

DVD Authoring in the Modern World

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Authoring DVDs is becoming more commonplace as technology advances and cost per disk shrinks. DVDs are more durable, with a higher quality image than videotape, can use many different types of digital material and access information in a non-linear menu-driven fashion. With the advent of fast inexpensive computers with DVD writable drives and easy-to-use authoring software, the production of professional looking DVDs is within the reach of most biomedical media departments.

Introduction

The number of DVDs and DVD players has exploded exponentially since the first DVD player appeared on U.S. markets in 1997. Since that time more than 140 million DVD playback devices and 4.7 billion DVDs with 47,000 titles have been sold in the United States (Digital Information Group 2005).

In addition to having twice the resolution of videotape, DVDs are cheaper to produce, more durable, not as easily damaged by magnetic fields or changes in temperature and make no contact with a play head that could cause physical wear (DVD Forum 1996). Unlike videotape, DVDs are organized in a non-linear, menu-driven fashion, allowing the end-user direct access to scenes or information, and compared with other media types,

DVDs certainly live up to their name, "Digital Versatile Disk." DVDs can include many sources of digital material including: video, audio, still images, animation, graphics and text. The advantages of DVDs are evident by looking at a DVD menu (Figure 1). The main menu (A) allows you to play the entire movie or access any one of many sub-menus from which you can play particular scenes (B); choose any one of several soundtracks or subtitles (C); view additional information on the disk outside the movie (D); or in the case of *WebDVDs*, access additional material via the Internet (E).

Historically, DVD authoring was limited to the Hollywood studios and large corporations, but with the advent of computers with DVD writable drives and DVD authoring software designed for the consumer, anyone can produce their own DVDs. When created properly, these DVDs can be viewed with DVD players all over the world.

Depending on the platform, you would need either a 1 GHz Macintosh G4 running Mac OS 10.3 or a 2 GHz Pentium 4 PC running Windows 2000; 512 MB of RAM and 20 GB of free hard drive space. A complete DVD authoring set-up can cost less than \$1500.

DVD Writable Drive Formats

In 1995 the DVD Forum, an industry group that included computer heavyweights IBM, Intel, Microsoft and Sony, adopted the first standard, DVD-Video (DVD Forum 1996). A writable DVD format standard (DVD-R) followed in 1997 (DVD Forum 1997). A competing format, DVD+R was introduced in 2002 (Taylor 2005). With more than 50 possible formats (Taylor 2005) it is difficult to decide which DVD format to use, let alone which writer to buy. DVD-R is the most universally accepted format, playing on over 95% of all commercial DVD players (Taylor, 2005).

It is important to make sure the DVD writer you buy is compatible with the computer platform, system software and other hardware in your system. Some of the more popular DVD writers are the Apple SuperDrive™, which writes DVD-R disks and the re-writable format (DVD+/-RW) and Sony and LaCie drives which write multiple formats. All of these drives write single or double layer DVD disks.

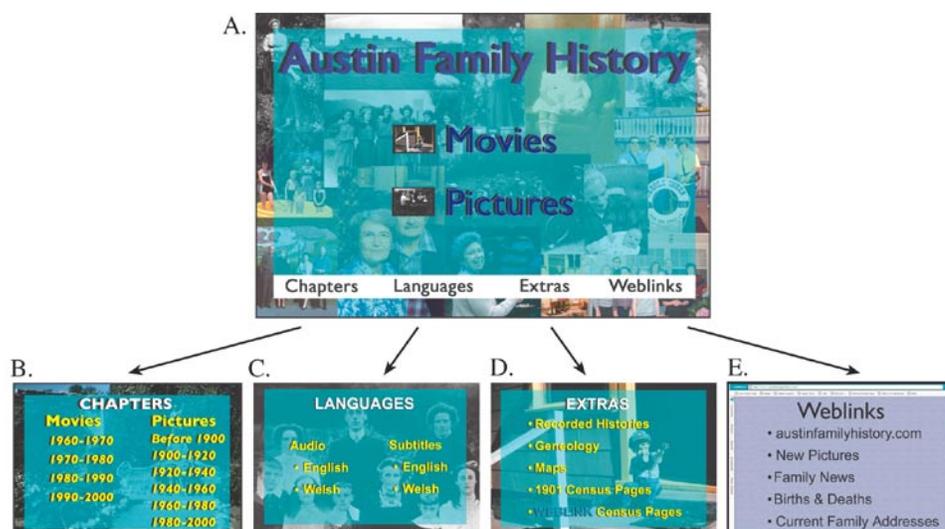


Figure 1. From the DVD main menu and submenus you can play the movie or slideshow (A), access individual chapters (B), play alternative languages or subtitles (C), view extra material on the DVD (E), or with a WebDVD access external websites (E).

