The MFA Thesis Report

Integrating Diverse Digital Elements and DVD Authoring to Design a Promotional Interactive DVD Media

Rochester Institute of Technology
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October, 2003

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Date Nov 06 2003
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I. Introduction

a. Thesis Proposal:

Question:
How can we combine diverse digital elements and DVD authoring to create promotional interactive DVD media?

Proposal:
My thesis will explore methods in the experimental design of DVD media. The main concept will be to convert traditional interactive programs into DVD media.

The DVD will promote conceptual products such as consumer goods, arts or lifestyles. The content of the DVD will be an interactive, fictional story about a product. It will include special features that are only possible using the DVD-video standard including:

- High quality multi-angle video tracks
- Multi channel audios
- Retail DVD play back ability.
- Interactive menu
- Web links or launch external functions.
- Multi-language subtitles
- DVD programming.
- Computer data capacity.

When maximized, DVD media allows users to view the story however they please, as the story has no set path. Users may define the story through the random play or multi-angles in the piece. No matter which path users take in the story, the creator will reach their goal of promoting their product or service.

Final Project Specifications:
The final project will utilize DVD authoring tools and will be packaged in DVD-R format (DVD-5 4.7GB single layer) containing a UDF file system and an ISO directory, intended for video content such as movies which can play both in retail DVD players and computers. The DVD will contain dual formats: DVD video format for DVD players and DVD UDF format for computers. The UDF format portion of the disc will contain multimedia design software, including Macromedia Director and Adobe After Effects. The DVD video portion of the disc will be based on the computer portion, but will utilize the Apple DVD studio and script in an authoring tool to add sophisticated interactivity and controls.

Target Audience:
The primary audience will be corporate training and sales departments, as well as government organizations. It is also optimized for use by general consumers and commercial use. The projection will be specifically designed for people who do not have a high level of proficiency with computers.
Target Software and Hardware:
A Macintosh operating system, version 8.6 or higher or a Windows operating system, version 98 or higher, will be necessary to use the UDF format. An internet connection, USB mouse, and DVD player for the DVD-video format will also be necessary. To play the DVD, an Apple DVD player or Windows Media player will allow users play the DVD-video on a computer.
<table>
<thead>
<tr>
<th>Thesis Timeline</th>
<th>Kai-Yi Chen</th>
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**Integrating diverse digital elements and DVD authoring to design a promotional interactive DVD media.**

<table>
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<tr>
<th>Winter break</th>
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<tr>
<td>Thesis statement</td>
<td>X'mas break</td>
<td>Week 7</td>
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<td>Begin thesis project</td>
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<td>Done thesis prototype</td>
<td>40% project</td>
<td>60% project</td>
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<td>Start shooting video</td>
<td>Start video editing</td>
<td>DVD-Rom content design &amp; User navigation Design</td>
<td>Create 3d model of thesis product</td>
<td>Defined Main Comic style of thesis</td>
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<td>DVD authoring study</td>
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II. Thesis Abstract

a. Project consideration
The project will be an experimental design using DVD media. Below are few factors to be considered before beginning the project.

**Goal:**
Use features of DVD media to create an interactive DVD.

**Value:**
To help users understand that interactive DVDs promote products better than traditional media.

**Design solutions:**
To find the best solutions for the project.

**Timeline:**
Define the timetable of project process.

**Evolution:**
Understand problems and revise the final project.

b. Product definition:
The product being promoted almost decides the entire design style in the final DVD. I had chosen the CDJ-1000, a DJ turntable. Not only is it an attractive product, it is also fun, and has the ability to remix audio. It really fits features of DVD media for those characteristics, and that type of lifestyle can be promoted well in DVD media.

c. Define project structure
(Please reference diagram 1. of the project structure)

**UDF Format**

1. Demonstration section:
   Real people demonstrate the product through film shooting, video editing, sound editing and remixing, lighting and special effects.
2. Main Features:
   QTVR motion menu. (3D modeling and animation, DVD scripting)
3. Training time:
   Use multi-angle video and multi-channel audio to train people how to use the product and also combine the quiz. (Different angle video editing, DVD scripting)
4. Terminology:
   Basic menu system provides a database-style information system.
5. Product specifications
   Same as terminology.
6. Credits:
   Credit information
ISO Format

1. Product game:
   The beat game for DVD media.
2. Product information:
   QTVR movie and product information.
3. DVD information:
   DVD media information, credits and web links.

d. Define project procedures
The project will explore new technology and create interactive DVD media. There are no examples or reference information for this new technology, which makes it necessary to have defined project procedures. (Please reference diagram 02. the project procedure)
Diagram 1: The Project Structure

**DVD format**

- Intro movie
- Main menu
- Real people demo, will mix with animation
- QTVR like feature menu
- Six multi-angle & multi-sound demo movie quiz game
- Documentation can select by A-Z (DVD slideshow)

**ISO format (PC/Mac)**

- Intro movie
- Main menu
- Beat game
- 3d QTVR interactive with main features
- Thesis web link
- Credits
- Product game
- Product info
- DVD info

001 Log dial
002 Scratch play
003 Super Fast Search
004 Frame Search
005 Reverse Play
006 On JPEG display

1. Original sketch
2. Lasers
3. G spin

Developed by Kai Yi Chen 2003
Diagram 2: The Project Procedure

1. Research: Understanding Project Technology
2. Define Target Audience and Usability Requirements
3. Possibilities testing
4. Define Design Consideration & Technical Problems
5. Project Design & DVD Authoring
6. Prototype Design
7. Evaluate Project Design
8. Final Project
III. Project Process

a. Understanding DVD Technology

1. Digital Versatile Disc
   DVD is an acronym for Digital Versatile Disc. This new generation of optical disc storage technology has become a very successful consumer electronics product since its introduction. Not only is it larger and faster than CDs (Compact Discs), it can also host cinema such as video. But it also can merge home entertainment (Digital Video Disc) and information technology using a single digital format (DVD-Rom). Consequently, the “Digital Versatile Disc” means versatility to media creators.

2. Physical format and Logical format
   DVD media contains physical and logical formats. The final DVD media will use DVD-R physical format and hybrid DVD logical format.

   Physical formats of DVDs
   • DVD-ROM: a read only format, similar to CD-ROM discs, but can store much more information.
   • DVD-R: A “write once and read many times” format media, similar to CD-R discs.
   • DVD-RW: Able to write and read many times, similar to CD-RW discs.
   • DVD+R: Another standard of DVD media, similar to DVD-Rs.
   • DVD+RW: Another standard of DVD media, similar to DVD-RWs.

   Logical formats of DVDs
   • DVD-ROM: Stores any type of digital file in DVD-ROM formatted discs.
   • DVD-Video: Holds DVD video that can be read only by DVD-video players or standard computer DVD player software. In most situations, the video content is stored inside a VIDEO_TS folder at the root level of the disc.
   • Hybrid DVD: A hybrid DVD contains both video content in a VIDEO_TS folder and data files in other folders.
   • DVD-Audio: Designed to replace audio-CDs due to the increased storage space available. It delivers higher-quality, multi-channel audio than that of the standard stereo, 16 bit 44.1 kHz audio CD.

3. UDF format structure of DVD-Video:
   Other than the common ISO-9660 file system, the DVD-video is based on a UDF (Universal Disc Format) file system. It was defined by OSTA (Optical Storage Technology Association) in 1996. This format is designed for making DVD-videos or miniDVDs from an already-authored UDF system (the VIDEO_TS folder). Not only is it a standard for DVD recording industry, it also helps software corporations obtain maximum compatibility when developing DVD recording software. The OSTA is still in the process of developing the UDF format. The newest version of UDF is version 2.50.

   • UDF Disc:
     The CD or DVD that uses the UDF 1.0.2 file format, and is usable on computers that have a UDF 1.0.2 or later reader installed.
   • The unique Folder Name “VIDEO_TS”
     Stands for “Video Title Set”. The files within the VIDEO_TS folder contain titles along with information about the titles, such as where they will go or their playback order.
• **VOB file:**
Stands for “Video Objects”. The presentation files contain the multiplexed video, audio and subtitle streams in the UDF format disc.

• **IFO file:**
Stands for “Information”. These navigation files contain all formatting information for the VOB files in UDF format discs. They are responsible for giving the DVD player setup information such as playback aspect ratio, subtitles, languages, menu, and audio.

• **BUP file:**
Stands for “Backup”. These backup files contain the same information as IFO files, in the event the IFO fails to read or is corrupted.

4. **Video compressing in DVD technology:**
The first video on digital media, the video CD, used the MPEG-1 technology. Today, DVD media uses more advanced MPEG-2 technology.

MPEG: Moving Picture Experts Group
MPEG1: SIF (Standard Interface Format): 352 X 240 NTSC, 352 X 288 PAL
MPEG2: Full D-1, 720 X 480, 29.97 FPS NTSC system
720 X 576 24 FPS PAL system

b. **Possibilities Testing Before Beginning the Process**
Testing based on a computer video playing in a computer and retail DVD player after encoding as MPEG2 in UDF format DVD disc.

**Testing DVD and Hardware Specifications:**

Disc information:
MPEG 2 Video Encoding: source size: 720 X 534, Target size 720 X 480, one pass
VBR, Target Bit-rate 5.0Mbps, Max Bit-rate 8.0 Mbps.
Length: 2 minutes and 30 seconds.
Aspect Ratio: 4:3
Audio: PCM 96Khz 16bit
DVD media recording: 1 X write speed in software Toast 5.2.1 with DVD UDF format.
DVD Disc: SONY DVD-RW disc with 4.7GB data capitation (DMW47L1)

• Retail DVD player-based system:
Video system: NTSC
DVD player model: Panasonic DVD Player DVDP31K.
TV: SONY 21 inch Flat Television, connect DVD player with S-video cable.

