring

> The major functional difference between mid-range and professional DVD authoring software tools is support for the navigation features of the DVD-Video specification. While all authoring tools offer support for features like the Next, Previous, Up, Down, Left, and Right buttons [on the DVD remote control], only advanced systems allow the DVD title developer to access the built in SPRM and general parameter registers (GPRM), and use them to develop complicated and highly interactive titles (LaBarge, 2001, p. 185).

All DVD-Video players are equipped with two kinds of memory parameters the DVD developer can read and write to with advanced DVD authoring tools. Accessed during playback, the system parameters are used by the DVD player to remember default settings such as language, angle number, audio stream number, and highlighted button number. These SPRM numbers change as the user navigates through different segments of the DVD. For example, when the user presses the "angle" button on the remote control during the dance instruction, the SPRM is updated with a new stream number and the overhead view, angle 2, is displayed. The user may also change the audio stream SPRM number by pressing the "audio" button on the remote or by accessing the "Audio

Setup" menu on the DVD and selecting either 5.1 Surround (default) or Dolby Stereo (SPRM 2).

General parameters can be used to increase the interactivity of a DVD title. GPRMs can compare GPRM values to another GPRM, SPRM, or set fixed value determined by the developer. These parameters are useful when executing complex navigation commands based on the user's customizable DVD experience. Navigation commands in combination with SPRM and GPRM registers can perform such functions as keeping game scores or skipping material the user has already seen. Multiple strings of navigation commands can be scripted in the Pre and Post-Command areas, but only a single navigation command can be associated with a cell or a menu button. When programming complex interactivity, this single command restriction may become tedious. If more than one command needs to be executed when a menu button is selected, the button can link to a Dummy Program Chain. To group multiple commands together or to move between Title Sets, Dummy Program Chains are employed. A Dummy PGC does not include media elements that will ever be seen by the viewer, but is used only for its Pre and Post-Command areas (Ely & Block, 1998, p.20). "Swing Into DVD" utilized two Dummy PGCs to facilitate the "play all" functions of the songs and instructional dance moves.

Five GPRMs were developed for "Swing Into DVD" to expand the interactive capabilities of the project. GPRM 0 kept track of which menu the user last accessed in order to highlight the correct button section upon returning to the main menu at any point in the DVD. For example, if the viewer selected the "main" button from the "Credits" page, he expected to be returned to the main menu with the "Bonus Material" section

highlighted, and not the "Audio Setup." GPRM 0 made sure all sections returned the corresponding highlight on the main menu so the user did not lose track of where he had been. GPRMs 1 and 2 were both used in conjunction with the Dummy PGCs to transition between Title Sets. In order to access the credits, thanks, and still gallery from the "Bonus Material" menu, the buttons linked to a Dummy PGC which than jumped to the chosen Title Set. Title Set 1 contained all of the video assets, Title Set 2 included the still images for the "Credits" and "Special Thanks" pages, and Title Set 3 consisted of all 88 images in the Behind-the-Scenes Still Galleries. GPRMs 1 and 2 kept track of what Title Set to jump to and where to return. GPRMs 3 and 4 were used to tell the DVD player whether to turn on or turn off certain functions. GPRM 3 designated whether or not the user selected the "play all" option for either the stage show or the dance instructional moves. GPRM 4 indicated if the "white rabbit" version of the dance show had been selected.

All of the interactivity, subpictures, and highlights discussed thus far are not restricted to usage by menus only. These features are available to be programmed during media element play as well (Ely & Block, 1998, p.21). For example, a movie may be playing back when a subpicture appears, indicating a choice the user can make to view behind-the-scenes footage for that segment before returning to the film. This "white rabbit" technique made famous by Warner's The Matrix DVD title was employed to enhance the interactive experience of "Swing Into DVD" during the dance version of the stage show. When the "dancing footsteps" subpicture graphic appeared (Figure 5), the user had the option of pressing "enter" on the remote control and jumping into the studio to learn the dance move presented. When the instruction was finished, the user was

returned to the stage show in the same place he left off to watch the couple perform the move. The "dancing footsteps" appeared again in case the user did not learn the move the first time.

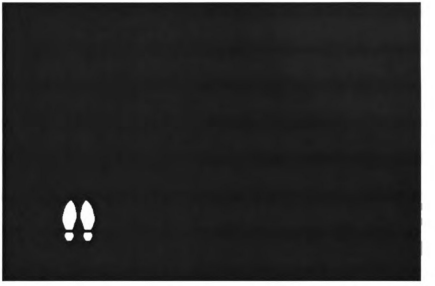


Figure 5. Subpicture Overlay Image for "White Rabbit" feature

The "dancing feet" highlight acted the same as any other menu button, executing a jump command that took the user to the corresponding PGC containing the instructional dance move presented. When the instruction finished, there is a Post-Command to take the user back to the segment of video from which he came. This predetermined entry point occurred just before the point the feet appear, and gave the user another opportunity to view the instruction again if desired. The Post-Command after the instruction simply jumped back to the specified chapter point in the dance show.

Multiplexing or Formatting

During the authoring process it is important to simulate the project and check for possible errors along the way. Sonic Solutions provides an emulation program called Proof that allows the project to be played from the hard drive as if it was an actual DVD. A virtual remote control with operational buttons appears on the screen in order to test menu navigation, simulating exactly how the DVD should appear to the end user. Although certain problems with emulation programs can surface, it still proves a decent way to check the entire project, fix problems, and to hone the title to final satisfaction. Programs usually display a Navigation States window showing all SPRMs, GPRMs, domains, button highlights, and more to aid in discovering programming errors. "Swing Into DVD" was checked thoroughly for audio and video sync, menu navigation, and video quality before proceeding to the formatting stage.

Once the project was verified as complete and fully functional, it was formatted into a form the DVD player could recognize and play. Formatting the DVD for playback, or multiplexing, converted the raw elementary streams of MPEG into a finished DVD Volume (Nazarian, 2001, "Multiplex the DVD"). This conversion of all video, audio, subpicture streams, graphics, interactivity, and navigation took place in the software process with Sonic's Format program. Multiplexing lasted nearly the real-time length of the DVD, as the program finds all relevant source files and builds the DVD Volume. When formatting was complete, the DVD Volume was burned to a DVD-R ready for use on a DVD player or computer. "Swing Into DVD" left the DVD creation process here, skipping the replication and distribution step and proceeding to the final analysis step for the culmination of this thesis project.

CHAPTER SIX:
Analysis and Conclusions

Audience

With the production stage finally completed, "Swing Into DVD" was ready for evaluation as a potential DVD title. Countless lessons were learned during the creation process, but the finished product provided the key to understanding its ultimate success in terms of content and design, technical merits, and overall presentation. In order to validate the analysis and to gain a firmer grasp of the potential success of "Swing Into DVD," feedback was solicited from a diverse sampling of people both affiliated and unaffiliated with the project. 31 participants were selected, and included sixteen media professionals currently employed in the industry, nine college students and lay people, and six dance enthusiasts. These groupings were chosen in order to generate a wide variety of responses concerning the content, aesthetics, and technical aspects of the DVD.

Each participant received a copy of the DVD along with a voluntary survey questionnaire to be completed after viewing the project. The survey was designed to elicit responses to aid in evaluating the design, content, and effectiveness of "Swing Into DVD," and can be found in its entirety in Appendix G. Some prior experience with the DVD medium was assumed, and the majority of the participants on average owned between one and thirty DVD titles and spent from one to five hours watching DVDs per week. 59% of the group had been exposed to a music, concert, or stage performance DVD before, and 89% would consider purchasing such a DVD title. With the audience's general DVD behaviors thus defined, the survey focused on the evaluation of this thesis project's success.

Objective

"Swing Into DVD" was designed for entertainment, educational, and promotional purposes. It entertained through the use of flashy menus and a three-song stage show, educated with interactive dance instruction, and promoted by focusing on the orchestra and displaying the band's web address to access additional information. One reviewer pointed out, "I was unsure if the objective of the DVD was to promote/showcase the Rhythm Society Orchestra or to teach swing! It did a bit of both but not enough of any one." The project did not delve deeply into any one of the three intended goals described above, but merely offered viewers a glimpse of its potential to deliver these objectives. As a creative thesis project, "Swing Into DVD" was not developed as a commercial title aimed at completely fulfilling all of these roles. Instead, it functioned to illustrate how the DVD medium could revolutionize the way content is delivered, merging entertainment, education, and promotion into one product.

When asked to describe this DVD experience, participants responded with words like "fun," "enjoyable," "catchy," and "entertaining," supporting the entertainment objective of the project. Others felt it was "informative," "interesting," and "involved," indicating effective communication of the educational or information bearing aspect of the disc. "Unique," "inspired," and "classy" spoke toward the overall project as an entire package, evaluating the DVD as a positive all-around experience. In addition to these descriptors, the majority of respondents ranked their general enjoyment of the DVD as "above average," further supporting the argument in favor of the project's overall success as a DVD title. The DVD was also moderately successful in its promotional objective,

although promoting swing music in general returned higher numbers than promotion of the band itself. On average, most participants recorded a one-point increase in their interest in swing music after viewing the DVD. For example, if their general interest started out as "average" before viewing the disc, their interest increased to "above average" after viewing. This indicated that the content was presented in an effective manner to engage the audience and peak their interest.

