THE AGE OF DVD

DVD

Brad Settle
Spring 1995 Honors Thesis

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Project Summary: The purpose of the project was to create an educational presentation on various aspects of DVD technology as compared to previous technologies such as CD-ROM. The audience for this project must have some knowledge of how to navigate through interactive documents on the computer.

Instead of writing a normal formatted research paper, I wanted to present my research in a non-linear interactive digital format to be accessed with computers. For my thesis project I used several software programs on Macintosh and PC computer platforms, consisting of Adobe Photoshop 6.0, Illustrator 9.0, GoLive 5.0 and Macromedia Flash 5.0. Having never used Flash 5.0 before, I gained a knowledgeable understanding of the software through my research project. I will use this knowledge to teach students in advanced website design and multimedia classes this spring at Seward County Community College.

The process of my research project started out by gathering information on CDs and DVDs through the use of the internet and the limited technical publications available. However, the internet provided the most up-to-date information on DVD technology. The next step was to develop an easy interface with recognizable icon buttons as a menu to allow the audience to navigate through the information. I sketched the interface and icon buttons on paper then converted them into digital format on my computer. Once the menu was complete, I proceeded to compile the information from references. Finally, I scripted each icon button to have graphics, movement and sound with its selectable information. I learned a good lesson on why "storyboarding" is important in multimedia. I did not use the "storyboarding" process, which could have saved me a significant amount of editing time.

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	Industrial Technology Department
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	Industrial Technology Department
	Ivy Knoshaug
	Honors Studies Director

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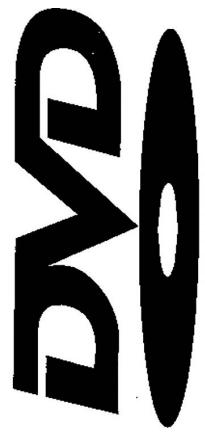
SKIP INTRO

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Overview

DVD is a high-density optical disc designed for the storage of large amounts of data. DVD originally stood for digital versatile disc and/or digital video disc, but now it may only be known as DVD. At first glance, a DVD disc looks much like its CD counterpart. In fact there are several similarities. Both share the same 12cm-diameter dimension and .12cm thick plastic disc, relying on lasers to read its data, but that's where the similarities end. A CD can hold 650MB, while a single-layer DVD disc can hold 4.7GB, the equivalent of a two-hour digital movie or seven times the capacity of today's CD. A double-sided, double-layer DVD disc can store up to 17GB of data, the equivalent of 25 CDs.
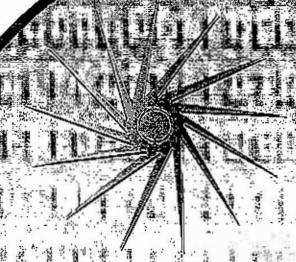
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Technology continues to evolve in an ever increasing rate. The demand for increase quality in audio and video formats makes a DVD a seemingly perfect investment for the consumer. Just as the compact disc format replaced the vinyl LP in the early 1980's, the DVD format will ultimately succeed in replacing the VHS and CD as the standard video and audio storage. DVD hardware is "backwards" compatible, therefore making dedicated CD players and drives obsolete.
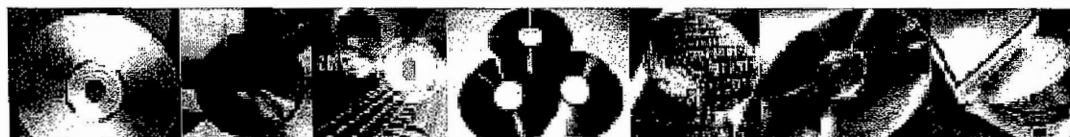
THE AGE OF DVD
HISTORY

CD to DVD Timeline

Even though DVD has become a thriving format in a very short period of time a lot of technology hurdles needed to be overcome before a unilateral formats was agreed upon. This is the first time in history that technical standards have been developed so quickly. There are many factors behind DVDs success some of which are more technically knowledgeable consumers and the increasing amount of information in digital format demanded by the public. This timeline notes each key DVD development and milestone.