• Computer-based system:
1) Hi-end computer system:
• PowerMac G4 Dual 867, 2GB RAM, 180GB, Apple Super-Drive
  Mac OS X 10.2.6, Apple DVD Player software v3.2
• Pentium 4 2.0G KHz, 1 GB RAM, 120GB, Panasonic 528B DVD-ROM drive

2) Low-end computer system:
• PowerMac G4 400, 1GB Ram, 60GB
  Mac OS 9.2, Apple DVD Player software v3.0
• Pentium III 1.0G KHz, 512mb RAM, 120GB
  Microsoft Windows XP Home Edition, Microsoft Windows Mediaplayer 7
1. DVD Video Playback Experiment:

Results:
- Most DVD players play the DVD-R disc as well as retail DVD-video discs.
- When DVD players play the general DVD video on a television set, the TV video aspect ratio appears incorrectly. It makes a simple object taller than it really is. The television also cut the size of the original video; it lost about 10 to 15 percent screen space.
- The video colors on television appear more saturated than on computers, with some colors bleeding to others when played back, particularly pure colors such as white when more than 235/255 or red when more than 204/255 (RGB color).
- The DVD video plays accurately in both Mac and PC DVD players, no matter the video aspect ratio or color.

Problem defined:
- The demo video appears larger than it does on a computer. When playing the DVD video on television, it must find a way to accurately adjust the aspect ratio. The final DVD video must display the correct aspect ratio of objects on the video.
- It must locate acceptable television playback dimensions before beginning the project design process. The video must avoid the television size limits to cut the objects in video.

2. Screen Text Readability Test Results:

Results:
- The computer display can hold 1024 X 768 pixels in a 17”inch viewable size. However, the television can only hold 640 X 480 pixels or lower in 20 to 60 inch viewable sizes. The display quality of a television is poorer than on a computer monitor, as a television cannot display smaller text very well.
- On television display, anti-alias text occasionally appears to be worse than normal text. The text shadow and contrast colors help viewers recognize text and make text appear clearer.

Problem defined:
- The goal of the typographic design must meet two criteria: acceptable text size and “comfortable” colors.

3. Loading Speed Experiment:

Results:
This experiment was not performed to acquire the actual loading data-rate speed. Instead, it is to understand the timing of the loop menu, the number of seconds between two menus, and the pace when switched to different tracks. Loading speeds in most DVD Players were acceptable. The low-end computer was slow in handling the loop menus. Most of the time, retail DVD players were faster than DVD-ROM computer drives. All DVD players and DVD–ROM drives get unacceptable loading tempos when playing slide show pictures.

Problem defined:
The loading speed will very likely become unacceptable when using slide-show function in DVD player systems.

4. QTVR Movie Simulation:
The purpose of the QTVR function is to get smooth, high-quality video playback, fast reposing, and the ability to control different directions when using the QTVR selection. Retail DVD players are not able to play QTVR movies created by Apple Quicktime VR Studio. Designing continuous menus is one way to simulate QTVR movies. The technique is to set
up spin directions on each menu and turn those menus into a continuous system. (Please reference diagrams 3 and 4, the QTVR simulation design).

Diagram 3: QTVR Simulation Design
Results:
The QTVR simulation failed. The loading speed and remote control ability are not acceptable. The switch speed between different menus is also unacceptable. The built-in, four-direction buttons on the DVD remote control do not make it easy to control object rotations in the QTVR simulation test.

Problem defined:
It cannot create the QTVR design in DVD format. There may be another solution.

Professor James Ver Hague recommended I record the results of this experiment and consider using 3D animation or demo videos instead of QTVR movies in the final design.
5. Scripting Test:
Using a DVD script to create interactivity in DVD authoring such as random play, play list, retain path information, counting score. (Please reference diagrams 5, 6 and 7)

Results:
• Allows the viewer to have choices regarding buttons, menus, and tracks and also remembers which selections the user clicks.
• Adds random play when playing a DVD disc. Based on the DVD script, it is possible to get a random menu when playing the DVD in each DVD system (television, hi-end and low-end computer systems). Also, all scripts play functionally.

Problem defined:
• The DVD script is not able to create enough interactivity in the DVD media. It is more complicated to design interactivity as opposed to computer-based media.
• The scripting can allow viewers to create a play list of tracks, and pass variables to each menu. This enables a beginning setup, playing sequence and counting scores to be constructed. These techniques should be integrated into the DVD authoring to make effective interactive designs in the final disc.
6. Switching test between computer-based programs and DVD player software:
The purpose of this experiment is to learn about its ability to switch between computer-based programs and DVD player software.

Results
It is not possible to switch between the DVD player software and the computer program. The DVD video is able to switch to another application when playing the DVD video disc. However, the DVD video uses the $\text{DVD@cess}$ technology to launch the external functions. The $\text{DVD@cess}$ intercepts the DVD video, calls for a URL, and opens the URL in a web browser. In addition, $\text{DVD@cess}$ is not automatically installed on the computer's hard drive when they input the disc into the DVD drive. Rather, they are required to install the $\text{DVD@cess}$ program and set it up in each DVD player's software. For these reasons, the DVD is not able to launch external programs other than web browsers.

Problem defined:
- The $\text{DVD@cess}$ installer should be included in final DVD disc if the final project uses the $\text{DVD@cess}$ function. Based on the experiment's results, the DVD media does not have the ability to hold and switch programs.
- The final project will involve some elements other than DVD-video, and it will be something other than just a web-based program.

Advisor Adam Smith suggested launching the converted project in a web browser application such as Internet Explorer. Of the final DVD media, the computer-based project can be converted to Shockwave file format to play in standard web browsers. The ability to launch other applications from Shockwave was tested before the project began.
c. Design Considerations and Problems

Design Considerations:
The proposal identified that the target audience will be training and sales departments in corporations, as well as government organizations. It is also optimized for general consumer and commercial use. The final DVD media should be designed according to the following principles:
• Fun and attractive to the audience
• Easy to operate
• Information is obtainable in a short amount of time
• Project should be educational and provide advantages for the user

Technical problems:
Technical problems should be discovered during the design process:
• Find a way to adjust the aspect ratio into an accurate screen aspect ratio
• Locate the acceptable television playback dimensions before compressing the video content and avoid the television screen size limit to cut the object in video
• Define the acceptable text size and “comfortable” content colors
• Optimize the loading pace and speed in the looping menu
• Create 3D animation and demo videos instead of a QTVR movie
• DVD script techniques should be integrated into the DVD authoring and make effective interactive designs in the final disc.
d. Idea development
See sketch and basic prototype in diagrams 8 and 9.

Diagram 08, 09 : The original sketch and prototype
sketch and prototype images

TRIXBIBN

CHAPTER SELECT

01 Original Scratch
02 Lazers
03 Hot Start
04 Mixing
05 Blending
06 6 Spin

HIT

SCORE 95
e. Project Preparation
Preparation before editing:

1. Lighting design and filming

* Setup
Lighting setup is an essential asset for filming video. Not only will good lighting help create a high-quality video, it also enlivens the casts. Every scene should contain high-quality lighting before any camera shots are taken.
The lighting setup for this project will utilize the typical lighting setup in most videos and will always have three lights: the key light, the fill light and the back light. The key light will be approximately 45 degrees from the camera so it creates shadows on one side of the subject’s face and adds a 3D-like quality to the footage. The fill light will be placed directly across from the key light and will fill in some of the shadows produced by the key light. I set up the key light softly and added color to match the content.

* Color
The lighting colors also determined the final style and characteristics of the video. The way to give color to the fill light is to place several colored papers (red, dark blue, and purple) in front of the fill light. The purple color (R 160, G 90, B 200) was selected for the fill light.
Purple was chosen to be the primary color in the video because it has a more “high-tech” feel. It also provides a feeling of excitement and vitality. Purple is the primary color used in the video, computer game, 3D animation, and Graphical User Interface in the final DVD.

* Video shooting
The DVD video requires a dimension of 720 by 480 pixels for video playback. This means the quality of the source footage must be higher than the 720 by 480 pixels. The level of the video camera will also affect the quality of the video footage. The video camera used is a SONY PD-100A DVCAM digital camcorder, as it provides broadcast-quality output. This camcorder was selected because if the capacity of the camcorder in the video shooting is lower than the DVCAM quality, it will produce crude video footage. It also will produce low-quality video after some of the details are lost in editing, compressing and postproduction.

* Camera setup
The best way to set up a camera is to keep the object simple and clear. It was not always easy to set up the two or three cameras that were necessary to shoot some parts of the video. The lighting setup, in particular, is not simple to set up, as each of the three cameras must be set up for the optimum camera angles and lighting. In addition, the three cameras need supplement lighting in order to make objects appear more three-dimensional.

2. 3D Modeling and 3D Animation
The purpose of 3D modeling is to demonstrate techniques which would be difficult to shoot on video or cannot be shot during production. It is also possible to rotate the product, showing it at different angles and using lighting which would not be possible through conventional means. This way, users will find it easier to understand each function of the product. The main advantage of the 3D animation is that the designer can simplify some elements of the product and enhance others in the 3D model. This will help users to better understand the product demonstration.

3. Graphical User Interface Basic Layout Design
The GUI layout design should fit the content, footage, background sound track, attributes, and lifestyle of the user. The GUI design is done in a 1970s cartoon style, in keeping with the style of the product.