Content

Were "Swing Into DVD" destined for commercial release without the restrictions of disc capacity or equipment and budgetary limitations, the project would have proceeded differently. Due to resource availability at GTN Inc., this thesis production was restricted to a single layer single-sided DVD-5, although most current DVD titles are produced on DVD-9 discs. Because of the decreased storage capacity of the DVD-5 the project was scaled down in order to accommodate the limited space. The survey participants recorded hardly any complaints in terms of existing content, but they also expressed a desire for more features and expansion of the content presented. When asked what additional features they would like to have seen included, respondents listed a behind-the-scenes documentary, director's commentary track about the making of the DVD, history of swing and information on swing culture, glossary of dance terminology, animated menus, additional camera angles during the stage show, and more songs in the concert. These were all valid suggestions deemed appropriate for this project given a DVD-9 to work with. A dual-layer disc also would have allowed for the inclusion of additional angles during the band's performance.

Content limitations resulted not only from available disc capacity, but also from time constraints. Several hours of behind-the-scenes footage had been shot at nearly every phase of the production process, but proved too lengthy to sort though after countless weeks of editing the stage shows. Time and space simply ran out before a full-length DVD could be produced. However, the resulting project presented a significant enough volume of material to engage the viewer successfully, earning high marks of praise from all reviewers. One participant summed it up nicely stating, "I think this DVD successfully caters to swing enthusiasts," pointing out that the project also entices non-dancers and "gets them interested," and concluding by praising the DVD's "good flow and great concept." Further, 89% of the reviewers indicated that they would watch this DVD again, and 93% said they would recommend the title to a friend. These high percentages also showed that the content presented was considered entertaining and valuable enough to warrant another viewing and earn a recommendation.

Instructional Value

For ideally effective dance instruction, human teachers are needed to demonstrate dance steps and to model body positioning. "Swing Into DVD" successfully presents a clear image of the dance instructors, just as they would be seen in a live studio dance course. However, even with the added benefit on an overhead angle for body alignment, the DVD lacks one crucial element for effective dance instruction: feedback. In a live studio setting, the dance instructor focuses on each couple and critiques their postures so they may practice executing the move in the correct manner. Learning to dance by watching a DVD may benefit the social dancer who simply wants to learn some basics of

fundamental movement, but proper technique might still be lacking. On the other hand, an experienced dancer who already possesses the proper form techniques may need only to see the move demonstrated on the DVD before mastering the complete movement. However, the purpose here is not to compare DVD with live instruction, but to evaluate the effectiveness of "Swing Into DVD" as an instructional tool.

One survey participant commented, "I watched this with a friend who has taken lessons at a dance club and she felt this was a great back-up item to use for people who may be shy about trying to learn in a group atmosphere." This observation highlighted another distinctive benefit of DVD as a dance training tool that could also be said of video instruction in any form. Viewing the DVD allowed people to learn and practice dance moves within the comfort of their own homes. Potential dancers who were intimidated by crowds or were self-conscious and would never consider enrolling in a group dance class could practice in private. Watching instructors on the DVD not only afforded the viewer the opportunity to learn at his own pace, but also had the potential to boost his self-confidence and motivation.

Repetition and imitation became the effective learning methods for "Swing Into DVD." According to the survey, participants felt they needed to watch the instruction an average of four times in order to learn and apply the demonstrated dance moves. The number of viewings required was directly related to the user's own ability to pick up the new dance steps; as one reviewer pointed out, the "value of dance instruction depends on your personal coordination." Every person learned at a different rate, and this DVD allowed an infinite number of repeated viewings without the hassle of rewinding videotape. Some reviewers commented that they thought "a slower paced DVD would be

beneficial to beginner dancers" and "the teachers offering instruction moved too quickly for me to be able to pick up anything." It would be valuable to the learner if the dance moves were broken down further into individual steps for more precise instruction. If each instructor explained the steps comprising each move in a systematic step-by-step manner, the user could build a firmer grasp of proper technique and foot placement, making it less "difficult to follow." Perhaps a slower, clearer rate of instruction with an added optional loop-playback of the demonstrated move would boost the effectiveness of the studio instructional segment. However, not all participants shared the pacing criticism, and many commented on the "good instruction and variety in instructors." The wide range of teaching styles clearly made the instruction more interesting from move to move; but even so, hiring professional instructors for the DVD could have improved the pacing and clarity issues discussed above.

The addition of the overhead angle was generally considered very helpful in terms of demonstrating body positioning. With a value of one being the highest, survey participants ranked the overhead camera at an average of 2.3 in terms of its helpfulness, leaning toward the "above average" point value assessment. This feature visibly fulfilled its intended purpose on the DVD, and proved an exceptional use of the DVD spec. The only negatives relating to the overhead angle had to do with camera framing. The ceiling of the dance studio was not incredibly high, and so the mounted overhead camera could only zoom out to fully capture a limited area on the dance floor. Because of this, the dancers were restricted to a small box within which to demonstrate moves, outlined by masking tape on the floor. During shooting, several takes were required in order to adequately record the dancers without one or both partners leaving the frame at some

point. Many of the moves simply covered too much area on the floor to keep the dancers contained within the taped box. Several reviewers attempting to learn the dance moves noted that "the overhead cam wasn't always positioned well to see all of the dance steps—dancers left frame." In addition to better framing or a higher ceiling, an additional angle may have proved helpful to the learner as well. Another camera functioning as a third angle option could have been positioned on the opposite side of the dance instructors so the viewer could select the reverse view for both the lead and the follow.

Advanced dancers who viewed the DVD made no negative remarks regarding the value of the dance instruction, which lead to conclude that the DVD needed to cater more toward the beginning dancer as well. A beginner stated, "the dance instruction assumed some prior dance experience, of which I have none," while others wished to see "more instruction or stages for the dances" from beginning through advanced. Similar comments such as "the teaching swing wasn't basic enough for my tastes" and "perhaps have some swing basics before advanced moves" emphasized the need for clearly defined levels of dance instruction tailored for the appropriate skill sets. Distinct levels for beginner, intermediate, and advanced should have been added, starting with the "basics" screen when navigating to the studio instruction from the menu. Users could then master the basics first before continuing on to the intermediate stages, where the pacing of instruction could increase.

Despite the few criticisms expressed, 69% of the survey participants ranked the instructional value of the DVD as "above average." They spoke highly of the "good instruction section" and described it as "motivational to learn swing," even though "Swing Into DVD" provided only a small sampling of DVD's ability to function as a

virtual instructor or trainer. With the instructional value of this thesis rated so highly among reviewers, dance enthusiasts may turn to instructional DVD titles in the future to avoid costly enrollment fees charged by local dance studios. Of those who had viewed instructional videos before, all agreed "Swing Into DVD" was equal in the quality of instruction delivered based on other programs they had seen. 37% said they would purchase this or similar instructional DVD titles if offered at prices comparable to other instructional videos, 33% remained unsure, and 30% declared they would not. With a few improvements and modifications revealed through the survey process, "Swing Into DVD" could stand as an early example of the potential future of dance instruction and physical training.

White Rabbit Feature

The "white rabbit" instructional feature during the dance version of the stage show was conceived to offer users an interactive viewing experience, utilizing the DVD spec to present a new form of active participation in the stage show presentation. The option to see a move executed, select to view its break down in the studio instruction, and then return to the show to witness its placement in a real dance environment was intended to enhance the viewer's experience and draw them further into the content presented. Instead of a typical behind-the-scenes piece playing upon selection of the "dancing feet" subpicture highlights, this DVD presented a different spin on the concept, offering a "behind-the-move" feature where the showcased dance move was explored and taught. The success of this unique feature was revealed through the survey questionnaire user responses.

93% of those surveyed indicated that they liked the inclusion of the "white rabbit" feature and did not feel it interrupted the stage show, but only enhanced the experience. Only one participant felt that the "dancing feet" graphic "could have been smaller to be less distracting if only watching the show." Since the majority of the reviewers heralded the feature, and extra selection could be added giving users the option to view the dance version with or without the "white rabbit" feature. That way, interested dancers could utilize the instructional aspect of the added feature, while non-dancers wishing to sit back and watch the stage show could opt to turn the option off. Additionally the "white rabbit" menu screen could clarify the function better, as some participants were unaware that the instructional footage had multiple angles until they visited the "Dance Instruction" menus. Some DVD player models indicated when additional angles were available for viewing with a little "angle" icon in the upper left corner of the screen. Apparently, not all players showed this, and so the menu text should define the angle availability as well.

One media professional reacted to the "dancing feet" appearing again when the user returns to the dance show after the studio instruction, suggesting the show should instead "resume after the highlight." While this method may be the standard on feature film DVD titles, the purpose was different for this instructional title. When the instructional segment finished, the user was returned to the stage show at the point they left off in order to see the move executed by the dancers on stage. The "feet" highlight again appeared, giving the user yet another chance to view the studio instruction. The DVD was programmed this way due to the nature of instruction. If the viewer wished to see the move taught again in order to practice, he could select the option again. Earlier it

was indicated that participants felt multiple viewings were necessary in order to learn the dance moves presented, so the reoccurring highlight enabled users to watch the instruction again.

93% of the participants felt that the "white rabbit" feature was beneficial to the instructional process, and 44% indicated that it was the most interesting or entertaining segment on the DVD. Based on this and the above collected data, tailoring the "white rabbit" feature for instructional application proved to be very effective. Utilizing this ability of the DVD spec made the dance version of the stage show not only more exciting to the viewer, but also enhanced the instructional value of the DVD.