Most of the information within the DVD Timeline comes from the original press releases (courtesy of Reuters, PR Newswire, Business Wire, Yahoo News, and the respective companies). Further information was provided by Robert's DVD Info Page, CEMA, Image Entertainment (formerly Laserviews).

Timeline cited from www.dvdangle.com

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HISTORY

Year 1972:

• Philips and MCA showcased the world's first optical disc (analog audio and video) creating the foundations for the Compact Disc.
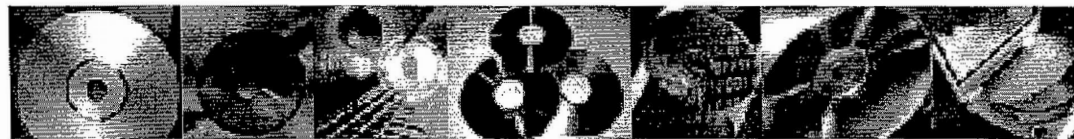
Year 1980:

• Philips and Sony agreed upon the standard for Compact Disc (CD).

Year 1983:

• Philips and Sony launched CD hardware and media shortly after the Red Book specs (CD Digital Audio or CD-DA) were published.

Year 1994:

• *June:* Toshiba started work to find a successor to VHS. Working closely with Time-Warner and Hollywood film companies Toshiba developed the Super Density SD disc. The SSSD disc was the grandfather to what is now termed as DVD-10.

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HISTORY

Year 1994:

- *September:* Sony/Philips took the industry by surprise when they announced the High-Density CD. The HDCD was the grandfather to dual layer DVDs such as DVD-9 and DVD-18.

Year 1995:

- *August:* Two competing groups (Sony/Philips and Toshiba/TimeWarner) announced they would begin to work together on one unified and universal format.

- *December:* The final DVD format is officially announced. Initially the word was not an acronym. It later came to mean Digital Video Disc and/or Digital Versatile Disc.

Year 1996:

- *November:* The first DVD players were released for sale in Japan.

THE AGE OF DVD

HISTORY

1997 was the key year for DVD. The majority of the major studios announced their support for DVD and several milestones were achieved.

• Just under 600 DVD-Video and 60 DVD-ROM titles were available to Region 1 (USA and Canada) users.
• 1.53 million DVDs were sold in the US.
• *April:* DVD Forum agrees upon DVD-R and DVD-RAM standards.
• *June:* Delos International announces the worlds first 'audio only' DVDs.
• *July:* DVD players start to become available to US consumers. DVD is well received in the US with close to 19,000 DVDs being purchased in the first two weeks of the formats official launch.
• *September:* "The Adventures of Pinocchio" from New Line becomes the first DVD ever to incorporate DVD-Video games that are playable on your set-top player. The games were created by EMA Multimedia.
• *October:* "Terminator 2: Judgement Day" from Artisan Entertainment becomes the first DVD ever to be released on a SS-RSDL disc (DVD-9).

THE AGE OF DVD

HISTORY

1998 saw more explosive growth for DVD. Thousands of titles were becoming available and DVD player prices began to steadily drop. DVD was finally an attractive alternative to millions of people. 1998 also saw the last of the studio holdouts decide to support the DVD format.

- 3,296 DVD-Video titles were on the market in Region 1 (USA and Canada.)
- 9.3 million DVDs were sold in the US (a 600% increase over 1997.)
- DVD player sales reach 1 million in the US.

THE AGE OF DVD

HISTORY

2000 becomes the year of the DVD to the consumer. With many of the new released movies on DVD, all of the studios revive their archives of film by releasing them in digital format. Distribution stores market the DVD format with reasonable pricing and eyecatching DVD point-of-purchase displays.