4. Computer-Based Game Design
The computer-based game for the DVD will integrate video content and DVD elements to create a game.
f. Project Design & DVD Authoring:
The following steps constitute the procedure used in the project design process:

1. Source content recording and shooting.
2. Basic layout design:
   Use programs such as Adobe Photoshop, Adobe After Effects, and Peak DV 3 Sound Studio to create source content (i.e. Graphical User Interface, Audio and video stream, interactive menu and 3D animation)
3. RemiXing video content:
   Use Adobe After Effects to create looping menu, demonstration video, training multi-angle video and multi-channel sounds
4. Encoding:
   Encode video and audio, respectively, to MPEG-2, PCM Audio, and AC-3 Streams
5. DVD Authoring
   Set up project framework, timeline, video markers, video story order, menu, and buttons to allow the viewer to interact with and navigate through the DVD.
   (Please reference the diagram 10: Structure of DVD authoring)
6. Scripting:
   Add DVD script to create interactive menu path and quiz game.
7. Computer game design
   The interactive game was created in Macromedia Director.
8. Final Disc Packaging
   Recording the project to DVD-R, DVD-RW, DVD-RAM media (or a DLT intended to be sent to a replication house) and DVD package design.
The structure of DVD Authoring.
g. Prototype survey and evaluation

The goal of the prototype survey was to prove that each element in the DVD media is functional. Then problems will be defined and used to improve the existing product. For prototype testing feedback, it was necessary to design a simple survey for users to fill out when viewing the prototype. Those surveyed were general users who have experience using retail DVDs.

- Prototype survey questions:

**Prototype survey**

Questions
1. Which hardware you have chosen for play this DVD Media?
   - [ ] Computer
   - [ ] General DVD Player.

2. Does DVD Video play well in computer or DVD player?
   - [ ] Yes
   - [ ] No

3. Is the text on screen easy to read?
   - [ ] Yes
   - [ ] No

4. Do you understand Video and 3D animation?
   - [ ] Yes
   - [ ] No

5. Does the Quiz Game in training section works well?
   - [ ] Yes
   - [ ] No

6. Does the Computer Beat Game works well?
   - [ ] Yes
   - [ ] No

5. Do you accept the loading speed on the general DVD Player?
   Please list the model of DVD Player if you don’t accept the reading speed.
   - [ ] Yes
   - [ ] No
   Your DVD Player Model: ____________________

6. Did you have any problem running this DVD? Please list problems if any.
   - [ ] No problem
   - [ ] Yes, some problems.

7. Any suggestion on this DVD media?
   Suggestions:

- Prototype survey results:
  1. Which hardware you have chosen for play this DVD Media?
     - Computer for 20% and General DVD Player for 80%.

  2. Is the Video plays well in computer or DVD player?
     - Yes for 100%

  2. Is the text on screen easy to read?
     - Yes for 90%

  3. Do you understand Video and 3D animation?
     - Yes for 80%

  4. Does the Quiz Game in training section works well?
5. Does the Computer Beat Game works well?
   Yes: 100%

6. Do you accept the loading speed on the general DVD Player?
   Please list the model of DVD Player if you don't accept the reading speed.
   Yes: 80%  No: 20%
   Your DVD Player Model:_________________________
   User statement: The disc in my DVD player get drop frame effect when play the multi-angle video.

7. Did you have any problem running this DVD? Please list problems if any.
   Yes: 80%  No: 20%
   Statement: Same as the loading speed issue.

8. Any suggestions on this DVD media?
   Suggestions:
   a. The demonstrate video seems like an independence selection in whole project, It seems doesn't have enough relation to other selections. What is the goal of the video integrated skateboard piece into demonstrate video. Also, the demonstrate video can be shorter in final project.
   b. Some automatic return function seems waiting too much time, It should be shorter.

   • The Advisor professor Chris indicates some problems in Color, typography and GUI design.
   • Chief Advisor professor James suggest shorten the video and reduce some duplicate footages in part of demonstrate video.

As the results show the majority of people found the prototype very easy to operate. These user feedbacks helped defined problems before final project release.
h. Problems and Solutions

These are the problems that came to light during the prototype survey, testing, and DVD authoring process.

a. Mpeg 2 encoding problem

- Problem Statement:

  Mpeg-2 video allows a maximum bit rate of 9.8 Mbps, which falls just within the current maximum DVD-video date rate of 10.08 Mbps. But the maximum DVD-video date rate includes multi-angle video, multi-language audios, subtitles and multi-format audios (AC3 audio, PCM audio, DTS audio, etc.). These are the limitations of DVD compression.

  The trick to video compression is selecting a bit rate that is low enough to provide the smallest possible file size, but high enough to maintain the source content’s visual quality. Low bit rates produce files that take less space on the DVD. They also make it easier for DVD authoring and to play the disc in retail DVD-video players. However, if the designer uses too low a bit rate, compression artifacts will work their way into the final video. On the other hand, if the compression data rate is high, and extras such as subtitles and sound push it over the data rate limitation, the video will not play when finally compressed to DVD disc.

  Based on the prototype testing survey, the multi-angle selection produces a drop frame problem in some DVD players. The training time section uses multi-angle video and audio. There are three multi-angle videos (front view, left view and right view) and two audios tracks (scratch audio with background music and background music only audio). The video and audio compressions become very tricky if the maximum data rate must be under 10 Mbps. It must measure each video’s data rate and obtain an accurate compressing bit rate prior to DVD authoring.

  The final encoded data rate follows the suggested data rate table in the DVD Studio user manual (Preparing Source Material, chapter 2, page 62). Unfortunately, the final encoding results are not acceptable for most retail DVD-players. My solution is based on personal research and compression experiments.

- Solution:

  1. Open the file in Quicktime or video encoding software and slice out a couple of 10 to 15 second chunks. Then compress these sections at several different bit rates and see which setting gives the best visual quality at the lowest bit rate. Once the appropriate bit rate is determined, position the videos and audios in DVD authoring. Make the test chapter playable and functional. Then go back and compress the entire source video and audio using that setting.

  2. All multi-angle MPEG streams must be compressed at exactly the same bit rate and same length of time. To make sure DVD-video plays back on a wide range of DVD-players. The following suggests that you do not exceed the following bit rates for MPEGs used in multi-angle tracks.

  3. The suggested compressing bit-rate are below:

        3.1 One video track with one audio track:
            The 8.0 Mbps maximum data rate for MPEG stream and linear/PCM 48kHz 16 bit audio or AC3 audio.

        3.2 One video track with two audio tracks:
            Either keep the high-quality video or audio track—both are good solutions.
            The 6.0 Mbps maximum data rate MPEG stream and two linear/PCM 48kHz 16 bit audio or the 8.0 Mbps maximum data rate MPEG stream and two standard data rate for AC3 audio.

        3.3 Two different-angled video tracks and two different audio tracks:
The 3.5 Mbps maximum data rate for each multi-angle MPEG stream and standard data rate for AC3 audio.

3.4 Three different-angled video tracks and two different audio tracks:
The 2.2 Mbps maximum data rate for each multi-angle MPEG stream and standard data rate for AC3 audio only.

b. MPEG 2 Dimension Problem

- Problem Defined:
  1. Perfectly square vs. non-square video
     The standard DVD playback dimension for television is 720 X 480. But the original video dimension in video footage is 720 X 540 (DV NTSC) or 720 X 543 (D1 NTSC). Because computers use perfectly square pixels (aspect ratio of 1:1), and televisions use non-square pixels (aspect ratio of 0.9:1 for NTSC or the 1.07:1 for PAL.) If the viewer sees square pixels on a television set, the television screen will stretch the pixels, making them taller than they are wide. Graphics designed in Photoshop will appear slightly thin when displayed on a television, unless the designer does something to compensate for the slimming effect.

  2. Broadcast-safe colors:
     Televisions reproduce fewer colors than what is available in Photoshop. It delivers saturated colors, such as reds, fluorescent colors, and even pure white and black. Super white and super black cause colors to bleed into one another, creating a "mushy" image. When a television displays a super white color (R:255 G:255 B:255) it will be present a poor-quality image on the screen. Adobe Photoshop contains a filter that adjusts colors to fit within the color range that can be displayed on televisions. This filter is called the NTSC Colors filter. It should always be applied before compressing video content.

<table>
<thead>
<tr>
<th>Color</th>
<th>Standard RGB range</th>
<th>Broadcast safe RGB range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red, (R)</td>
<td>(0-255), 0, 0</td>
<td>(0-204), 0, 0</td>
</tr>
<tr>
<td>Green, (G)</td>
<td>0, (0-255), 0</td>
<td>0, (0-204), 0</td>
</tr>
<tr>
<td>Yellow, (R=G)</td>
<td>(0-255), (0-255), 0</td>
<td>(0-153), (0-153), 0</td>
</tr>
<tr>
<td>Black, (R=G=B)</td>
<td>0,0,0</td>
<td>(R&gt;15), (G&gt;15), (B&gt;15)</td>
</tr>
<tr>
<td>White, (R=G=B)</td>
<td>255,255,255</td>
<td>(R&lt;235), (G&lt;235), (B&lt;235)</td>
</tr>
</tbody>
</table>

- Solution:
  The difference between the aspect ratio of square and non-square pixels remains constant, so the designer can compensate by designing Photoshop graphics at a larger resolution and then resizing them to the dimensions of the video standard that the designer is working with (NTSC or PAL). The files will appear squashed in Photoshop, but when viewed on a television, they will go back to their original proportions.
Based on my own experiments in compression, the following steps are the solution for dimension and color problems when designing the graphical user interface in DVD authoring.