Promotional Value

DVD has the potential to become the next big promotional medium, similar to the CD or CD-ROM of today. Instead of giving agents and producers a demo CD, bands could potentially hand out DVDs the size of business cards, including sample music tracks, broadcast quality video, and even hybrid links to web content. "Swing Into DVD" did not get that sophisticated on the promotional applications, but it did include a web address to the band's website where users could access additional information about the band. The reviewers' desires to pursue more information about Paul King and the Rhythm Society Orchestra were directly related to their interests in swing music. The audience was roughly split, with 52% interested in finding out more, and 44% not interested, while 4% abstained. Out of those who saw the web address, 70% said they would log on to the website, while 30% said they would not. 26% of the entire sample failed to explore the DVD thoroughly enough to find the web address. This lead to the

conclusion that "Swing Into DVD" may have been useful as a hybrid DVD able to link directly to the band's website if placed in a DVD-ROM drive. Its promotional use via the Internet could potentially rank much higher than its stand-alone promotional applications. 70% again expressed interest in either seeing the orchestra live in concert or purchasing a CD, illustrating the potential promotional use of the DVD could indeed be viable.

Technical: Video Quality

From a technical standpoint, the challenges faced during production were numerous. For all of DVD's acclaimed versatility, a number of the medium's limitations came to light at various stages in the creation process. With the completion of "Swing Into DVD," many of these weaknesses became trivial, overshadowed by the overall success and presentation of the project. However, certain technical issues still surfaced and were apparent in some of the questionnaire responses. The most obvious visual critique of the DVD was that of image quality. Due to the very nature of compression and maximum allowable bit rate allocation, the encoded video did not look as good as the original source video. The DVD medium boasts superior picture quality when compared to other video mediums such as CD-ROM or VCD; however, quality issues still remain. One reviewer who watched the DVD on a large-screen television commented on the obvious appearance of digital artifacts, or pixelization, during the fade-ins and fade-outs of each song. This digitization effect, though less noticeable in static shots, was apparent in most feature film DVD titles as well. Even so, participants gave the picture quality an average rating of 2.37, falling in between the "average" and "above average" labels. This

higher rating may have resulted from viewers' experiences with the inferior quality of VHS tapes as compared to DVDs.

Aside from the image quality, the video production itself proved satisfactory. Working with a limited number of usable shots and covering for camera and sync errors, the final video edit appearing on the DVD came across as smooth and near professional. The placement of cameras during the shoot proved worthwhile, evidenced in comments complimenting, "The sheer number of angles and kinetic flow of cuts helped build a sense of energy that made me feel a part of the performance," or the "concert was well shot/edited." During postproduction, edits were chosen to visually accommodate the music, cutting on quick downbeats or slowly dissolving to showcase an entire section or instrument solo. "The editing gave the picture rhythmic excitement" and "the movement of camera angles and transitions of shots [gave the piece a] going to a ballroom feel" further enforced the decisions made during the editing process. Video postproduction consumed vast amounts of time and resources, yet in the end appeared to have been successful. However a "more cohesive edit of [the] stage dancing section" was proposed by one reviewer, which highlighted the noticeable difference in flow between the band version and the dance version of the stage show. The dance version did not offer as many opportunities for cutting as the band version did, as most of the takes concentrated on the musicians, while only two takes focused on the spotlight dancers. The pacing of the dance version edit lagged behind the excitement of the band version, due to the utilization of longer duration shots that focused on the dance couples so as not to miss a single move. A greater variety of takes involving the spotlight dancers would have helped the pacing and flow of the dance version by presenting more material with which to edit.

To compensate for the recording quality differences between the various types of video cameras used in shooting, each edited cut was color corrected in the Avid. Additional adjustments were necessary, as pointed out by one media professional, "video levels/black levels were not consistent between all shots in concert (more in dance show)." The contrast was also increased and a "film look" was added during tape-tape transfer at GTN Inc. to soften the "video feel" of the pieces. The resulting effect prior to encoding was magnificent, as the desired film effect had been achieved. After encoding, the footage retained most of this polished look when viewed on a studio calibrated professional monitor. However, the DVD appeared vastly different on every television is was watched on, owing to different television set settings for picture, contrast, color balance, brightness, etc. Unfortunately, most consumer televisions completely altered the picture, practically eliminating the work done at GTN Inc. to achieve the "film look." Several reviewers commented on the "video feel" of the segments, confirming that each monitor behaved differently. The only way to combat this effect would be to include a color test strip on the DVD so that consumers could adjust their televisions accordingly and view the title as it was meant to be seen. However, the number of people willing to utilize this feature would be questionable at best.

Technical: Audio Quality

The overall audio quality was rated even higher than the video, totaling an average of 2.19, almost landing solidly on the "above average" scale. Considering the bit budget was calculated with the inclusion of multiple angles during the stage show, in retrospect more bits should have been reallocated to the audio encode when the additional

angles were cut from the project. The majority of the reviewers praised the audio quality of both the stereo and surround mixes, and one even claimed "the 5.1 mix was quite good; better than some professional DVD mixes I own!" Conversely, one of the media professionals thought the "digital artifacts make it sound like mp3." It should be noted that this reviewer listened to the DVD in a professional audio studio, exactly configured to deliver optimal sound performance. In a more acoustically equipped environment such as this, the little inconsistencies in the audio signal were more apparent than in a home viewing situation. Another participant suggested, "for surround sound DTS would be much better," which remained a purely subjective observation, but could be taken into consideration when evaluating the surround mix. Since the mix was not a true 5.1 mix, possessing no LFE channel, perhaps DTS would be a good option to add as an optional audio track for user selection.

Additionally, there were significant level differences between the music of the stage show and the dance instructors' audio. The level fluctuations between instructors were so varied that it was difficult to encode each segment at a higher level without causing vocal distortion. Because of this obvious difference, hiring professional instructors with vocal projection skills may have been beneficial. "Audio quality was not consistent between instruction and show" and "the dance instruction audio could have been improved" were characteristic of the general comments made referencing the audio quality of the segment. An overhead boom mic could have been helpful in better picking up the instructors, but would have appeared in the overhead shot, so was not an option during shooting. Lavalier mics clipped to the instructors' lapels were attempted, but the brush of clothing during all of the movements was too apparent to record a clean signal.

Placing a directional shotgun mic on a boom stand facing the dancers just off-camera was the best option, but still could have been improved as indicated by the reviewer comments. Headset microphones might have been employed to solve this issue, or the existing audio could have been normalized in the Avid during the editing process to ensure working with the loudest possible audio signal. Normalizing would adjust the average volume of the instructional audio to make it sound about equal to the music in the stage show.

Many participants agreed that although they enjoyed the stage show immensely, the true feeling of a "live" show would have been captured had the band been recorded live during the shooting. The musicians did a nice job for the most part in pantomiming to the prerecorded tracks, but the mix came across as sounding too "clean" to be effectively used for a live performance. Even though the band was not recorded live, other steps could have been taken to further draw the audience into the performance. The observation that it "needed more natural sound of applause, etc. mixed in to completely capture a live stage show feel" was relevant and could have occurred during postproduction. Foley techniques could also have been employed, adding dancers' footfalls and other sounds in a separate studio session. Also, "the perspective of the audio didn't match stage visuals – audio too close" was another comment based on the studio-recorded feel to the music. In defense, the DVD audio sounded cleaner and sharper than a live recording would have. The studio recording better showcased the wide range of instrumentation, allowing for the addition of overdubs and the inclusion of parts not originally played during the first recording pass.

Aesthetic Design and Navigation

The aesthetic design of "Swing Into DVD" contributed to its overall professional appearance. Menus set the tone of the project and prepared the audience for what to expect from the DVD experience. The quality of the menu design was ranked at an average of 1.78, positioned between "high" and "above average" on the scale. This score reflected the time and care put into the continuity and polished look of the menus, clearly ranking "Swing Into DVD" high above the basic menus typically constructed with most consumer DVD application programs. "Nice job on menu graphics," "well put together," and "classy," were representative of the comments collected from reviewers. The different swing tunes behind the menus also helped set the stage, and added an exciting, swinging feel to the entire DVD.

Navigational clarity became as important as aesthetic design to the DVD's ultimate success. Many commercial DVD titles were reviewed and analyzed when preparing to design the flow of navigation for "Swing Into DVD." It was frustrating as a user to navigate to an on-screen button with the DVD remote only to discover that pressing some of the arrow keys did not advance to another button. All arrow keys should lead somewhere different on the screen, even if this means simply returning to the previous button. The navigation for this project was designed with this thought in mind, so that no on-screen buttons left the user with only one option to "back out" of his navigational path. Participants ranked the clarity of navigation averaging 1.59, falling between "high" and "above average" on the scale. Clearly, the navigational process of "Swing Into DVD" provided a well thought out and obvious path for the user to follow.

Additionally, 93% liked the fact that they were able to skip between songs and choose the order of viewing the concert, illustrating the users' interests in tailoring their DVD experiences to suit their personal tastes. The DVD offered users the option to customize the way in which they viewed the program, and 63% of the participants skipped around using navigational commands and on-screen buttons, while 37% opted to watch the concert straight through from beginning to end. "Swing Into DVD" catered to user interactivity, aiming for a viewing experience custom-fit to each audience member.

DVD-R Compatibility Issues

The problem with DVD technology is that it keeps changing. Many set-top players that came out as recently as two years ago are already ill equipped to play DVD-R discs burned today. Compatibility issues will continue to be a problem, with the consumer forced to upgrade to a new player every few years in order to keep abreast of the advancements made within the DVD spec. A few of these player to DVD-R medium issues arose during the review process for "Swing Into DVD." Most DVD-Video players made within the past two years read the disc fine, along with computer DVD-ROM drives and the Sony Playstation 2 DVD System. Some older set-top players refused to recognize the disc, played it with multiple glitches and severe image artifacting, or had trouble accessing certain areas of the DVD. If the project had been burned on authoring media on the S201 drive rather than on DVD-R media burned on a DVD-ROM drive, these playback issues might have been avoided. However, given the limited budget of this project and without intention for commercial distribution, DVD-R was the preferred option.