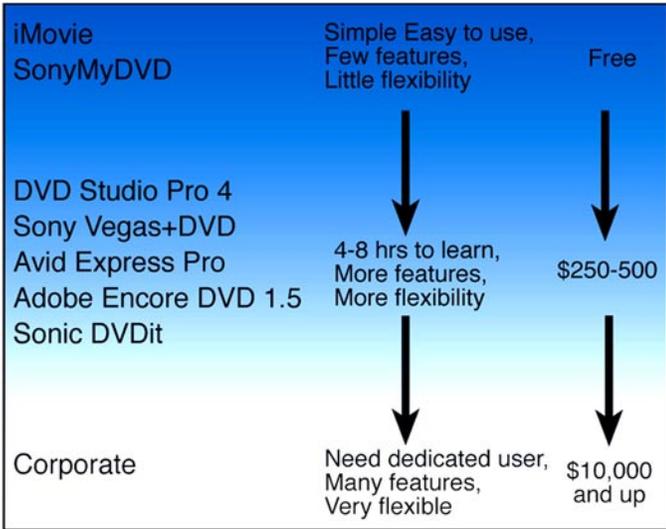


Figure 2. Different levels of DVD authoring programs

Authoring Programs

Authoring programs range in price from free to those costing thousands of dollars

(Figure 2). They progress from programs that are simple and easy to use, but with limited control by the user, to those that give the user complete control of the authoring process. The program you choose will depend on your needs, how much you can afford and a number of other factors (Kadner and Hawes, 2003):

Platform: What platform do you currently have or prefer, PC or Mac? Programs for either platform can produce professional-looking DVDs.

Feature support: What creative features do you need? Do you need to create single or dual layer DVDs? Do you want to create *Web DVDs*? Do you want to be able to preview your project before you burn the DVD? Generally speaking, as you progress upward through the different levels from amateur to professional, programs have more features – features that can be turned on and off at will.

Learning curve: How will you use the program? If you only make one DVD project every six months, you don't want a program that has a protracted learning curve. Programs at the consumer level can be mastered in one afternoon, while programs at the professional level require days to months of training.

Proofing capabilities: Will you want to tweak your project? Many authoring programs let you preview your project before you burn a disk. At this time modifications can be made to the optimize compression and improve quality. This can save time, money and frustration. The alternative is to burn and proof the disk.

Formatting engine: Once the project is complete it needs to be prepared to play on DVD players around the world. This is critical, because the formatting engine will determine the compatibility and quality of your DVD. Formatting engines vary widely. Most programs, even at the simplest level, produce DVDs that can be played on a variety of DVD players.

Price: Authoring programs range from free amateur level programs like iDVD and SonyMyDVD™ to professional programs that can cost tens of thousand of dollars (Figure 2). It really comes down to what you need balanced against what you can afford. Fortunately, many programs offer professional features and quality at consumer prices.

Currently there are many good programs on the market. For the Macintosh, the field is dominated by iDVD 5™ at the amateur level and DVD Studio Pro 4™ at the professional level. For the PC, there are a host of programs. Some of the more popular at the amateur level are Sony MyDVD™ and Pinnacle Studio 9™ and at the professional level, Sony Vegas+DVD™, Avid Express Pro™ and Adobe Encore DVD 1.5™.