1. Create the Photoshop size menu at 720 X 534 pixels.
2. Design the Graphical User Interface graphics in the central of safe area (576 X 462).
3. Apply the Photoshop NTSC colors filter.
4. Resize graphic to 720 X 480 pixels and import the final Photoshop file into video composition software such as Apple Final Cut or Adobe After Effects.

c. Loading speed delay problems:

- Problem Defined:
  Some parts of the looping menu have slow loading speeds when playing the DVD. The reason for this is that the DVD player needs time to load a new video track, and the average loading speed is one half to one second. Moreover, when users switch to a different menu, the fade in and fade out effects use one or two new tracks. Every time users switch menus or enter a selection, the DVD player starts loading new tracks. This is the reason why users will notice a slow loading speed.
- Solution:
  The DVD authoring can use track markers and story orders. That means those fade-in-fade-out effects in separate tracks can be combined into one track, as well. This solution will remedy track number limitations and loading speed problems.

d. Menu size limitation and track number limitation

- Problem Defined:
  The menu size cannot exceed a file size of 1 GB (a maximum of approximately 0.99GB) and the number of tracks cannot exceed 99.
- Solution:
  To avoid reaching the 99-track limit, use DVD scripts to reuse tracks, put video markers in each video track, and shorten the loop time of menu tracks.

e. The input device

- Problem Defined:
  The original remote control is difficult to use and less functional and does not have the ability to control more than four directions.
- Solution:
  The solution is to redesign or enhance the input devices. It will help users to control the DVD or QTVR movie. Another possibility is to put arrow functions on the screen. (Please reference diagram 11: The enhanced DVD remote control)

This new enhanced input device will save control problems in DVD media in my idea. But it involves much more than computer graphics designer can do. It involves a professional in human factor and industrial design. This solution will not be taken and help GUI control in this thesis project.
f. DVD Programming Abilities

DVD video specifications include a simple, yet powerful scripting language. However, it cannot be compared to a computer-based program because it functions very differently. There are many limitations to DVD scripting, including:

1. The DVD media has very poor functionality in programming. There are a total of only eight variables in DVD scripting, which are not enough for advanced programming.
2. The DVD scripting does not have the timeline concept that is available in programming.
3. Because DVDs are a read-only medium, it does not store any of the changed variables. When the DVD player restarts or the viewer uses the time search or time play functions of remote control, all variables will be reset.
4. The DVD authoring supports the NVRAM (non-volatile memory) functions. The NVRAM keeps the stored variables when player is turned off. But NVRAM is only available on some models of Philips DVD players.

Therefore, the final project will not utilize stored variables and will instead use basic scripting to create interactivity. When applying the scripting, the “time search” and “time play pop-up menu” functions will not be used in the DVD authoring. Also, the project will not use NVRAM because some of its functionality can only be used in certain models of DVD players.
i. Usability Survey

Its purpose is to obtain users' opinions of defined problems and is designed for people to fill out when viewing the final project. To compare the differences between traditional media and DVD media, the final survey will show participants the original VHS video and the redesigned DVD. It also requires users to operate each prior to filling out the survey. Survey participants were comprised of people who had experience using computers and retail DVDs.

User Usability Survey

Questions

1. Which hardware have you chosen for this DVD Media
   □ Computer       □ General DVD Player.

2. Is the text on screen easy to read?
   □ Yes              □ No

3. Is the color skin fits the promote product?
   □ Yes              □ No

4. Which part of this DVD you like the most?
   □ Demonstrate □ Main Features □ Training. □ Terminology □ Product Spec

5. Would the demonstrate video catch your attention and let you obtain idea about this DVD media when you first start the DVD?
   □ Yes              □ No

       If your answer is NO, please statement the problem.

6. Would the Video and 3D help you understand the product?
   □ Yes              □ No

       If your answer is NO, please statement the problem.

7. Does the “Training Section” help you understand how to use the product?
   □ Yes              □ No

       If your answer is NO, please statement reason(s).

8. Do you like the beat game in the computer?
   □ Yes              □ No

       If your answer is NO, please statement reason(s).
9. Do you prefer this interactive DVD or traditional media (VHS tape, user menu or catalog)?
   □ Yes □ No
   If your answer is NO, please state reason(s).

10. Do you accept the loading speed and whole pace of project on the General DVD Player?
    □ Yes □ No
    If your answer is NO, please state DVD Player Model and reason(s).

11. Did you have any problem running this DVD? Please list problems if any.
    □ No problem □ Yes, some problems.
    If your answer is Yes, please state reason(s).

12. Do you enjoy this interactive DVD media?
    □ Yes □ No
    If your answer is NO, please state reason(s).

13. Does the DVD media make you get interesting and help you understand on the promote product?
    □ Yes □ No
    If your answer is NO, please state reason(s).

14. Would you like pay extra cost on this interactive DVD media when you purchase the promote product?
    □ Yes □ No
    If your answer is NO, please state reason(s).

15. Any Suggestions on this DVD?
    Suggestions:
Questions and Results:

1. Which hardware you have chosen for this DVD Media
   - □ Computer
   - □ General DVD Player.
   - 30% Computer and 70% General DVD Player

2. Is the text on screen easy to read?
   - □ Yes
   - □ No
   - 95% Yes and 5% No

3. Is the color skin fits the promote product?
   - □ Yes
   - □ No
   - 80% Yes and 20% No

4. Which part of this DVD you like the most?
   - □ Demonstrate
   - □ Main Features
   - □ Training
   - □ Terminology
   - 40% Demonstrate, 20% Main Features, 30% Training, 0% Terminology, 10% Product Spec

5. Would the demonstrate video catch your attention and let you obtain idea about this DVD media when you first start the DVD?
   - □ Yes
   - □ No
   - 80% Yes and 20% No

If your answer is NO, please statement the problem.
1. I just don’t understand some part of demonstrate video.
2. I don’t get it, why the DJ turntable relate with to skateboard player.

6. Would the Video and 3D help you understand the promote product?
   - □ Yes
   - □ No
   - 90% Yes and 10% No

   I just don’t understand the demonstrate video.

7. Does the “Training Section” help you understand how to use the promote product?
   - □ Yes 100% for Yes,

8. Do you like the beat game in the computer?
   - □ Yes
   - □ No
   - 70% Yes and 30% No

   1. The game is too difficult and hard to understand.
   2. I am not able to play the game in my PowerMac G3, It get really slow.
   3. The game doesn’t provide enough information about the promote product.

9. Do you prefer this interactive DVD or traditional media (VHS tape, the print menu or catalog )?
   - □ Yes
   - □ No
   - 90% Yes and 10% No

   1. I don’t like read or play anything about product, I never try to read whole instruction. I will just search or call the tech support when I get question.

10. Do you accept the loading speed and whole pace of project on the General DVD player?
    - □ Yes
    - □ No
    - 80% Yes and 30% No

    Some selections get kind of slow when I loading, It isn’t loading smoothly like computer.

11. Did you have any problem running this DVD ? Please list problems if any.
    - □ Yes
    - □ No
    - 90% Yes and 10% No
I am not able to play the game in my PowerMac G3 233, It get really slow.

12. Do you enjoy this interactive DVD media?
   90% Yes and 10% No
   I am not able to play the game in my PowerMac G3 233, It get really slow.

13. Does the DVD media make you get interesting and help you understand on the promote product?
   90% Yes and 10% No
   I am not able to play the game in my PowerMac G3 233, It get really slow.
   Suggestions form the positive answer user:
   I like to see more video and 3D animation stuff in the DVD media. I think those exciting videos and choosing menus make more inserting then traditional VHS video.

14. Would you like pay extra cost on this interactive DVD media when you purchase the promote product?
   80% Yes and 20% No
   It 's depends how much it cost.
   I don't want pay extra money for the DVD media. Those stuff should be free.

15. Any suggestion on this DVD?
   Suggestions:
   Please put more videos and animations in DVD media, I really enjoy that part of DVD.
   • Chief Advisor professor James suggests short the video, save the tempo issue and reduce some duplicate footages in part of demonstrate video.
   • Advisor professor Chris also indicates some problems in Color, typography and GUI design.
   • Advisor professor Adam was analyzed the playback time of video, defined some timing problems and indicated GUI design problems in main-features selection.

j. Final Project Evaluation
Based on user surveys and suggestions from both users and thesis advisors, the following are some requirements for the final project revision:

• Re-edit some problem parts of the demonstration video selection and remedy the tempo issues.
• Fix some timing and pacing problems in the main feature selection
• The GUI design in main feature should be more simple and functional
• Add more 3D objects in 3D animation
• Re-edit the screen typography to enhance its readability
• Make computer game design part faster and lower the system requirements by modifying the graphics and programming
IV. Conclusions

a. Thesis Defense

Questions and comments in thesis defense  Date: 05/23/03

Note 1:
CGD graduate student, Vincent:
I got couple comments,
You definitely made a this media very fun to the user, even though leaning the product, learning lot of information, you made very fun for the user and add lot of interactive for user, and user will be enjoy learning the product and those select fun for use this DVD.
But some problems I saw:
Your menu, you force user to make two of same choose, like when you click the demonstrate selection or any one of those. The graphic are right changes, but for no reason you have to click again. After the menu change at all, it seems you have 2 more menu over again, and the second choose will be the final destination. What is your reason for that?
Kai:
The reason is that I set auto-action function for this DVD media If you click any menu options it will be launch or switch automatically. In the DVD player is possible to jump different menu just by one click, but it doesn't works on DVD player software in computer. You have to click those menus again to get what you want. This is the reason why you can't switch those menus just by one click.
Vincent: So you said in the DVD Player will become quick choose?
Kai: Yes.