Overall Impressions

As the results from the survey forms indicated, the creation of "Swing Into DVD" proved a notable accomplishment, and the DVD was hailed as a successful effort and a viable product if released in the commercial market. Participants rated the three-song stage show very high in terms of its entertainment value, and even wanted to see more songs performed in a longer concert. Generally positive reviews praising the disc's technical merits confirmed decisions made by the producer during audio and video postproduction. The video editing was judged as solid, and the stereo and surround audio mixes were deemed commendable, even though the audio levels during the instructional segments could be improved. Issues concerning image quality were apparent, as limitations in storage space and bit allocation were encountered during encoding. The DVD was effective as an instructional tool, validated by beginning and advanced dancers who enjoyed the interactive dance instruction presented. With the option to view an additional overhead angle for body positioning, users reacted positively to the project's instructional value but suggested the inclusion of distinct levels of instruction for skill advancement. The interactive "white rabbit" feature during the dance version of the stage show enhanced the DVD's instructional application and offered viewers an exciting new spin on the traditional "behind-the-scenes" use of the feature, specifically tailoring it for dance instruction. Use of the disc for promotional applications was moderately successful, although it increased user interest in swing music in general more than generating specific interest in the band. The menu design, clarity of navigation, and interactive elements were all favored by the evaluation results, demonstrated by high

marks given in the surveys and also by additional comments made regarding the value of the DVD as a possible commercial product. Restrictions on disc capacity and time constraints prevented the inclusion of recommended extra features such as a behind-the-scenes documentary, multiple angles during the stage show, and a director's commentary, but the DVD was still well received as an overall package and commended for its quality presentation. As one reviewer attested, "Extremely well executed and professional. With a bit more focus on the objective this would be worthy of rental/purchase in any commercial outlet. Excellent effort. Great producing. Classy. Thumbs Up!"

CONCLUSION

This project was started when DVD was still in its infancy, and in two years' time gigantic strides have been made in the advancement of DVD technology, stretching the limits of the original DVD spec. The cutting edge authoring tools used in professional postproduction houses have since been streamlined and simplified, and the need for programmers to know the actual scripting language has been reduced. It has become much cheaper and easier now to create DVDs, and programs with friendly user interfaces allow consumers to create DVDs on their own home computers. But regardless of the consumer applications now available, the production component of "Swing Into DVD" still remains. The project was recorded, mixed, shot, edited, and put together utilizing equipment largely unavailable to the home consumer, and the use of Sonic Solutions DVD Creator enabled this thesis to develop into a professional product offering advanced interactivity above and beyond anything that could be produced on a home system. This project stands as a testament to the DVD code programmers who developed the language of authoring scripts and who continue to produce impeccable DVD titles in the wake of today's ever increasing trend of drag-and-drop consumer applications.

The lessons learned over this span of time have proven invaluable. Creating this DVD from scratch was a daunting yet rewarding task. Tackling the roles of planner, organizer, recordist, mixer, producer, director, designer, encoder, and author all afforded the opportunity to gain valuable insights into the entire production process involved in making a DVD title. Some of these roles were more challenging than others, and some phases of production took longer than anticipated. Recording an entire 16-piece

orchestra was not an easy undertaking, nor was editing together numerous hours of camera footage into two 11-minute video segments. Managing the human resource element was also complicated at times, from negotiating with non-production orientated band members to dealing with sync difficulties during the edit phase brought on by camera operator errors. The experience gained throughout the production process made this creative thesis worthwhile, and the resulting product is an ambitious and admiral effort. As attested by media professional Mike Levy of GTN, Inc., "With the space of a DVD-5 single-sided single layer, you took full advantage of the spec...Overall, you kicked DVD Booty!!!"

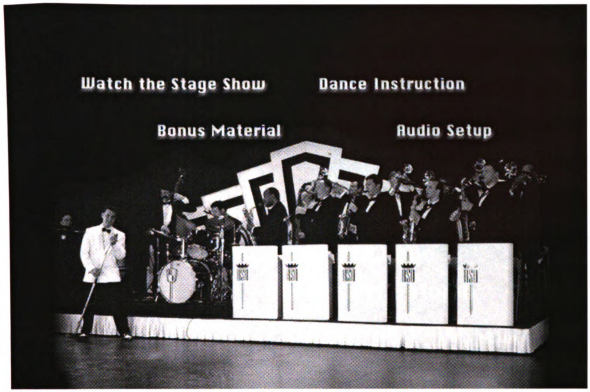
This production thesis project presented only a minute sample of the DVD medium's versatility. "Swing Into DVD" represented a fraction of the possibilities outlined in the DVD spec and offered viewers a taste of the delicious richness of DVD's interactive powers. It utilized multiple video and audio streams with seamless branching between the multiple angles during the studio dance instruction and the stereo versus surround audio tracks. The project pushed the limits of compressed asset storage on a 4.7G disc, attempting to deliver the highest quality video possible during the stage show, sacrificing additional angles to assure a better picture. Subpicture streams were used to create the "white rabbit" interactive feature, allowing buttons to appear within the full motion movie and not strictly on still menus only. This feature involved users in active learning through physical interaction, engaging learners and offering them such high quality audio and video unlike any other medium. The level of interactivity was extended and stretched by exploring the functionality of system and general parameters while coding to offer a greater range of user options. Through an evaluation process

based on survey results, the DVD was deemed successful in communicating its goals as an entertainment, educational, and promotional medium.

DVD technology will continue to evolve and change for use with future applications. It will bridge the gap between the old and the new, eventually replacing VCRs and ushering in the HDTV era. As we move toward the day when the Internet functions as the universal supplier of all home entertainment, news, music, education, and advertising, DVD will stand as the transition medium for the new technological age. Regardless of the delivery medium of the future, there will always be a need for skilled producers with the knowledge of the production components required to build a successful product. Audiences' entertainment demands will increase, and industry players cannot afford to lose sight of what it takes to put together a valuable program. "Swing Into DVD" demonstrates the successful synthesis of audio, video, and multimedia elements, and stands as evidence of the care and effort put into creating such a product.