- *April:* Universal announces Steven Spielberg blockbuster's will begin to see DVD release – starting with "Jaws: 25th Anniversary Collector's Edition" on 07/11.
- *November:* Warner releases the first wave of 'mainstream' DVD-Audio discs.
- DVD sales and rentals more than doubled from $1.6 billion in 1999 to $4.1 billion.
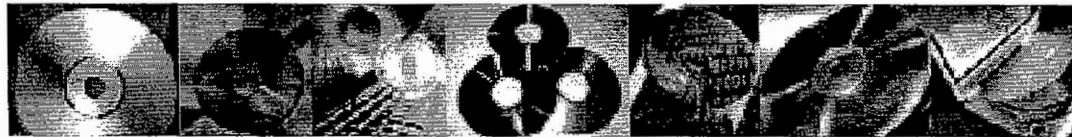
THE AGE OF DVD

HISTORY

2001 puts the DVD on the path to become the media choice for viewers and listeners. DVD production studios continue to add extras (behind-the-scenes footage, actor interviews and out takes) to the DVD-Video and DVD-ROM formats, enhancing the overall entertainment experience. VHS video tape format starts to see it's market numbers decline for the first time.

- *March:* Artisan proves to be an innovator once again - their release of "Book of Shadows: Blair Witch 2" is the first DVD/CD hybrid disc (DVD on one side, CD on the other.)
- *July:* Apple announces iDVD 2.0 - allowing users to create "professional" quality DVD's on the Mac.
- Market analysts predict the DVD sales and rentals to double again from $4.2 billion to $8.5 billion.
- VHS revenues decline $17.7 billion to $16.9 billion.
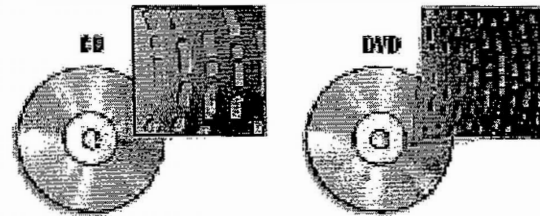
THE AGE OF DVD

MEDIA SPECS

Media Technical Specifications

The optical storage technology uses a laser beam to read data in a series of pits stamped into a plastic disc. The disc's surface has a reflective silver layer and is protected by a thin, hard coating of lacquer. Unlike floppy magnetic disc which stores information in concentric rings divided into sectors, the CD and DVD uses one continuous spiral track similar to vinyl LP records. DVDs rotate at a slower rate than CDs because of a closer pit differencial, but at the same time, the DVD reads more data per second. The 12cm CD disc holds 650MB of data compared to the 12cm DVD disc at 4.7GB, 8.5GB, 9.4GB and 17GB storage capacity.

## CD Media Specifications

The Compact Disc was developed by Philips and Sony, and was first implemented commercially for storing digital audio data (CD-Digital Audio format). Compact Discs encode data on a continuous spiral track of about 1.6 to 2.2 micrometers wide with the pit depth of about 0.83 micrometers. Conventional CD technology utilizes an infrared laser with a wavelength of 780 nanometers.

CD

DVD

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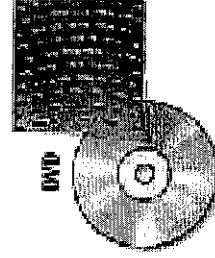## MEDIA SPECS

COMPACT disc DIGITAL AUDIO

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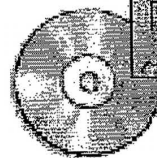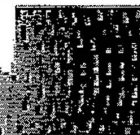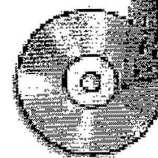
CD-Audio Format

The CD Digital Audio format is designed to hold about 60 minutes of audio data in up to 99 tracks (songs) at a rate of 44.1 KHz and a sample size of 16 bits to produce high quality stereo sound. The success of CD Digital Audio was the key for growth and success of the CD-ROM and other CD formats.