Note 2:
Thesis Chief Advisor, Professor Jim Ver Hague:
You mention the variables on DVD authoring of your project, what is the actual capability of those variables?
Kai:
There are total 8 variables in the DVD Authoring and those various will be active when DVD media is Playing, But it doesn't remember any various after restart DVD player or DVD player software in computer. Any various will be gone.

Note 3:
Thesis Chief Advisor, Professor James Ver Hague:
One of things other than look at on the movie of DVD, I didn't have much of sense of power for interactive before. I am impress and glad you combine so many video and computer animation into GUI and put of lot of “multi” on the multimedia that DVD media can do. Do you see this kind of thing can be view more on the television set or computer screen?
Kai: In my point of view, I think it is more on the television.

Note 4:
Thesis Advisor, Professor Adam Smith:
Kai, during your demonstrate selection, seems more like music video. Demonstrate selection should purpose showing the user specific usage or something about product. But it seems demonstrate video more like the finished piece of music video. Can you tell what is the goal or purpose of that?
Kai: I try to remix the audio by myself but I don't know why it goes like that way. I guess those remix audio are more like music video's background music. But I think I am shown lot of real demonstrate in demonstrate video. Like how to do the things or click each button on the right time and specific position in the product. I assume it helps and makes user feel interesting on product. That is the reason I make the demonstrate video like that way.
Note 5:
CGD graduate student, Peter Sigrist;
I wondering base on your experience on the DVD authoring. Where you see the future of DVD technology goes?
Kai:
the DVD's future. I think this kind of media like DVD media that can be play in Home video set are just a temperate solution for general user. Maybe the new media will instead DVD media after 3 or 4 years. But same method of design procedure in DVD media you can still apply in the future media continuously.
Peter:
What you see of next development of DVD media.
Kai:
Base on my experience in DVD authoring, I guess designer want design a media and have lot of functions on it. However, it will be hard to use. If the media can be easy to use then designer won't get many functions. In my idea, I think DVD is in the middle of range of design media. But for the future technology, I guess it will have more functions.
Peter: So it will be more functional media?
Kai: I think so.
b. The project execution: Thesis Exhibition Design

Exhibition Design

The purpose of the exhibition design is to create a learning system for the thesis show. Based on the training selection can switch different view angle and sounds. The exhibition design will have a video camera and a VCR set up in order to shoot and record the user’s activities and then play back the recorded video when user operates the digital turntable by following the instructions on the multi-angle video in the training selection.

It is also possible for the user to change the audio to, for instance, scratch sound or no scratch sound. It helps the user to follow the training selection video and listen to his or her own scratch sounds.

After operating the learning system, it lets the user see the recording video and DVD multi-angle training section in the same time. Users can see the difference, or any mistakes they may have made and learn from those experiences. (Please reference the diagram 12 and 13: The exhibition design 1, 2)

The features of the learning system include:
1. A demo screen like two and eleven to get an idea of scratch learning.
2. The ability to switch multi-angles of demonstration videos in the training selection and multi-sounds at any time.
3. The real digital turntable that provides the user with practice in exhibition design (No. 6).
4. A video camera and VCR to shoot and record the user's activities and play back the recorded video when the user operates the digital turntable by following the instructions on the multi-angle video in the training selection.
Diagram 13: Exhibition Design 02

1. Main Projector Screen
2. Demo Display
3. Computer Base DVD Player
4. Project Poster
5. Project fly sheet
6. Scratch CD Player
7. Mixer
8. DVD Remote Control
9. Project DVD Player
10. Playing DVD
11. Demo Display
12. Camera Display
13. Same Display as main project
14. Remote Control
15. Video Camera
c. Project Conclusions

Technical Failures
1. The final project could not launch or switch programs and then come back when the DVD video was running.
2. Taking into account the slow loading speed of the DVD and the limitations of the input device, I was unable to create a real, 360-degree interactive QTVR movie.

Design Solutions Discovered
1. Understanding the DVD know-how in computer graphics design.
2. Succeeded in integrating many multimedia elements into a DVD.
3. Created a reusable design process.
4. Established the solution in video compression.
5. Succeeded in using basic DVD scripting to simulate an interactive menu.
6. Integrated maximum usage of multi-angle and multi-audio in order to train and educate users.
7. Utilized DVD scripting to create the actual GUI path in the DVD menu.
8. Succeeded in simulating a story with a random ending in the game in the training selection.

Conclusions
Computer graphics design involves much more than just aesthetics in visual design, it also involves functionality and user-friendly elements.

The multimedia applications in computers offer more functionality in comparison to DVD players but are not as user friendly. In other hand, the DVD players offer a more expedient way to use DVDs but are less functional. DVDs must strike a balance between functionality and user friendliness. This means designers must weigh functionality and aesthetics when they begin to develop their ideas. I believe that I am establishing a good balance between functionality and aesthetics in computer graphics design.

Looking back at all of the processes involved in this thesis project, the most valuable part was to experience a process about defining many problems and finding solutions for them. I suggest that if a designer is planning to construct a new design using unknown new technology, they should experiment as much as possible before starting the creation process. It provides good problem-solving training as a designer. Such experiences help designers to create design procedures and feel more confident in creating designs using new technology.

Exploring and designing this project was much more difficult than I expected it to be. It was a new challenge and never-ending learning process for me. After clearly defining the problem and studying the relevant DVD technology, understanding its limitations, and establishing solutions, I am glad I took this challenge and explored it so deeply.
Contributors
Advisors:
   Chief advisor: Professor James Ver Hague
   Associate Advisors: Chris Jackson, Adam Smith.
   School of Design Chairperson: Professor Pattie Lachance

Project Voice Over: Scott Tamas:
Scratch BGM Sounds: BATTLE SOUNDS http://www.battlesounds.com

Special Thanks:

To Chief advisor Jim:
Thank you for being there for so many meetings and giving me so much advice and confidence.

To my dear parents:
Thanks for your support to accomplish my studies.

To my lovely wife, Mei:
Thanks for giving me so much support and encouragement so I can focus on my studies. I could not have finished my studies without you.
V. Appendixes

a. Bibliography

Books

3. *Apple DVD Studio user's menu* Apple Computer. Inc.
4. *Macworld DVD studio Pro Bible* by Todd kelsey, Chad Fahs
5. *DVD Studio Pro 1.5 for Macintosh: Visual QuickPro Guide*
6. *Director 8.5 Shockwave Studio* by David Mennenoh
   Publisher: Brandon A. Nordin, ISBN: 0-07-219490
7. *Advanced Lingo for Games* by Gary Rosenzweig

DVD Related Recourses

1. [www.dvddemystified.com/dvdfaq.html](http://www.dvddemystified.com/dvdfaq.html)
   DVD authoring AcartoResource of Internet.DVD Frequently Asked Questions (and Answers)
   Where's Interactive DVD Finding a Future in the Multimedia Market?
3. [www.uemedia.com/CPC/2-pop](http://www.uemedia.com/CPC/2-pop)
   Solutions to most DVD Studio Pro problems
4. [www.macrovision.com](http://www.macrovision.com)
   Macrovision
   The information of Macrovision AGC copy protection.
5. [www.dolby.com/digital](http://www.dolby.com/digital)
   The Dolby lab for audio AC-3 Encoding
   The OSTA (Optical Storage Technology Association) official website,
Software DVD Authoring Companies

1. DeLorme http://www.delorme.com
2. Digital Leisure http://www.digitalleisure.com
3. INTEC America http://www.inteca.com
5. Metropolis DVD http://www.metropolisdvd.com
7. Spruce Technologies http://www.spruce-tech.com
8. Sumeria http://www.sumeria.com

Software Manufacturers

   General information about Apple DVD Studio Pro and Final Cut Pro
8. www.adobe.com
   Information about Photoshop, After Effects, and other Adobe products.
9. www.macromedia.com
   Information about Director and other Macromedia products.
10. www.roxio.com
    Information about Toast and disc recording software.
11. www.terran.com
    Information about cleaner and encoding software.
b. DVD scripts

**Spin Script**
--Script of random spin

```plaintext
C ?= 6
if C == 1 then play script "B1"
if C == 2 then play script "B2"
if C == 3 then play script "B3"
if C == 4 then play script "B4"
if C == 5 then play script "B5"
if C == 6 then play script "B6"
```

**B1 script**
--Script for back to spin menu

```plaintext
B = 1
play track "F01 Track"
```

**B2 script**
--Script for back to spin menu

```plaintext
B = 2
play track "F02 Track"
```

**B3 script**
--Script for back to spin menu

```plaintext
B = 3
play track "F03 Track"
```

**B4 script**
--Script for back to spin menu

```plaintext
B = 4
play track "F04 Track"
```

**B5 script**
--Script for back to spin menu

```plaintext
B = 5
```
play track "F05 Track"

B6 script
--Script for back to spin menu

B = 6
play track "F06 Track"

spin script 2
--pass the variable to A script

D != 6
if D == 1 then play script "a1"
if D == 2 then play script "a2"
if D == 3 then play script "a3"
if D == 4 then play script "a4"
if D == 5 then play script "a5"
if D == 6 then play script "a6"

a1 script
--pass the variable to "back 1-6 choose script"

A = 1
play script "back 1-6 choose script"

a2 script
--pass the variable to "back 1-6 choose script"

A = 2
play script "back 1-6 choose script"

a3 script
--pass the variable to "back 1-6 choose script"

A = 3
play script "back 1-6 choose script"

a4 script
--pass the variable to "back 1-6 choose script"
A = 4
play script "back 1-6 choose script"