APPENDICES

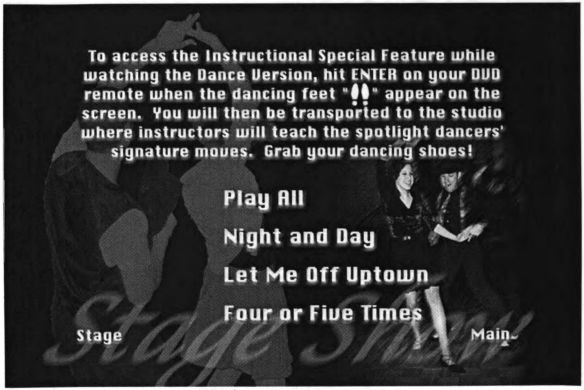
APPENDIX A



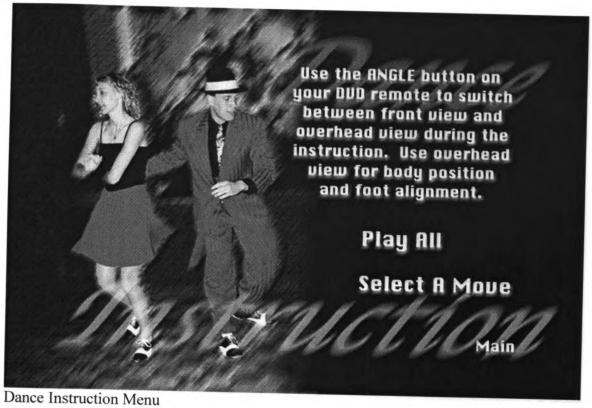
Main Menu

Stage Show Menu

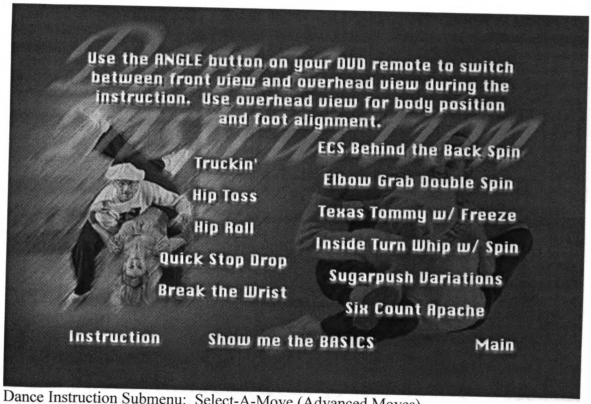
Stage Show Submenu: Band Version



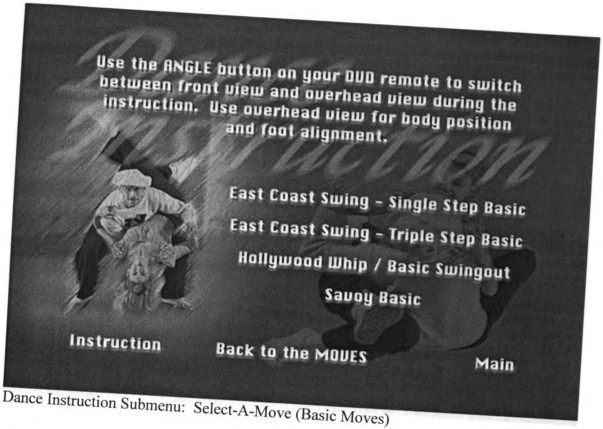
Stage Show Submenu: Dance Version



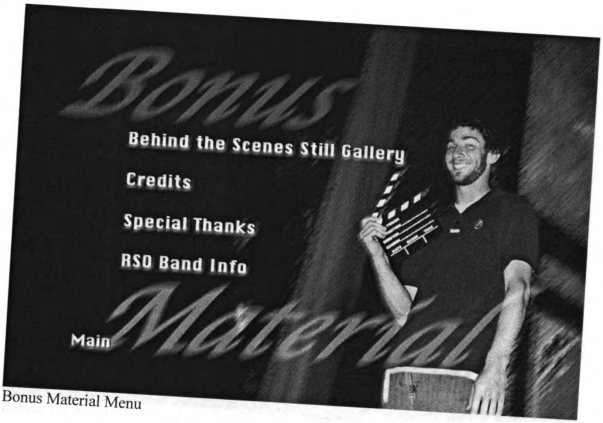
Dance Instruction Menu



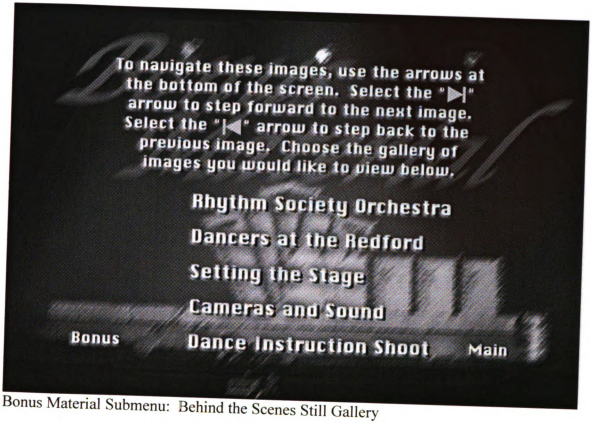
Dance Instruction Submenu: Select-A-Move (Advanced Moves)



Dance Instruction Submenu: Select-A-Move (Basic Moves)



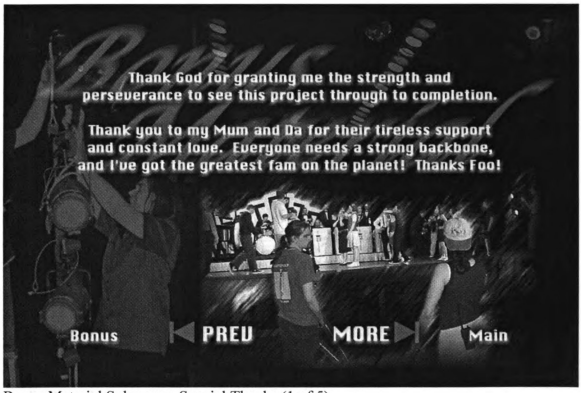
Bonus Material Menu



Bonus Material Submenu: Behind the Scenes Still Gallery

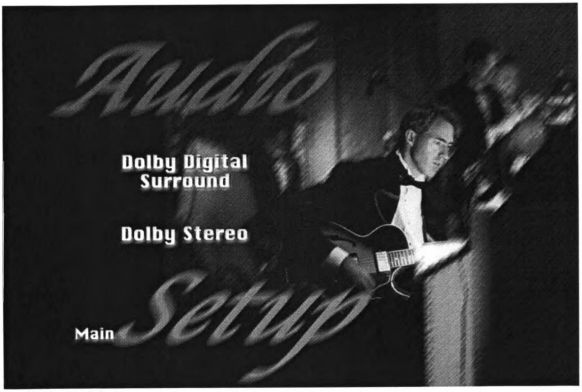
Behind the Scenes Still Gallery photo example (1 of 88)

Bonus Material Submenu: Credits page (1 of 14)



Bonus Material Submenu: Special Thanks (1 of 5)

Bonus Material Submenu: RSO Band Info



Audio Setup Menu

APPENDIX B

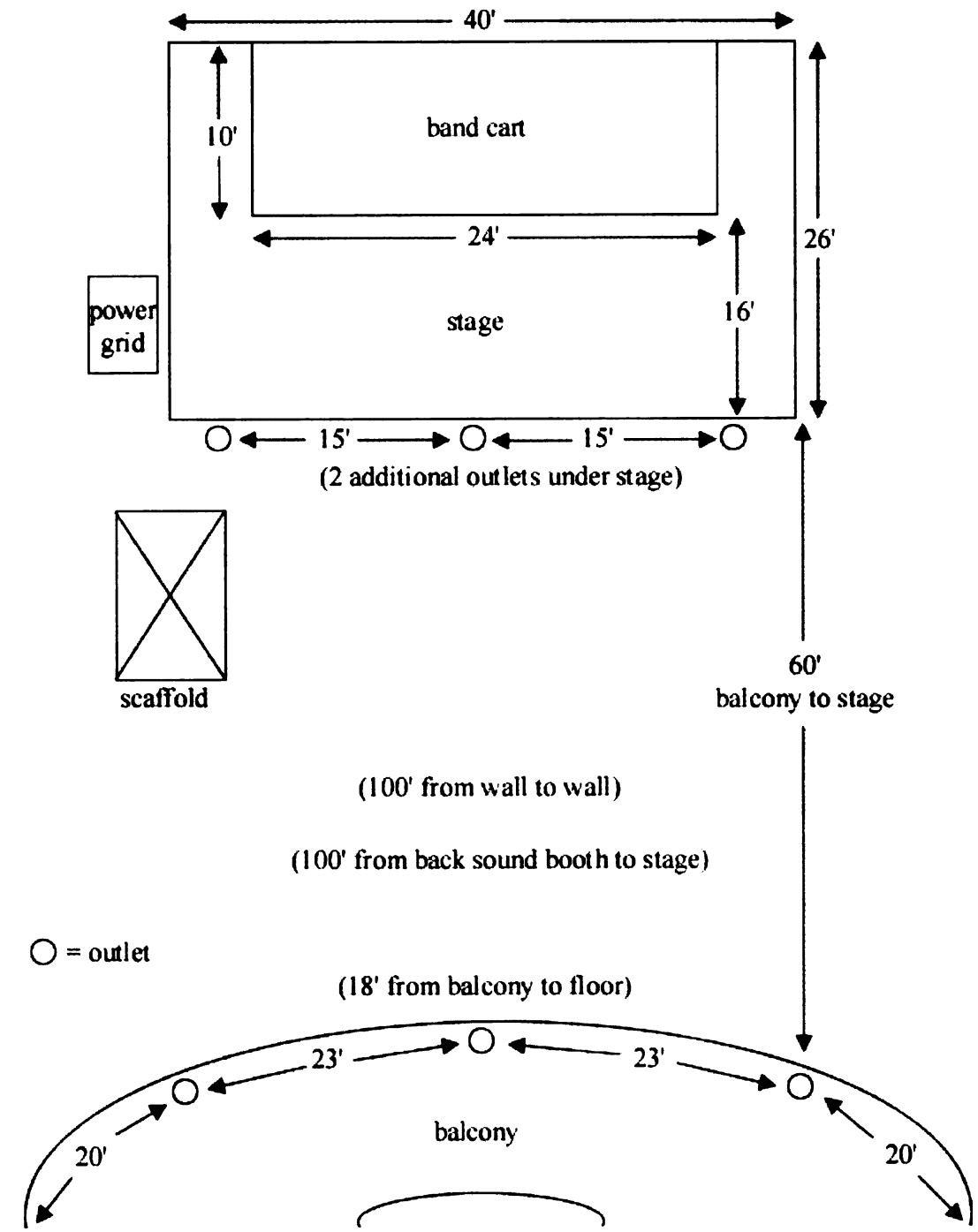
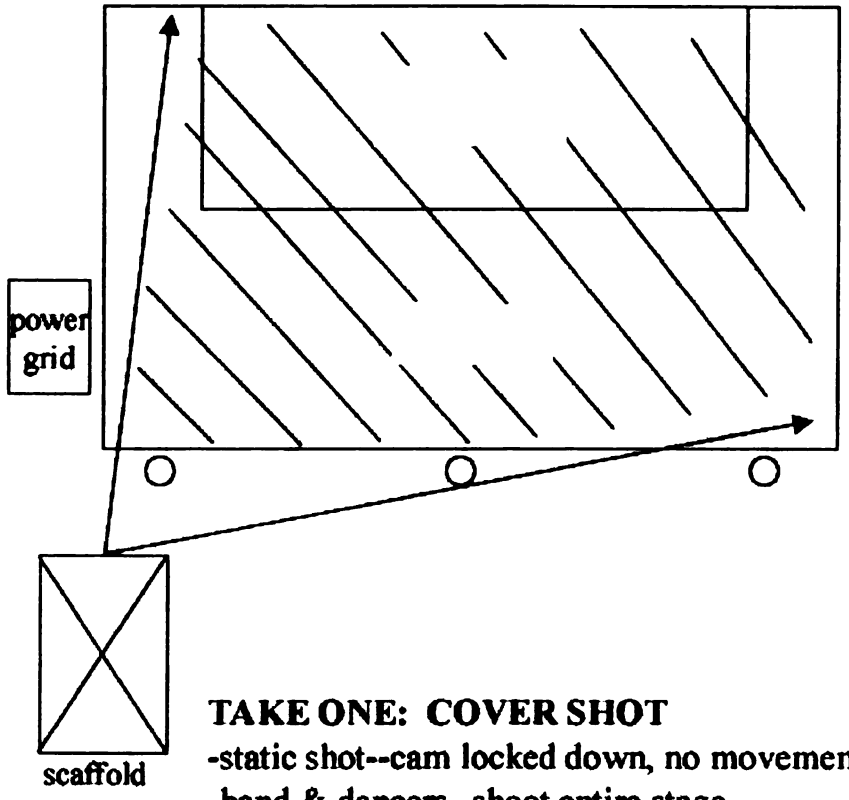