CD-ROM Format

Physical characteristics and track structure of a CD-ROM disc are similar to CD-Audio. A CD-ROM is used to store computer data such as text, graphics and audio files. This format also has additional error detection and correction ability. The logical volume and file structure of CD-ROM is specified in the ISO 9660 which allows this format to be used in the computer arena.

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HOME

MEDIA SPECS

CD-R

CD-Recordable technology allows the user to author customized CD-ROMs. It requires a PC, a CD-R recorder, appropriate software and 'recordable' media to create this customized "one-off" disc. Once recorded, the "one-off" CD-R disc is read only and the data cannot be erased or rewritten. CD-Recordable discs are sold pregrooved, in 63 or 74 minute capacities. The disc is manufactured in a layered structure with a sensitive chemical recording layer and a gold reflective layer.

CD-RW

CD-Rewritable discs allow for data to be written, read and/or erased and rewritten many times. A CD-RW recorder or drive is required along with rewritable discs. CD-ROM and CD-R drives have some difficulty reading CD-RW discs because CD-RW media has a lower co-efficient of reflectivity which is 15-25% for CD-RW format compared to 65-70% for other CD formats.

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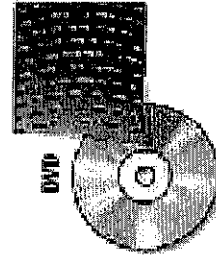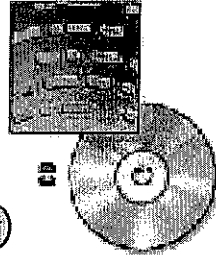
MEDIA SPECS

DVD Media Specifications

Similar to CD technology, DVD has several formats that meet specific industry needs. DVD-Video and DVD-ROM were the first DVD formats to hit the consumer market. With the same CD disc diameter and thickness, DVD specifications dictates a double-layer, single-sided disc or double-layer, double-sided option with a capacity of 4.7GB per layer. DVD formats require a more precise version of the error detection and correction scheme than the CD formats because of the close proximity of the DVD tracks. DVDs are encoded for piracy protection determined by 8 geographical regions within the world.

*For more information on geographical regions visit the Glossary from main menu.*

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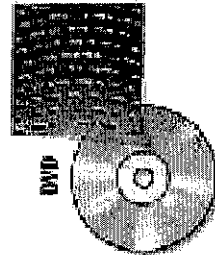
MEDIA SPECS

DVD Media *continued*

The internal design of the DVD provides major advantages over CD. To improve the resolution and readability of two distinct layers, the minimum pit length of a single layer DVD is 0.4 micrometers as compared to 0.83 micrometers for a CD. In addition, the DVD track pitch is reduced to 0.74 micrometers, less than half of CDs 1.6 micrometers. With the number of pits equating capacity levels, DVDs reduced track pitch and pit size creates four times as many pits as CDs. The laser used in DVD drives has a more accurate focus than the CD-ROM drives. DVD uses a red-light laser with a wavelength of 640 nanometers that not only reads the pits but also guides the laser on the pitch track.
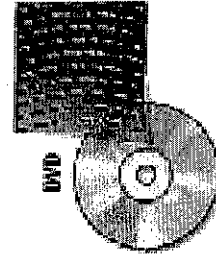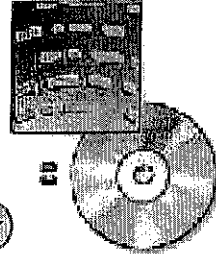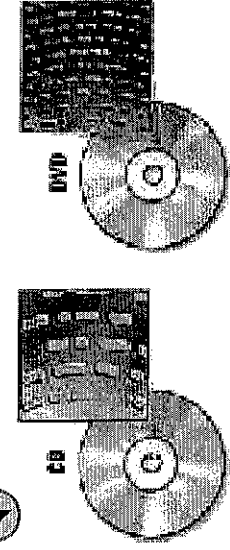
MEDIA SPECS