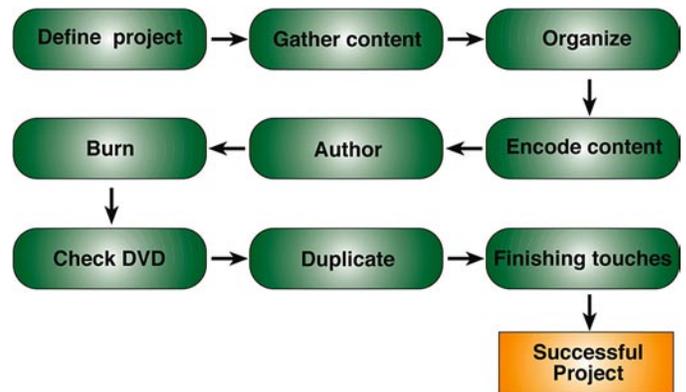


Figure 3. Steps in DVD production.

Steps in DVD Production

Figure 3 illustrates the steps involved in DVD production, from the generation of an idea to the finished product. Let's look at these steps a little closer.

1. Defining your Project

The first step in DVD production is the generation of the idea. At this step you not only generate the idea, but also plan what you want to say and how you want to say it before you begin. You need to determine the content (what to film, photograph, record, or create) and then how you will present the content. Good planning saves time and money and is the key to a successful DVD.

2. Gathering Content

The next step involves gathering the content. There are several important things to keep in mind when gathering content for a DVD. Different types of content may have different requirements to make a quality DVD. Ultimately the quality of the final product depends on three things, a) quality of the source material, b) visual or audio aspects, of the source material like excessive movement or faint audio. c) encoding of the content (Taylor 2001). Let's take a look at the requirements for different types of media.

Video- Always use the highest quality video source. For digital video this means either the original source material or uncompressed archival digital video. Analog video must be converted into a digital format using an S-video source.

It is necessary to compress video with the MPEG-2 codec (Taylor, 2001) in order to fit two hours of video on a single layer DVD. You have a choice of compressing the video with a non-linear editing (NLE) program like Final Cut Pro™ or Adobe Premier™, or with the authoring program. Compressing video with an NLE program has the advantage of allowing you to optimize the video before the authoring step. Always save an uncompressed version of the source video for future editing and archiving.

Images- While any digital image format can be used, it eventually needs to be converted to MPEG-2 I-frame files for slideshows (Taylor, 2001). Images can also be used directly for chapter markers and titles and can include digital still images, scanned slides or pictures, or artwork created by graphics programs like Adobe Illustrator™ or Macromedia FreeHand™. All vector graphics must be converted to a raster image before they can be used in a DVD. DVDs can only use RGB images. If the NTSC format is used make sure to use only NTSC-safe colors for all elements. As with video it's always best to convert the images to an MPEG-2 I-frame format at 720 x534 for NTSC images (Loy 2005) before you reach the authoring stage. Don't forget to save an uncompressed or lossless compressed archival image at the largest possible size in case any future editing is required.

Audio- DVDs can have up to eight audio tracks associated with each video track (Taylor, 2001). Dolby Digital (AC-3) is the most common format, but MPEG-1 layer-2, WAV, AIFF or PCM formats can also be used (Taylor, 2001).

Text- DVDs use text files for chapter markers and subtitles (Taylor 2001).

3. Organizing Content

At this point you need to develop a menu structure for the DVD. In addition to being eye catching, the menu must be easy

to navigate. Effective menu design revolves around getting information to your audience in the most intuitive manner, and within the parameters of a standardized DVD architecture.

4. Encoding Content

All content should be encoded to fit on a DVD using either the MPEG-2 format for video, MPEG I-frames for images, any of the supported audio formats or text for subtitles and chapter markers (Taylor, 2001). Everything except video encoding is straightforward. To achieve the best results for video, I use the following: a) only MPEG-2 encoding (Taylor, 2001), b) the highest quality video source available, c) two-pass variable bit rate encoding, d) a software encoder with extended encoding times for video with abrupt changes in contrast or lots of movement. As a final step, I always check my results critically and make minor changes in encoding parameters to optimize quality.



Figure 4. Distribution of the Worldwide TV video formats, NTSC, PAL and SECAM.

You must also consider which video format is most appropriate for your DVD's audience. There are two major video formats worldwide, and they differ in size, lines displayed, frames per second and color encoding. These are NTSC and PAL/SECAM (Figure 4). Unfortunately these formats are not compatible. Although many PAL DVD players made in Europe play NTSC encoded material, no NTSC DVD player made in the United States can play the PAL/SECAM format. Those interested in making their own DVDs have the tools to create NTSC or PAL movies and DVDs with either NLE or authoring programs.