Figure 6. Redford Theatre Site Survey

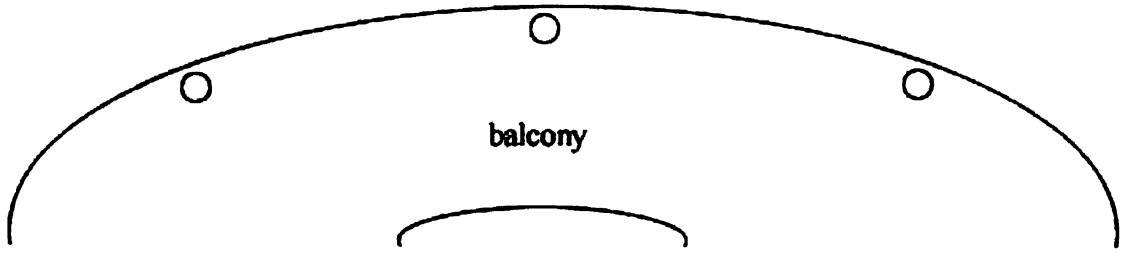
APPENDIX C

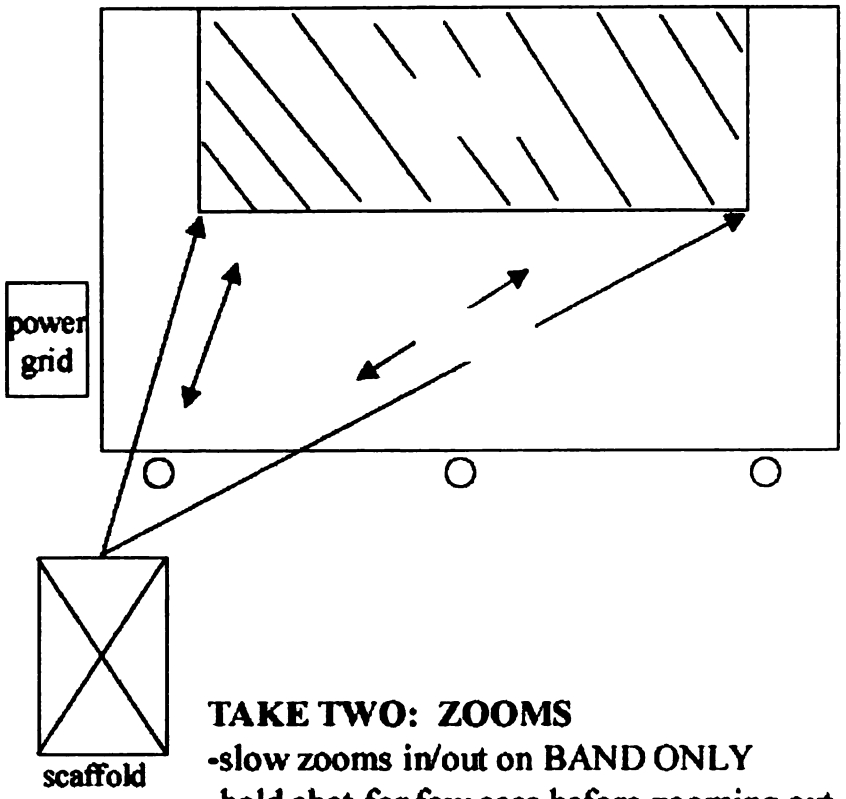


TAKE ONE: COVER SHOT

-static shot--cam locked down, no movement
-band & dancers--shoot entire stage
-fill frame from top of band cart backdrop to front dancers (do not shoot lip of stage in front--pit should not be visible)

○ = outlet

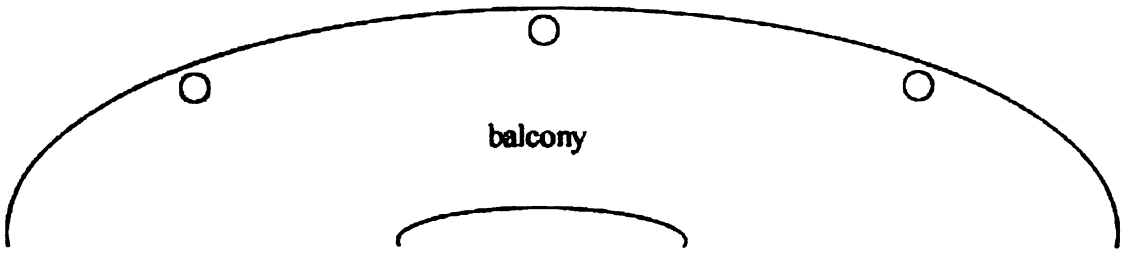


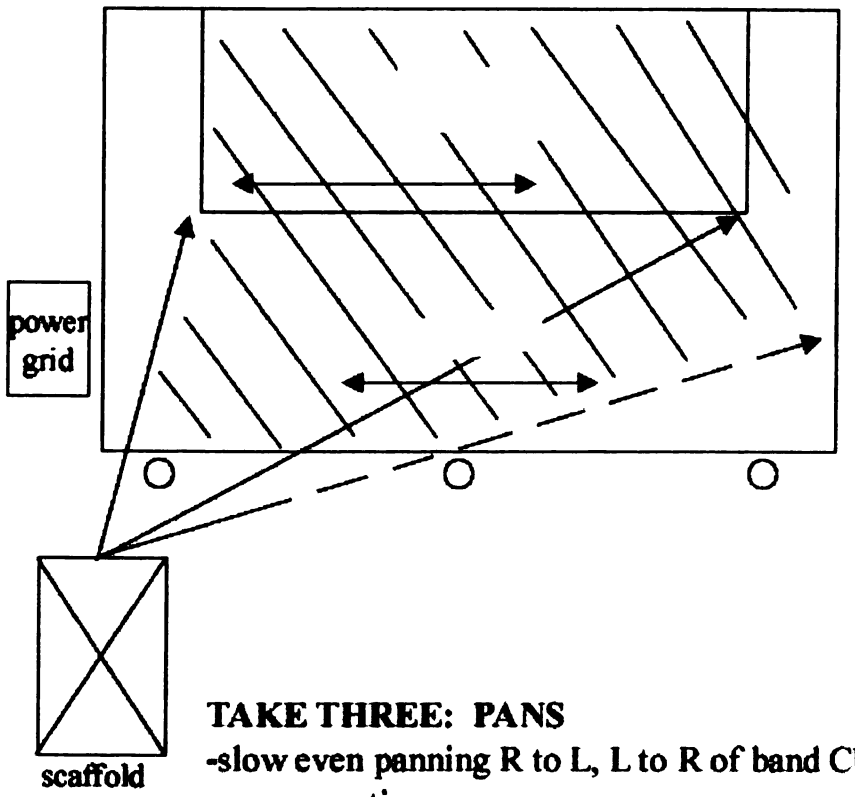


TAKE TWO: ZOOMS

-slow zooms in/out on BAND ONLY
-hold shot for few secs before zooming out
-vocalist should get most attention when singing
-zoom in on instrument solos (listen for my cue over house mic)
-all other instances, zoom instrument sections
-DO NOT shoot dancers for zoom focus