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MEDIA SPECS

COMPACT disc DIGITAL AUDIO

DVD

DVD Media continued

In standard CD formats, the data is always accessed from the center of the disc to the outside rim. A distinct feature of DVD is the disc's second data layer. The second layer can contain data recorded "backwards" or in a reverse spiral track. This allows the DVD disc to be read from the center of the disc to the outside rim as well as from the outside rim to the center. With this feature, it takes only an instant to refocus a lens from one reflective layer to another allowing faster access to the information than in CD format.

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MEDIA SPECS

DVD-Audio

The CD-Digital Audio format started the revolution of optical storage, yet DVD-Audio is the last to achieve standardized specifications for the music industry due to piracy concerns. DVD-Audio has two audio formats. The first audio format allows files to be sampled at 48 KHz, 20 bit samples and 8 channels creating a capacity of 96 minutes per layer. The second audio format can be sampled at 96 KHz, 16 bit samples and 8 channels creating a capacity of 86 minutes per layer. Both can be output as Dolby AC-3: 5-1.

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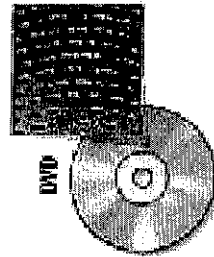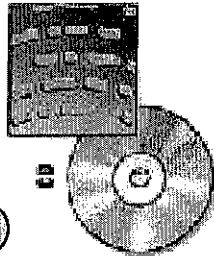
MEDIA SPECS

DVD-R

When DVD-R first appeared it had a capacity of 3.95GB surpassing the storage capacity of 650MB for CD-R. This was later increased to 4.7GB of information on a single-layer, single-sided DVD-R disc. Currently, the DVD format supports double-sided media up to 9.4GB. DVD-R uses a red-laser with a wavelength of 635 nanometers. At the same time a DVD-R drive uses lenses with a numerical aperture of 0.6.

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MEDIA SPECS

DVD-Rewritable

DVD-Rewritable is a high-capacity, high-performance optical disk that allows data to be read, written, erased and rewritten many times. With current capacities of 2.6GB to 5.2GB per disk, DVD-Rewritable offers up to 6 to 7 times the storage capacity of a rewritable CD format. The improvements of DVD-Rewritable takes capacities even higher to 9.4GB per disc. In addition, DVD-Rewritable is much cheaper than conventional magneto-optical drives. At less than one penny per megabyte, it is the most economical rewritable media available.
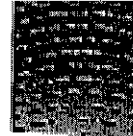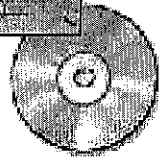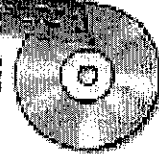
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MEDIA SPECS

DVD-ROM

DVD-ROM formats will replace the CD-ROM formats in time. Multimedia developers and the gaming industry have claimed the DVD-ROM format as its media of choice due to the limited storage capacity of the CD-ROM format. With MPEG-2 and Dolby digital surround sound playback capabilities, DVD-ROM format is ideal for full-length feature films and computer games with advanced multimedia graphics. This technology system is one of the most important components of the emerging "living room" computers with large, TV-like monitors and game console-style remote control devices.