**a5 script**
--pass the variable to "back 1-6 choose script"

A = 5
play script "back 1-6 choose script"

**a6 script**
--pass the variable to "back 1-6 choose script"

A = 6
play script "back 1-6 choose script"

**back to 1-6 script**
--tell the program back to the right back track when it go back

if B == 1 then play marker "back Marker" Of track "F01B"
if B == 2 then play marker "back Marker" Of track "F02B"
if B == 3 then play marker "back Marker" Of track "F03B"
if B == 4 then play marker "back Marker" Of track "F04B"
if B == 5 then play marker "back Marker" Of track "F05B"
if B == 6 then play marker "back Marker" Of track "F06B"

**script of 1-6 choose script**
--tell the program back to the right select menu after play the back track

if A == 1 then play script "B1"
if A == 2 then play script "B2"
if A == 3 then play script "B3"
if A == 4 then play script "B4"
if A == 5 then play script "B5"
if A == 6 then play script "B6"

**F01 script**
--this script purpose to reuse the "info" track and pass the variable to "choose script"
F = 1
play track "info"

F02 script
--this script purpose to reuse the "info" track and pass the variable to "choose script"

F = 2
play track "info"

F03 script
--this script purpose to reuse the "info" track and pass the variable to "choose script"

F = 3
play track "info"

F03 script
--this script purpose to reuse the "info" track and pass the variable to "choose script"

F = 3
play track "info"

F04 script
--this script purpose to reuse the "info" track and pass the variable to "choose script"

F = 4
play track "info"

F05 script
--this script purpose to reuse the "info" track and pass the variable to "choose script"

F = 5
play track "info"
F06 script
--this script purpose to reuse the "info" track and pass the variable to "choose script"

F = 6
play track "info"

choose script
--this script purpose to reuse the "info" track and remember

if F == 1 then play track "01T"
if F == 2 then play track "02T"
if F == 3 then play track "03T"
if F == 4 then play track "04T"
if F == 5 then play track "05T"
if F == 6 then play track "06T"

game reset script
--this script purpose to reset the game

F = 1
H = 0
play menu "Q1M"

F1-F2 script
--this script purpose to pass the variable to the "next question" script

F = 2

F2-F3 script
--this script purpose to pass the variable to the "next question" script

F = 3

F3-F4 script
--this script purpose to pass the variable to the "next question" script

F = 4
**F4-F5 script**
--this script purpose to pass the variable to the "next question" script

F = 5

**F5-end script**
--this script purpose to pass the variable to the "next question" script

F = 6

**plus 1 script**
--this script purpose to make addition on variable after get the correct answer.

H += 1

**next question script**
--this script purpose to tell the program where to go base on passed variables

if F == 2 then play menu "Q2M"
if F == 3 then play menu "Q3M"
if F == 4 then play menu "Q4M"
if F == 5 then play menu "Q5M"
if F == 6 then play script "end game"

**show answer script**
--this script purpose to tell the program go to the answer track.

if F == 2 then play track "answer1"
if F == 3 then play track "answer2"
if F == 4 then play track "answer3"
if F == 5 then play track "answer4"
if F == 6 then play track "answer5"

**end game script**
--this script purpose to count the score and go to the each score track

if H == 1 then play track "s1"
if H == 2 then play track "s2"
if H == 3 then play track "s3"
if H == 4 then play track "s4"
if H == 5 then play track "s5"
c. Lingo Script:

```lingo
movie script
global life, levelstage, stopsound, goplay, rungraphic, tscore, Abpm, tclick, tmiss, thit, tcue, plusscore, minscore

on startmovie me
  life = 0
  levelstage = 1
  plusscore = 0
  minscore = 0
  tcue = 0
  tclick = 0
  tmiss = 0
  thit = 0
  tscore = 0
end
```
Button A script

global spechit, specopen, life, presstime, tscore

on mouseenter me
  cursor 280
  sprite(me.spriteNum).blend = 70
end

on mouseleave me
  sprite(me.spriteNum).blend = 50
  cursor -1
  sprite(66).visible = 0
end

on mouseup me
  sprite(66).visible = 0
end

on mousedown me

  if presstime = 1 and specopen = 1 then
    sprite(me.spriteNum).blend = 100
    sound(3).play(member("effl"))
    sprite(59).visible = 0
    tscore = tscore + 10
    life = life - 20
    spechit = spechit + 1
    sprite(66).visible = 1
  end if

  if presstime = 3 and specopen = 1 then
    sprite(me.spriteNum).blend = 100
    sound(3).play(member("effl"))
    sprite(59).visible = 0
    tscore = tscore + 10
    life = life - 20
    sprite(66).visible = 1
    spechit = spechit + 1
  end if

  if presstime = 5 and specopen = 1 then
    sprite(me.spriteNum).blend = 100
    sound(3).play(member("effl"))
    sprite(59).visible = 0
    tscore = tscore + 10
    life = life - 20
    sprite(66).visible = 1
    spechit = spechit + 1
  end if

  if presstime = 7 and specopen = 1 then
    sprite(me.spriteNum).blend = 100
    sound(3).play(member("effl"))
  end if
sprite(59).visible = 0
 tscore = tscore + 10
  life = life - 20
  sprite(66).visible = 1
  spechit = spechit + 1
 end if
 end
global speakit, specopen, life, presstime, tscore

on mouseenter me
  cursor 280
  sprite(me.spriteNum).blend = 70
end

on mouseleave me
  sprite(me.spriteNum).blend = 50
  cursor -1
  sprite(66).visible = 0
end

on mouseup me
  sprite(66).visible = 0
end

on mousedown me

  if presstime = 1 and specopen = 1 then
    sprite(me.spriteNum).blend = 100
    sound(4).play(member("eff2"))
    sprite(59).visible = 0
    tscore = tscore + 10
    life = life - 20
    sprite(66).visible = 1
    speakit = speakit + 1
  end if

  if presstime = 3 and specopen = 1 then
    sprite(me.spriteNum).blend = 100
    sound(4).play(member("eff2"))
    sprite(59).visible = 0
    tscore = tscore + 10
    life = life - 20
    sprite(66).visible = 1
    speakit = speakit + 1
  end if

  if presstime = 5 and specopen = 1 then
    sprite(me.spriteNum).blend = 100
    sound(4).play(member("eff2"))
    sprite(59).visible = 0
    tscore = tscore + 10
    life = life - 20
    sprite(66).visible = 1
    speakit = speakit + 1
  end if

  if presstime = 7 and specopen = 1 then
    sprite(me.spriteNum).blend = 100
    sound(4).play(member("eff2"))
sprite(59).visible = 0
tscore = tscore + 10
life = life - 20
sprite(66).visible = 1
    spechit = spechit + 1
end if
end
Button C script

global spechit, specopen, life, presstime, tscore

on mouseenter me
    cursor 280
    sprite(me.spriteNum).blend = 70
end

on mouseleave me
    sprite(me.spriteNum).blend = 50
    cursor -1
    sprite(66).visible = 0
end

on mouseup me
    sprite(66).visible = 0
end

on mousedown me
    if presstime = 1 and specopen = 1 then
        sprite(me.spriteNum).blend = 100
        sound(5).play(member("eff3"))
        sprite(59).visible = 0
        tscore = tscore + 10
        life = life - 20
        sprite(66).visible = 1
        spechit = spechit + 1
    end if

    if presstime = 3 and specopen = 1 then
        sprite(me.spriteNum).blend = 100
        sound(5).play(member("eff3"))
        sprite(59).visible = 0
        tscore = tscore + 10
        life = life - 20
        sprite(66).visible = 1
        spechit = spechit + 1
    end if

    if presstime = 5 and specopen = 1 then
        sprite(me.spriteNum).blend = 100
        sound(5).play(member("eff3"))
        sprite(59).visible = 0
        tscore = tscore + 10
        life = life - 20
        sprite(66).visible = 1
        spechit = spechit + 1
    end if

    if presstime = 7 and specopen = 1 then
        sprite(me.spriteNum).blend = 100
        sound(5).play(member("eff3"))
        sprite(59).visible = 0
        tscore = tscore + 10
life = life - 20
sprite(66).visible = 1
spechit = spechit + 1
end if
end
```
button d script

global spechit, specopen, life, presstime, tscore

on mouseenter me
  cursor 280
  sprite(me.spriteNum).blend = 70
end

on mouseleave me
  sprite(me.spriteNum).blend = 50
  cursor -1
  sprite(66).visible = 0
end

on mouseup me
  sprite(66).visible = 0
end

on mousedown me

  if presstime = 1 and specopen = 1 then
    sprite(me.spriteNum).blend = 100
    sound(6).play(member("eff4"))
    sprite(59).visible = 0
    tscore = tscore + 10
    life = life - 20
    sprite(66).visible = 1
    spechit = spechit + 1
  end if

  if presstime = 3 and specopen = 1 then
    sprite(me.spriteNum).blend = 100
    sound(6).play(member("eff4"))
    sprite(59).visible = 0
    tscore = tscore + 10
    life = life - 20
    sprite(66).visible = 1
    spechit = spechit + 1
  end if

  if presstime = 5 and specopen = 1 then
    sprite(me.spriteNum).blend = 100
    sound(6).play(member("eff4"))
    sprite(59).visible = 0
    tscore = tscore + 10
    life = life - 20
    sprite(66).visible = 1
    spechit = spechit + 1
  end if

  if presstime = 7 and specopen = 1 then
    sprite(me.spriteNum).blend = 100
    sound(6).play(member("eff4"))
    sprite(59).visible = 0
```
tscore = tscore + 10
life = life - 20
sprite(66).visible = 1
    spechit = spechit + 1
    end if
end
Button script