○ = outlet



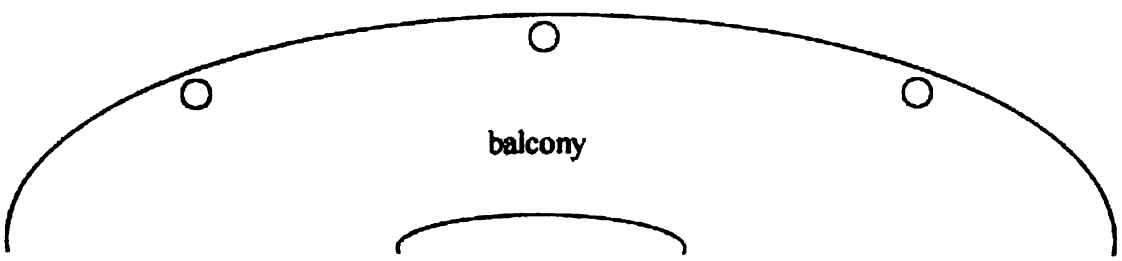


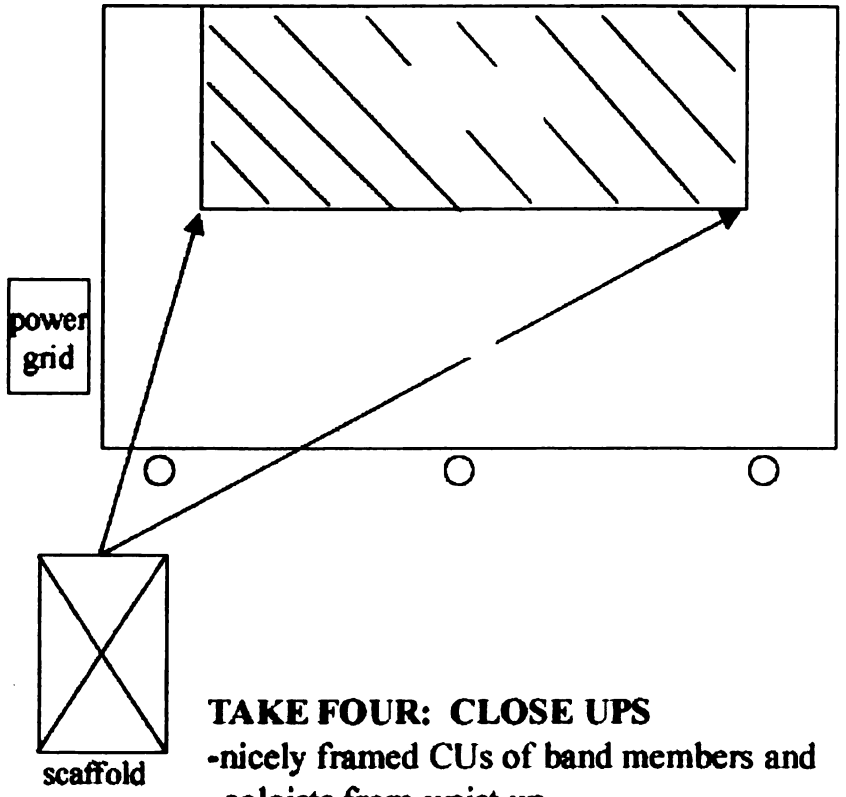
TAKE THREE: PANS

-slow even panning R to L, L to R of band CU across sections

-some limited panning of dancers across stage

○ = outlet

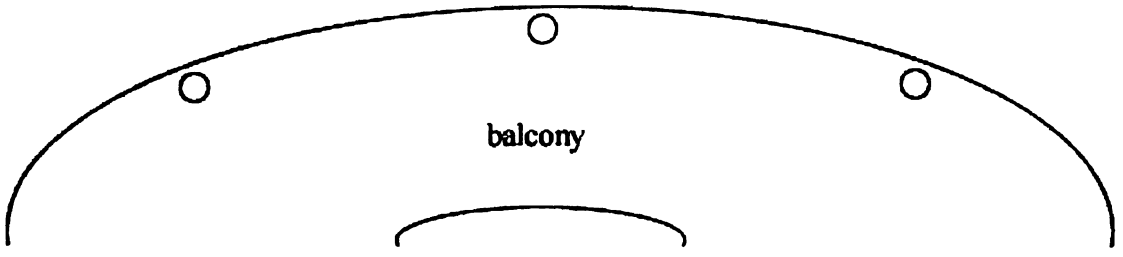


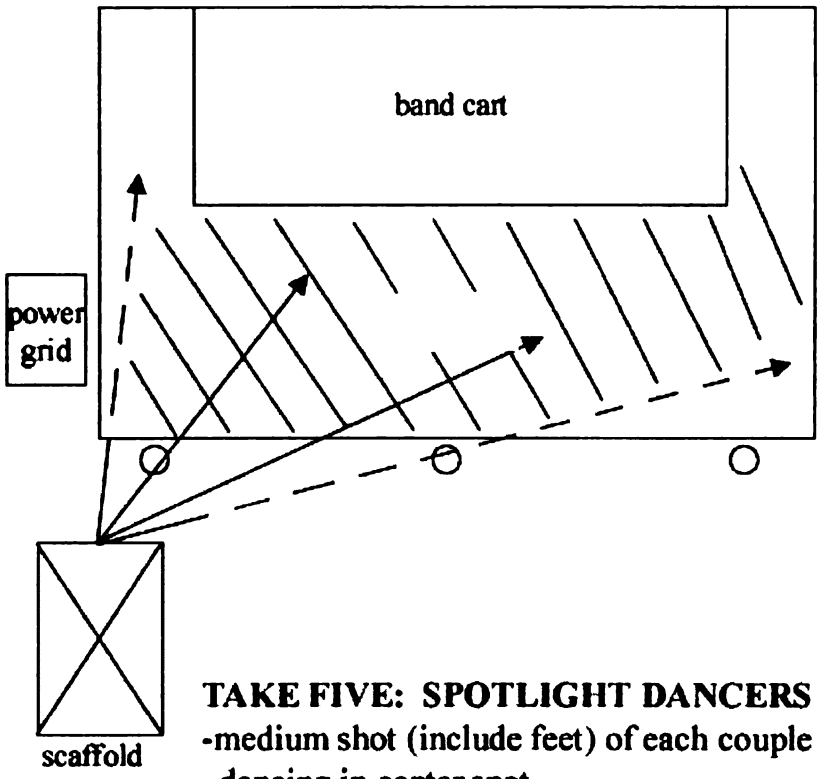


TAKE FOUR: CLOSE UPS

-nicely framed CUs of band members and soloists from waist up
-pay most attention to vocalist and soloists
-CU from band member to band member--shoot each member at least once
-watch for other stage cameras so not in your shot
**stay with vocalist at end (last two songs) CU!

○ = outlet

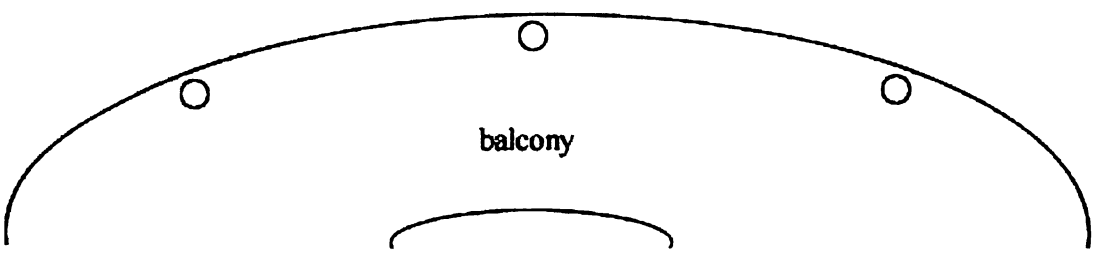




TAKE FIVE: SPOTLIGHT DANCERS

-medium shot (include feet) of each couple dancing in center spot
-can pan or zoom to get to couple, but stay with them once they perform
-little to no band in shot
-watch for other stage cameras so not in your shot

○ = outlet



APPENDIX D

***Casting call for Detroit area DVD production
with Paul King and the Rhythm Society Orchestra***

...Do you dance? Then we need you!

When:
Sunday June 17, 2002 (Father's Day) in the late afternoon/early evening

Where:
Redford Theatre in Redford, MI

What is this?
This five-camera video shoot is for an interactive entertainment/instructional DVD project developed as part of the Masters Thesis of Janice Miller for Michigan State University. The DVD will feature an interactive stage show with Paul King and the Rhythm Society, where users can either sit back to watch the concert, or access scenes of dance instruction as they happen on stage.

Who do we need?
We need 10 to 12 couples to dance on stage in front of Paul King and the band. PK&RSO will be playing three tunes, all suitable tempos for Swing and Lindy. The DVD will be both promotional and instructional, for the band as well as for the greater swing community and dancing in general. Throughout the songs, dancers will "take the spotlight" and execute a cool move (doesn't have to be anything aerial or fancy, but can be if you like), which that couple will then teach to the camera afterwards. You don't have to be a certified instructor or anything like that either...as long as you can show step-by-step how to do the move and break it down for instruction; that's what we're looking for. If you don't want to teach a move, that's okay too, as we need couples just to "fill" the floor as well. I've seen some fantastic swingin' in this area, so come on out and strut your stuff!

What's the payoff?
Your name and image immortalized on DVD. :-) I can pay you your weight in food, and of course a credit on the DVD. We will have craft service in the theatre with food and water/soda/juice. The real payoff is the promotion of swing!

Please reply by this weekend via email to danseuse75@home.com if you are interested, and we will give you more details, directions, etc.

Cheers,
Janice C. Miller
Producer/Director

APPENDIX E

STAGE PRODUCTION CONSENT FORM

After reading the attached statement, you may now make the decision on whether you want to participate or not participate in the DVD stage production with Paul King and the Rhythm Society Orchestra. If you choose not to participate in this production, you may stop now. If you choose to participate in this production, meaning that you are willing to perform as a musician or dancer knowing that your performance will be recorded, please fill in the following blank lines.

I, _____ (your full name) agree to perform in the academic production thesis of Janice Miller at the Redford Theatre for development to DVD.

You authorize Janice Miller and all persons or entities acting pursuant to Janice Miller's permission or authority, all rights to use your recorded image and/or voice in any manner necessary to complete this DVD production. In addition, you authorize Janice Miller and all authorized entities the right to reproduce, distribute and promote the DVD video and audio products of this production. By granting this authorization, you are fully aware that your image and/or voice will be recognizable in the final program and that your name will appear in the credit sequence of this DVD as it applies to all related performances.

Your participation in this production confers on to you no ownership rights. In addition, you are aware that your participation in this project offers you no future/further compensation or liability, in perpetuity.

You represent that you are 18 years of age or older and have the right to enter into this agreement.

In signing this form, you represent that you have read all of the above statements.