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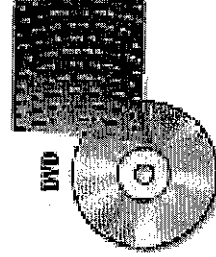
CD

MEDIA SPECS

DVD-Video Format

DVD-Video format supports high quality full motion MPEG-2 video. Image size varies from 480 horizontal lines per frame at 720x480 pixels/frame at 30 frames/sec (NTSC) to 720x576 pixels/frame at 25 frames/sec (PAL). Other unique video formats include 425 lines for laserdisc and 250-270 lines for VHS video. DVD-Video format also provides for high quality audio (MPEG-2, 7-1; Dolby AC-3, 5-1; or Linear Pulse Code Modulation) and up to 32 sub-picture elements such as captions and still images. It supports multiple aspect ratios, allowing the viewer to choose the viewing screen, such as 16:9 letterbox, wide-screen formats and a more conventional 4:3 ratio.
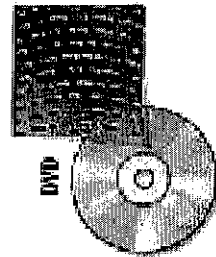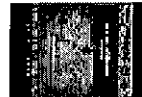
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CD

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MEDIA SPECS

DVD-Video Format *continued*

Furthermore, DVD-Video titles also let you choose from up to eight different languages and from 32 different sets of subtitles. In addition, DVD-Video format offers the user various navigation and interactive controls (including random access for interactive games), regional coding, copy protection and other features demanded by the movie industry. A single-side, single-layer DVD-Video format can contain a 133 minute full-featured movie title; where as, a double-side, double-layer can accommodate a film in length of 270 minutes.
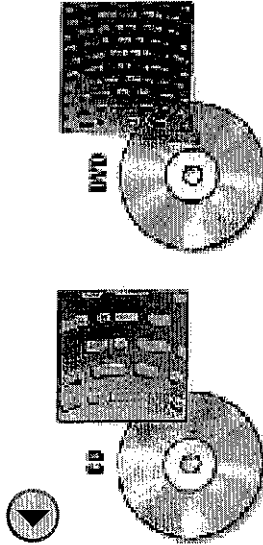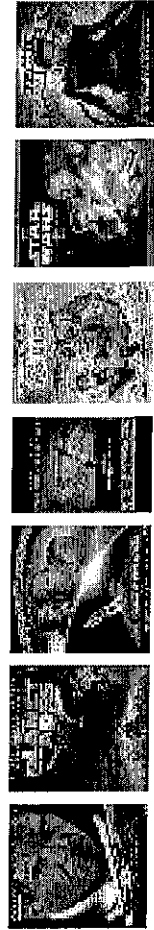
HARDWARE

HARDWARE

Hardware Technical Specifications

With increased consumer demand on the entertainment and computer industries, more emphasis is being placed on DVD technology and its capabilities. DVD-Video players and DVD-ROM players have established a stronghold in the home-based entertainment center. Computers with CD-ROM drives can play only CD-ROMs and Audio CDs, while DVD-ROM computer drives can play DVD-ROMs, DVD-Videos, CD-ROMs and Audio CDs. Burning CDs and DVDs from a CD-R or DVD-R drive allows the user to create customized production such as interactive educational materials, sophisticated computer games or multimedia corporate presentations.

HOME

HARDWARE

HARDWARE

CD-ROM Drives

The growth of the optical storage industry is reflected in the types of CD-ROM drives offered today. The original CD-ROM drives had a transfer rate of 150KB/sec. with no audio plug. The recent CD-ROM drives offer 6X, 12X, 16X and even higher transfer rates. The drive can also read CD Audio tracks, connect with the computer sound card and play the audio track through the computer speakers. Most current CD-ROM drives also support CD-ROM XA and Photo-CD formats. A configuration of multiple CD-ROM drives in one box, known as a CD-ROM tower is usually connected into networks with an appropriate CD-ROM computer server. The tower works in busy multiuser environments because all the drives in the tower are accessible to multiple workstations at all times.
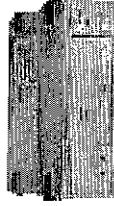
HARDWARE