global spechit, specopen, life, presstime, tscore

on mouseenter me
  cursor 280
  sprite(me.spriteNum).blend = 70
end

on mouseleave me
  sprite(me.spriteNum).blend = 50
  cursor -1
  sprite(66).visible = 0
end

on mouseup me
  sprite(66).visible = 0
end

on mousedown me

  if presstime = 1 and specopen = 1 then
    sprite(me.spriteNum).blend = 100
    sound(7).play(member("eff5"))
    sprite(59).visible = 0
    tscore = tscore + 10
    life = life - 20
    sprite(66).visible = 1
    spechit = spechit + 1
  end if

  if presstime = 3 and specopen = 1 then
    sprite(me.spriteNum).blend = 100
    sound(7).play(member("eff5"))
    sprite(59).visible = 0
    tscore = tscore + 10
    life = life - 20
    sprite(66).visible = 1
    spechit = spechit + 1
  end if

  if presstime = 5 and specopen = 1 then
    sprite(me.spriteNum).blend = 100
    sound(7).play(member("eff5"))
    sprite(59).visible = 0
    tscore = tscore + 10
    life = life - 20
    sprite(66).visible = 1
    spechit = spechit + 1
  end if

  if presstime = 7 and specopen = 1 then
    sprite(me.spriteNum).blend = 100
    sound(7).play(member("eff5"))
    sprite(59).visible = 0
    tscore = tscore + 10
life = life - 20
sprite(66).visible = 1
spechit = spechit + 1
end if
end
really to quit script

on mouseUp me
  go to "quit"
end

stop script

on exitFrame me
  go to the frame
end

definition script

global spechit, levelstage, tclick, tmiss, thit, tcue, plusscore, minscore, tscore, levelstage

on beginsprite me
  sound(1).fadeout(1200)
end

on exitFrame me
  member("total beat").text = "Total Beats =" & (tcue/2)
  member("total click").text = "Total HITs =" & tclick
  member("total hit").text = "Correct HITs =" & thit
  member("total miss").text = "Miss HITs =" & tmiss
  member("hitpoint").text = "One Correct Hit =" & plusscore & " point"
  member("misspoint").text = "One Miss Hit = -" & minscore & " point"
  member("level text").text = "level " & levelstage

  member("countline").text = thit &" x " & plusscore & " point - " & tmiss &" x " & minscore & " point + " & spechit & " Special x 10 = " & tscore

  if levelstage = 6 then
    sprite(48).visible = 0
  else
    sprite(48).visible = 1
  end if
  life = 0
  go to the frame
end
level script

global spechit, specopen, life, gspeed, looptime, rungraphic, levelstage, tempox, goplay, tscore, presstime, Abpm, plusscore, minscore, tclick, tmiss, thit, tcue
property playingsound

on beginsprite me

if levelstage = 1 then
    sprite(10).member = "Gsound-L1"
    playingsound = "sound01"
    looptime = 21
    Abpm = 90
    plusscore = 5
    minscore = 3
    gspeed = 13
    sprite(10).loch = 330
end if

if levelstage = 2 then
    sprite(10).member = "Gsound-L2"
    playingsound = "sound02"
    looptime = 26
    Abpm = 125
    plusscore = 2
    minscore = 1
    gspeed = 20.5
    sprite(10).loch = 280
end if

if levelstage = 3 then
    sprite(10).member = "Gsound-L3"
    playingsound = "sound03"
    looptime = 26
    Abpm = 125
    plusscore = 1
    minscore = 1
    gspeed = 10
    sprite(10).loch = 280
end if

if levelstage = 4 then
    sprite(10).member = "Gsound-L4"
    playingsound = "sound04"
    looptime = 26
    Abpm = 130
    plusscore = 1
    minscore = 1
    gspeed = 10.5
    sprite(10).loch = 220
end if

if levelstage = 5 then
sprite(10).member = "Gsound-L5"
playingsound = "sound05"
looptime = 26
Abpm = 160
plusscore = 1
minscore = 1
gspeed = 12.5
sprite(10).loch = 640
end if

if levelstage = 6 then
sprite(10).member = "Gsound-L6"
playingsound = "sound06"
looptime = 26
Abpm = 160
plusscore = 1
minscore = 1
gspeed = 12.5
sprite(10).loch = 260
end if

member("level text").text = "level " & levelstage
sprite(66).visible = 0
spechit = 0
tcsore = 0
life = 0
tclick = 0
tmiss = 0
thit = 0
goplay = false
rungraphic = false
sprite(33).member.text = string(abpm)
sprite(35).member.text = string(tscore)

sound(1).queue([#member: member(playingsound),
#loopCount: looptime, #rateShift: tempox])
prersstime = 0
sprite(59).visible = 0
letgo
end

on letgo me
sound(1).play()
goplay = true
rungraphic = true
sprite(29).member = "play-on"
end

on cuePassed whichChannel, cuePointNumber, cuePointName
tcue = tcue + 1
life = life + 6
if cuePointName = "1" then
prersstime = 1
sprite(36).member = "upt"
updatestage
end if
if cuePointName = "2" then
  presstime = 2
  sprite(36).member = "ready"
  specopen = 0
  updatestage
end if

if cuePointName = "3" then
  presstime = 3
  sprite(36).member = "downt"
  updatestage
end if

if cuePointName = "4" then
  presstime = 4
  sprite(36).member = "ready"
  specopen = 0
  updatestage
end if

if cuePointName = "5" then
  presstime = 5
  sprite(36).member = "leftt"
  updatestage
end if
if cuePointName = "6" then
  presstime = 6
  sprite(36).member = "ready"
  specopen = 0
  updatestage
end if
if cuePointName = "7" then
  presstime = 7
  sprite(36).member = "rightt"
  updatestage
end if
if cuePointName = "8" then
  presstime = 8
  sprite(36).member = "ready"
  specopen = 0
  updatestage
end if
cuepassed

on keydown
  case (the keycode) of

    126:
      sprite(60).member = "Aup"
      sprite(51).member = "upH"
      if presstime = 1 then
        correct
      else
        wrong
      end if
125:  
sprite(60).member = "Ado"
sprite(52).member = "downH"
if presstime = 3 then
  correct
else
  wrong
end if

123:  
sprite(60).member = "Aleft"
sprite(53).member = "leftH"
if presstime = 5 then
  correct
else
  wrong
end if

124:  
sprite(60).member = "Aright"
sprite(54).member = "rightH"
if presstime = 7 then
  correct
else
  wrong
end if
end case
end

on keyup
  case (the keycode) of
  126:
    sprite(51).member = "up"
  125:
    sprite(52).member = "down"
  123:
    sprite(53).member = "left"
  124:
    sprite(54).member = "right"
end case
sprite(60).member = "arrdumm"
sprite(37).member = "ts"
sprite(59).visible = 0
end

on wrong me
  sound(3).play(member("fx1"))
  tscore = tscore - minscore
  member("miss").text = "Miss -" & minscore
  sprite(37).member = "miss"
tclick = tclick + 1
tmiss = tmiss + 1
  life = life + 6
sprite(59).visible = 1
on correct me
    sound(4).play(member("correct"))
    tscore = tscore + plusscore
    member("hit").text = "HIT +" & plusscore
    sprite(37).member = "Hit"
    tclick = tclick + 1
    thit = thit + 1
    life = life -15
    sprite(59).visible = 0
    specopen = 1
end

on exitframe me
    sprite(64).height = life
    put "spechit ===== " spechit
    if life < 0 then
        life = 0
    end if
    if life > 250 then
        go to "end"
    end if
    if goplay = true and sound(1).loopsRemaining <1 then
        GO TO "END"
    end if
    if rungraphic = true then
        sprite(10).loch = sprite(10).loch - gspeed
    end if
    if sprite(10).loch < 0 then
        sprite(10).loch = 800
    end if
    sprite(35).member.text = string(tscore)
    go to the frame
end

on stopsound me
    pause(sound(1))
    goplay = false
    rungraphic =false
end
sound fader script

global Avolume, Bvolume
property spritenum
property trackSpriteNum

on beginSprite me
    sprite(spritenum).moveablesprite = TRUE
    trackSpriteNum = spritenum -1
    sprite(spritenum).constraint = trackSpriteNum
end

on exitFrame me
    whole = sprite(trackSpriteNum).width
    part = sprite(spritenum).loch - sprite(trackSpriteNum).left
    Bvolume = float(part)/whole
    Avolume = Bvolume -1
    sound(2).volume=-255 * (Bvolume)
    sound(1).volume=-255 * (Avolume)
end

on mouseenter me
    cursor 280
end

on mouseleave me
    cursor -1
end
up key script

global  life, gspeed, looptime, rungraphic, levelstage, tempox,
goplay, tscore, presstime, Abpm, plusscore, minscore, tclick, tmiss,
thit, tcue

on mouseenter me
  cursor 280
end
on mouseleave me
  cursor -1
  sprite(37).member = "ts"
  sprite(59).visible = 0
end

onmousedown me
  sprite(60).member = "Aup"
  sprite(me.spriteNum).member = "upH"
end

onmouseup me
  sprite(60).member = "arrdumm"
  sprite(me.spriteNum).member = "up"
  sprite(59).visible = 0
  if presstime = 1 then
    correct
  else
    wrong
  end if
end

on wrong me
  sound(3).play(member("fxl"))
  tscore = tscore - minscore
  member("miss").text = "Miss -" & minscore
  sprite(37).member = "miss"
  sound(4).play(member("fxl"))
  tclick = tclick + 1
  tmiss = tmiss + 1
  life = life + 6
  sprite(59).visible = 1
end