Name (please print) _____

Address _____

_____

Telephone number (optional) _____

Email address (optional) _____

Signature _____ Date_____

Witness Signature _____ Date_____

APPENDIX F

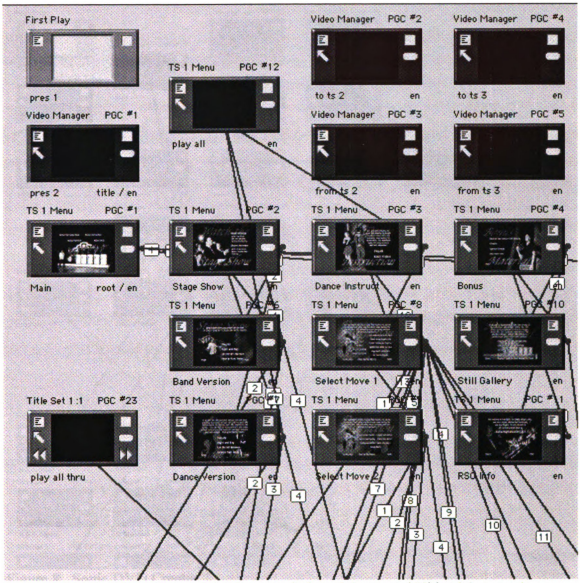


Figure 7. Sonic DVD Creator 2.1.6 layout window (Menus and Video Managers)

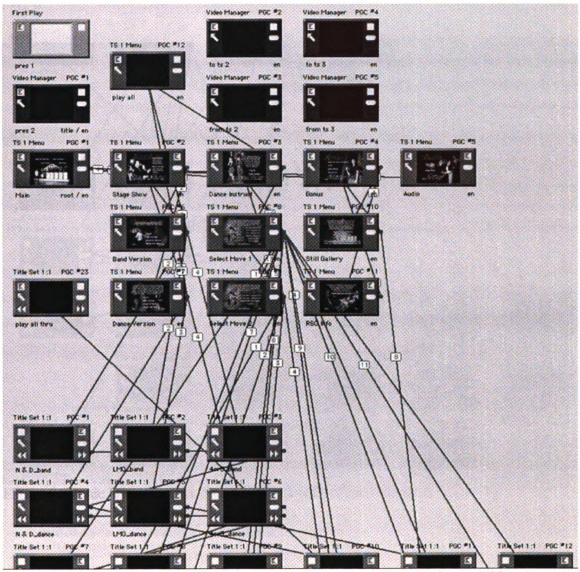


Figure 8. Sonic DVD Creator 2.1.6 layout window (Menus connecting to Video Assets)

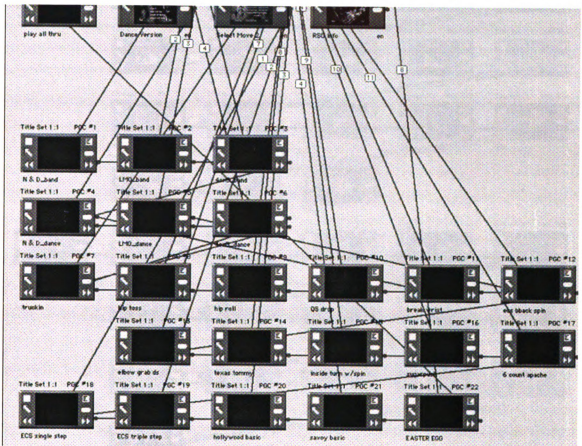


Figure 9. Sonic DVD Creator 2.1.6 layout window (Video Assets)

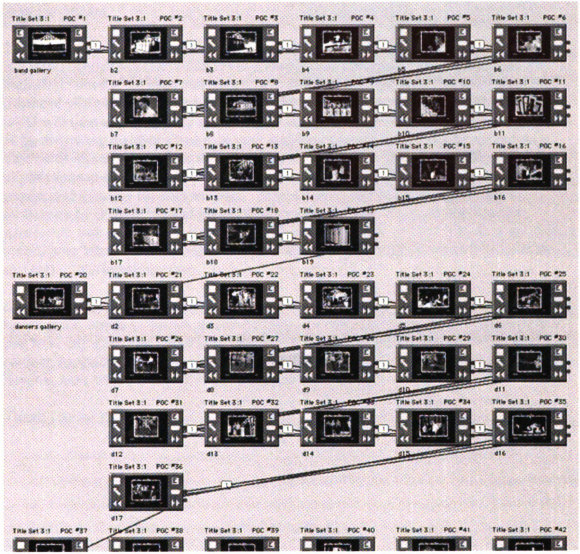


Figure 10. Sonic DVD Creator 2.1.6 layout window (Still Gallery Images)

APPENDIX G

DVD Beta Test Questionnaire

Dear participant,

Thank you for agreeing to view and explore the DVD featuring Paul King and the Rhythm Society Orchestra. The DVD allows you to choose from many features, including viewing the band and stage show, dance instruction with full body shots and overhead viewpoints, a behind-the-scenes photo gallery, and more. Exploring the entire DVD will take approximately 20 to 30 total minutes. After viewing, please answer each of the following questions based on your experiences with the DVD content and your own perceptions of the interactivity presented. The survey should only take 10 minutes of your time to complete. This questionnaire will be used in the evaluation of this thesis project and to refine the beta test disc. You indicate your voluntary agreement to participate by completing and returning this questionnaire. If you do not wish to participate, you may personally dispose of the questionnaire or hand it back to the project investigator blank. Your anonymity is guaranteed as you need not provide your name on any part of this questionnaire.

Should you have any questions regarding this research, please contact the project investigator, Janice C. Miller, at 248-398-0216 or mille143@msu.edu. Additionally, if you have any questions about your role and rights as a subject of research, you may contact the Chair of the University Committee on Research Involving Human Subjects, Ashir Kumar, M.D., at 517-355-2180 or ucrihs@msu.edu.

Thank you for your time.

DVD Beta Test Questionnaire

Note: This DVD-R may not function correctly in older model DVD players. If you experience any glitches, pauses, or artifacts during this viewing, please mark an "X" on the line: ____

1. List the manufacturer and model number of the DVD player on which you are viewing this DVD:

_____

2. Are you: ____ Female ____ Male

3. Please mark all that apply to your current status.

____ Media Professional (currently employed in the industry; non-student)
____ Student (college, technical, or trade school)
____ Avid Dancer (dance swing, Latin, or ballroom 4 or more times per month)
____ Other _____

4. How many DVD titles do you currently own?

____ none ____ 1-15 ____ 16-30 ____ 31-60 ____ 60 or more

5. How many hours do you spend watching DVDs per week?

____ none ____ 1-5 hrs ____ 6-10 ____ 11-15 ____ 15+ hours

6. Have you ever viewed a music, concert, or stage performance DVD before?

____ Yes ____ No

7. Do you currently own or would you consider buying a music, concert, or stage performance DVD?

____ Yes ____ No

8. Which of the following categories best describes your general interest in swing <u>music</u> <u>BEFORE</u> you viewed this DVD?

High	Above Average	Average	Below Average	Low
1	2	3	4	5

9. Which of the following categories best describes your general interest in swing <u>music</u> <u>AFTER</u> you viewed this DVD?

High	Above Average	Average	Below Average	Low
1	2	3	4	5

10. After viewing this DVD, please indicate your level of motivation toward exploring swing dance, learning to dance, or expanding your repertoire if you dance already?

High	Above Average	Average	Below Average	Low
1	2	3	4	5

11. In the space provided, please write the word or phrase you feel best describes this DVD experience.

12. Which of the following categories best describes your general enjoyment of this DVD?

High	Above Average	Average	Below Average	Low
1	2	3	4	5

13. Please rank the overall image quality (video/picture quality) of this DVD.

High	Above Average	Average	Below Average	Low
1	2	3	4	5

14. Please rank the overall sound quality (audio/5.1 surround or stereo) of this DVD.

High	Above Average	Average	Below Average	Low
1	2	3	4	5

15. Please rank the quality of the menu design.

High	Above Average	Average	Below Average	Low
1	2	3	4	5

16. Please rank the clarity of navigation (Were you able to get to all the places you wanted to go easily? Were the highlights clear and easy to see?).

High	Above Average	Average	Below Average	Low
1	2	3	4	5

17. Which feature did you find most interesting/entertaining? (Please mark only one)

____ Rhythm Society Concert
____ Dance Mix Stage Show with instructional feet "White Rabbit" feature
____ Studio Instruction without stage show
____ Still Photo Gallery
____ Band Information/Bio
____ Easter Eggs (if found)

18. What was one thing (additional feature) you would like to have seen included?

19. What was one thing that could have been done better to improve this DVD with regards to existing content (what would you change?)

20. Did this DVD capture the feeling of a live stage show? ____ Yes ____ No

Explain_____

21. Did you like the fact that you were able to skip between songs and choose the order of viewing the concert?

____ Yes ____ No

22. Did you watch the concert straight thru, or did you skip around?

____ Straight Thru ____ Skipped Around

23. Would you watch this DVD again?

____ Yes ____ No

24. Would you recommend this DVD to a friend?

____ Yes ____ No

25. Would you like to find out more about Paul King and the Rhythm Society Orchestra?

____ Yes ____ No

26. Would you log on to the band's website given on the DVD?

____ Yes ____ No ____ Didn't see it

27. Would you consider seeing Paul King and the Rhythm Society Orchestra in concert or purchasing a CD?

____ Yes ____ No ____ Don't Know

This next set of questions applies to the INSTRUCTIONAL DANCE MIX VERSION

28. Did you find the "White Rabbit" dancing feet feature interrupted the dance stage show, or did you like that feature?

____ Liked ____ Disliked ____ No Opinion

29. This DVD was designed for you to either select dance instruction segments while viewing the dance concert, or for you to select dance instruction only. Did you find the dance mix "White Rabbit" dancing feet feature concept beneficial to the instructional process?

____ Yes ____ No ____ Don't Know

30. How many viewings of each dance move presented do you feel would be necessary before you could fully learn and apply the demonstrated dance moves?

____ 1 viewing only ____ 2 ____ 3 ____ 4 ____ 5 or more

31. Have you ever bought/rented/viewed an instructional video or DVD before?

____ Yes ____ No

32. If yes, would you rate this program higher or lower in terms in instructional clarity and quality, based on other instructional programs that you have seen?

____ Higher ____ Lower ____ Don't Know

33. On a five-point scale, how would you rank this DVD in terms of its instructional value?

High	Above Average	Average	Below Average	Low
1	2	3	4	5

34. Please rank the multi-angle (overhead view) feature in terms of its helpfulness in body positioning?

High	Above Average	Average	Below Average	Low
1	2	3	4	5

35. If this DVD, or a similar one offering other dances, was available for purchase at a price comparable to other instructional programs, would you buy this DVD?

____ Yes ____ No ____ Don't Know

36. If you have any additional comments you would like to add, please feel free to use the space provided below or write on the back. Thank you sincerely for your time.

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BIBLIOGRAPHY

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