CD-RW Drives

CD-RW drives can reach a CD-R write speed of 24X and divides the disc into inner, middle and outer zones to write data. Recently, some manufacturers have introduced tower models with CD-Recordable units and LAN-ready configurations. One of the biggest developments in recordable CD technology is Calimetrics' long-awaited MultiLevel Recording Technology which enables you to write approximately 2GB of data to ML CD-R/RW media. This technology will be available sometime in 2002. CD-RW drives equipped with an ML chip will write to MultiLevel CD-R media at 36X and will use packet writing to write to ML CD-RW media at 30X.
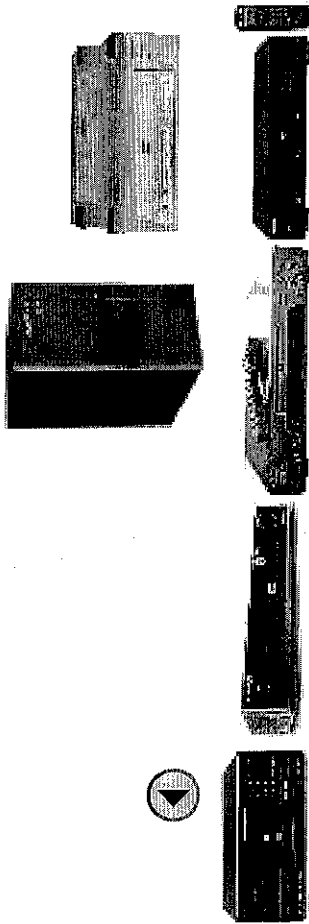
HARDWARE

DVD-RW, DVD+RW & DVD-RAM Drives

To help achieve 6 to 7 times the storage density of CD-R drives, two key hardware components needed to be altered. DVD drives have a laser wavelength of 635nm (780nm CD) as well as a numerical lens aperture of 0.6 (0.5 CD.) DVD-RW and DVD+RW formats are two of the three standards battling for the position as final standard for rewritable optical disc system in both the consumer electronics and personal computer markets. The two DVD Rewritable formats are more than a "-" and "+" in their names. The two formats have the same capabilities of recording about 5GB of data on discs that can be played back on read-only DVD Video players. However, DVD-RW and DVD+RW are incompatible with each other. They were developed by different teams of companies. A third format, DVD-RAM, was developed by yet another set of companies and is unique in that it uses a disc enclosed in a plastic cartridge. The DVD-RAM drive also allows other CD/DVD formats to be read.

HARDWARE

CD Players

CD-Audio formatted discs can be played in multiple CD-players and changers or single CD portable players. Both produce high-end quality sound. Single CD portable players and automotive CD players have enhanced stability by creating skip protection within the hardware. Skip protection is achieved by temporarily writing 45 seconds of the file to cache memory before playing the file.

HARDWARE

HARDWARE

DVD Players

All DVD players are equipped to provide simple access to all DVD features including: multiple aspect ratios, languages, subtitles, camera angles plus parental control and multi-story lines. DVD players consist of a disc reader, signal processor, decoder and a microcontroller similar to CD players. The reader consists of the motor which spins the disc and the red-light laser reads the information from the disc. The digital signal processor is an integrated circuit that translates the laser pulses back into an electrical form for other parts of the decoder. The digital audio/video decoder formulates the compressed data on the disc, converting it for computers, TV monitors and stereo systems. The microcontroller has the capacity to create parental lockout controls to restrict materials read by the player.

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SOFTWARE

SOFTWARE

Software - cited from www.dvdplusRW.org

Most available software applications on the market for DVD authoring and burning are drawing no lines or distinctions between the two. They come bundled together. As technology of the DVD format becomes more developed, software packages for the home user will continue to be the target audience as compared to Hollywood production studios. Setting up for a similar explosion of "home" desktop publishing of the mid '90's, digital home videos have an ideal storage media for capacity that will not deteriorate with time and/or usage unlike VHS video tape.