on correct me
  tscore = tscore + plusscore
  member("hit").text = "HIT +" & plusscore
  sprite(37).member = "Hit"
  sound(3).play(member("correct"))
  tclick = tclick + 1
  thit = thit + 1
  life = life - 12
  sprite(59).visible = 0
end
left key script

global life, gspeed, looptime, rungraphic, levelstage, tempox,
goplay, tscore, presstime, Abpm, plusscore, minscore, tclick, tmiss,
thit, tcue

on mouseenter me
cursor 280
end

on mouseleave me
cursor -1
sprite(37).member = "ts"
sprite(59).visible = 0
end

on mousedown me
sprite(60).member = "Aleft"
sprite(me.spriteNum).member = "leftH"
end

on mouseup me
sprite(60).member = "arrdumm"
sprite(me.spriteNum).member = "left"
if presstime = 5 then
correct
else
wrong
end if
end

on wrong me
sound(3).play(member("fxl"))
tscore = tscore - minscore
member("miss").text = "Miss -" & minscore
sprite(37).member = "miss"
sound(4).play(member("fxl"))
tclick = tclick + 1
tmiss = tmiss + 1
life = life + 6
sprite(59).visible = 1
end

on correct me
tscore = tscore + plusscore
member("hit").text = "HIT +" & plusscore
sprite(37).member = "Hit"
sound(3).play(member("correct"))
tclick = tclick + 1
thit = thit + 1
life = life - 12
sprite(59).visible = 0
end
down key script

global  life, gspeed, looptime, rungraphic, levelstage, tempox,
goplay, tscore, presstime, Abpm, plusscore, minscore, tclick, tmiss,
thit, tcue

on mouseenter me
  cursor 280
end

on mouseleave me
  cursor -1
  sprite(37).member = "ts"
  sprite(59).visible = 0
end

onmousedown me
  sprite(60).member = "Ado"
  sprite(me.spriteNum).member = "down"
end

onmouseup me
  sprite(60).member = "arrdumm"
  sprite(me.spriteNum).member = "down"
  sprite(59).visible = 0
  if presstime = 3 then
    correct
  else
    wrong
  end if
end

on wrong me
  sound(3).play(member("fxl"))
  tscore = tscore - minscore
  member("miss").text = "Miss -" & minscore
  sprite(37).member = "miss"
  sound(4).play(member("fxl"))
  tclick = tclick + 1
  tmiss = tmiss + 1
  life = life + 6
  sprite(59).visible = 1
end

on correct me
  tscore = tscore + plusscore
  member("hit").text = "HIT +" & plusscore
  sprite(37).member = "Hit"
  sound(3).play(member("correct"))
  tclick = tclick + 1
  thit = thit + 1
  life = life - 12
  sprite(59).visible = 0
end

right key script
global life, gspeed, looptime, rungraphic, levelstage, tempox, goplay, tscore, presstime, Abpm, plusscore, minscore, tclick, tmiss, thit, tcue

on mouseenter me
    cursor 280
end

on mouseleave me
    cursor -1
    sprite(37).member = "ts"
    sprite(59).visible = 0
end

on mousedown me
    sprite(60).member = "Aright"
    sprite(me.spriteNum).member = "rightH"
end

on mouseup me
    sprite(60).member = "arrdumm"
    sprite(me.spriteNum).member = "right"
    sprite(59).visible = 0
    if presstime = 7 then
        correct
    else
        wrong
    end
end

on wrong me
    sound(3).play(member("fxl"))
    tscore = tscore - minscore
    member("miss").text = "Miss -" & minscore
    sprite(37).member = "miss"
    sound(4).play(member("fxl"))
    tclick = tclick + 1
    tmiss = tmiss + 1
    life = life + 6
    sprite(59).visible = 1
end

on correct me
    tscore = tscore + plusscore
    member("hit").text = "HIT +" & plusscore
    sprite(37).member = "Hit"
    sound(3).play(member("correct"))
    tclick = tclick + 1
    thit = thit + 1
    life = life -12
    sprite(59).visible = 0
end
play script

global rungraphic, goplay,

on mouseenter me
  if goplay = false then
    cursor 280
    sprite(me.spriteNum).member="play-on"
  else
    exit
  end if
end

on mouseleave me
  if goplay = false then
    cursor -1
    sprite(me.spriteNum).member="play"
  else
    exit
  end if
end

on mouseup me
  if goplay = false then
    sound(1).play()
    goplay=true
    rungraphic =true
    sprite(28).member="stop"
  else
    exit
  end if
end
stop play script

global  rungraphic, playingsound, goplay

on mouseenter me
  if  goplay = true then
    cursor 280
    sprite(me.spriteNum).member="stop-on"
  else
    exit
  end if
end

on mouseleave me
  if  goplay = true then
    cursor -1
    sprite(me.spriteNum).member="stop"
  else
    exit
  end if
end

on mouseup me
  if  goplay = true then
    pause(sound(1))
    goplay = false
    rungraphic =false
    sprite(29).member="play"
  else
    exit
  end if
end
go play the same script

global levelstage

on mouseenter me
cursor 280
    sprite(me.spriteNum).member = "play-b"
end

on mouseleave me
cursor -1
    sprite(me.spriteNum).member = "playt"
end

on mouseUp me
go to "go"
end

select level-1 script

on mouseenter me
cursor 280
end

on mouseleave me
cursor -1
end

on mouseUp me
    levelstage = 1
    sprite(me.spriteNum).member = "levell-b"
sprite(42).member = "level2"
sprite(43).member = "level3"
sprite(44).member = "level4"
sprite(45).member = "level5"
sprite(46).member = "level6"
end
select level-2 script

global levelstage

on mouseenter me
cursor 280
end

on mouseleave me
cursor -1
end

on mouseUp me
levelstage =4
sprite(me.spriteNum).member = "level2-b"
sprite(41).member = "level1"
sprite(43).member = "level3"
sprite(44).member = "level4"
sprite(45).member = "level5"
sprite(46).member = "level6"
end

select level-3 script

global levelstage

on mouseenter me
cursor 280
end

on mouseleave me
cursor -1
end

on mouseUp me
levelstage =3
sprite(me.spriteNum).member = "level3-b"
sprite(41).member = "level1"
sprite(42).member = "level2"
sprite(44).member = "level4"
sprite(45).member = "level5"
sprite(46).member = "level6"
end
select level-4 script

global levelstage

on mouseenter me
cursor 280
end

on mouseleave me
cursor -1
end

on mouseUp me
levelstage = 4
sprite(me.spriteNum).member = "level4-b"
sprite(41).member = "level1"
sprite(42).member = "level2"
sprite(43).member = "level3"
sprite(45).member = "level5"
sprite(46).member = "level6"
end

select level-5 script

global levelstage

on mouseenter me
cursor 280
end

on mouseleave me
cursor -1
end

on mouseUp me
levelstage = 5
sprite(me.spriteNum).member = "level5-b"
sprite(41).member = "level1"
sprite(42).member = "level2"
sprite(43).member = "level3"
sprite(44).member = "level4"
sprite(46).member = "level6"
end
select level-6 script

global levelstage
on mouseenter me
    cursor 280
end

on mouseleave me
    cursor -1
end

on mouseUp me
    levelstage = 6
    sprite(me.spriteNum).member = "level6-b"
sprite(41).member = "level1"
sprite(42).member = "level2"
sprite(43).member = "level3"
sprite(44).member = "level4"
sprite(45).member = "level5"
end

go play the game(end) script

global levelstage, tscore, life
on mouseenter me
    cursor 280
    sprite(me.spriteNum).member = "playagain-on"
end

on mouseleave me
    cursor -1
    sprite(me.spriteNum).member = "playagain"
end

on mouseUp me
    life = 0
    tscore = 0
    go to "game"
end
quit script

on mouseUp me
   sound(1).stop()
   go to "end"
end

go select script

on mouseenter me
   cursor 280
   sprite(me.spritenum).member ="select leveles-eo"
end
on mouseleave me
   cursor -1
   sprite(me.spritenum).member ="select leveles-e"
end
on mouseUp me
   go to "select"
   life = 0
end
play next level script

```plaintext
global  life, levelstage, stopsound, goplay, rungraphic, tscore, Abpm, tclick, tmiss, thit, tcue, plusscore, minscore

on mouseenter me
  cursor 280
  sprite(me.spriteNum).member = "play next level to"
end

on mouseleave me
  sprite(me.spriteNum).member = "play next level t"
  cursor -1
end

on mouseUp me
  levelstage = levelstage + 1
  sound(1).stop()
  plusscore = 0
  minscore = 0
  tcue = 0
  tclick = 0
  tmiss = 0
  thit = 0
  tscore = 0
  life = 0
  go to "game"
end
```

how to play script

```plaintext
global  levelstage

on mouseenter me
  cursor 280
  sprite(me.spriteNum).member = "howtoplay-b"
end

on mouseleave me
  cursor -1
  sprite(me.spriteNum).member = "howtoplay"
end

on mouseUp me
  go to "instr"
end
```
d. Visuals
How can we combine diverse digital elements & DVD authoring to make promotional interactive DVD?
1) JOB DIAL

2) SCRATCH PLAY

NOTE: Use the "job dial" to set the desired BPM (beats per minute) or to locate specific points within a track. The "scratch play" feature allows you to play music backwards or forwards by physically moving the turntables.

Pioneer's digital DJ equipment offers advanced features such as fast search and reverse play. Directions switch to the desired position to play songs backwards.

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http://www.pioneerelectronics.com

http://proproductline.com

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