It is also important to be careful about being "TV safe" with your project. When the DVD is viewed on a computer it will play the full frame, but will lose 5-10% of the image on both the horizontal and vertical axes when viewed on a TV screen (Figure 5) (Loy, 2005). Most NLE and authoring programs will assist you in making your DVD "TV safe."

5. Authoring

Authoring is where you put it all together, creating a DVD that can be played on millions of DVD players around the world. Depending on the program you use, you will either have little

control over the process or complete control of all aspects of the authoring process. The authoring program multiplexes, or combines, the collected audio, video, menus and subtitles into an interactive branching structure that can be burned on a DVD and played back on a DVD player. The DVD can contain a video stream with nine picture angles, eight streams of multichannel audio, eight languages and 32 menu levels in a multistory branching architecture (DVD Forum, 1996). Video and images can also be displayed in either full screen (4:3) or widescreen (16:9) formats (DVD Forum, 1996). In addition, you can add bonus tracks that can only be accessed with a code (DVD Forum 1996).



Figure 5. Image from full screen DVD video showing “TV safe” area surrounded by the area lost (pink) when viewed on a TV versus a computer screen.

6. Making Sure It Plays

Once you’ve created your DVD be sure to check that it plays like you expect it to. You may have previewed your project in the authoring program, but there is no substitute for testing it in the real world. Play your DVD on as many DVD players as you can in order to be sure it is playable and its quality is universal.

7. Duplicating

You will more than likely need multiple copies of your DVD. If you need only a few copies it’s probably most efficient to just go ahead and burn them, but if you must produce many copies (>100), it’s more cost efficient to take them to an outside service bureau for duplicating. There are two ways of quickly duplicating that many disks. One method is to provide the service bureau with a final version of your DVD. They will simply duplicate it using a bank of high speed duplicating DVD writers. The other, and more efficient method, is to submit your material on DVD-Rs (Taylor 2001) or digital linear tape (DLT) (Taylor 2001). The service bureau takes that file, creates a master and presses

as many copies as you need. An additional advantage of this method is that the DVDs are compatible with all DVD players (Taylor, 2001).

8. Finishing Touches

This is where you make your project stand out from the rest of the field by adding labels, DVD covers, jewel cases, sleeves and other things. CDs and DVDs will last from 40-100 years, but many of the materials used for labels and sleeves can actually damage the disk (Byres, 2003). DVDs are just as susceptible to the damaging effects of acids in paper, certain glues and photographs (Byres, 2003). Many labels and sleeves on the market use acid-based paper or glues that over time can damage the DVD to the point that it is unplayable. Fortunately, some manufacturers use acid-free paper and glues that will not damage disks. Alternatively, you can print directly on the special DVDs with an inkjet printer and non-damaging inks (Epson Incorporated, 2005) or use a DVD writer with “Light Scribe™” technology to burn the DVD and burn a label directly onto the disk (LightScribe, 2005). Sleeves free of harmful acids, like Tyvek, must be used to protect your DVDs (Byres, 2003).

It is also very important that you provide instructions for using the disk. This applies especially to *WebDVDs*, since a user might not know how to access the features that make these disks so useful. If you don’t provide the basic information on how to use your DVD, all your hard work might just end up in the trash.

Conclusion

The DVDs you produce not only look better than analog videotape, but can contain multiple sources of digital material, access content in a non-linear, menu driven fashion, are more durable than videotape and can be viewed by anyone with a DVD player all over the world. With a clear understanding of the authoring process and the standardized DVD architecture, along with the proper hardware and software, DVD authoring can be a useful tool for biomedical media departments.

Author

Dan Austin is the Director of Graphics Core at the Center for Research and Occupational and Environmental Toxicology at the Oregon Health and Science University in Portland Oregon. He has BA and MS degrees in Biology, and for 15 years conducted research in Biochemistry, Histology and Neurobiology. He currently serves the media needs of 15 faculty and over 100 researchers producing figures and movies for publications, presentations and meetings, as well as developing new communications techniques.

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