THE AGE OF DVD

SOFTWARE

Software - cited from www.dvdplusRW.org

Sonic MyDVD 3.0: MyDVD 3.0 will be bundled with a number of DVD+RW drives, such as the ones from Philips, Ricoh, Sony and Hewlett-Packard. It can be used to create DVD-Video compatible video discs.

Sonic DVDit! 2.5: DVDit supports DVD+RW drives from version 2.5 onwards. It offers more sophisticated DVD-Video editing than MyDVD.

Ahead Nero Burning ROM: Nero Burning ROM is a general purpose CD/DVD recording tool that supports the recording of DVD+RW data discs from version 5.5.4.0 onwards.
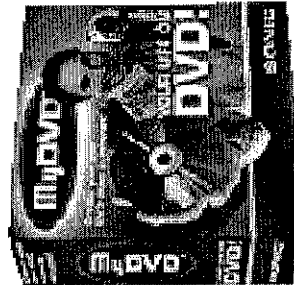
THE AGE OF DVD

SOFTWARE

Software – cited from www.dvdplusRW.org

Ulead DVD MovieFactory: DVD MovieFactory is an easy to use tool to produce highly customized DVD-Video discs.

Ulead DVD PictureShow: DVD PictureShow allows you to create high quality slideshows and picture discs for playback on a DVD-Video player.

Pinnacle Impression DVD Pro: Impression DVD Pro is a professional DVD-Video authoring tool, that is being used by various Hollywood film studios to create their DVD-Video titles.

SOFTWARE

HOME

THE AGE OF DVD

SOFTWARE

Software - cited from www.dvdplusRW.org

Roxio VideoPack 5: VideoPack 5 is a VCD/SVCD/DVD authoring package from the makers of Easy CD Creator, which offers extensive features to customize your DVD projects.

Mediostream NeoDVD: Mediostream NeoDVD was specifically designed to make it easy for camcorder users to turn their home videos into DVD titles.

MGI Videowave 5: MGI Videowave 5 is an integrated suite of video editing and DVD authoring tools.

DVDCre8 DVD Complete: DVD Complete is a a DVD-Video authoring tools that includes video capturing, MPEG2 encoding and DVD emulation.
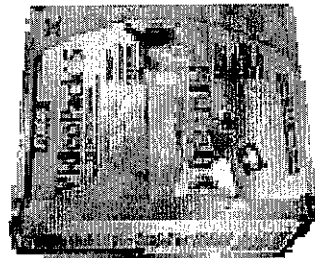
SOFTWARE

THE AGE OF DVD

TRANSITION

Transition of Technology

DVD was developed as a multi-purpose format to transcend all previous formats. This is the age of DVD. Consumers have rapidly embraced the technology recognizing the benefits of versatility, portability, interactivity, depth of sight and sound, and ease of use. Since the birth of DVD format in 1997, DVD players penetrated a third of American households by the end of 2001. VCR technology took twice as long to achieve similar dominance in the American household. This has led to an incredible proliferation of products available on the market. The consumer demand for DVD media, hardware, software and will dictate the life-expectancy of the CD formats and VHS video tape.

TRANSITION

TRANSITION

TRANSITION

Transition of Technology *continued*

VHS home movie libraries are being rapidly replaced by high quality DVDs just as CD format replaced vinyl LPs and turntables. Annual shipments of DVD players quadrupled to 4 million in 1999 then doubled to 8 million in 2000, outpacing industry observers' expectations. By comparison, VCR shipments peaked at 23 million in 2000 and declined to 22 million units in 2001. The closest product to rival the DVD player's steep adoption rate would be the black-and-white television in the years after World War II.

TRANSITION

Transition of Technology *continued*

Major retailers are altering their VHS display space to place DVDs in the forefront. By the end of 2001, Blockbuster cleared 25% of its VHS tapes at all of its stores to make more room for DVD rentals, doubling the number of DVDs at some stores from 2,000 to 4,000. DVDs account for 20 percent of Blockbuster's domestic rental revenues in 2001 and the company expects it to grow to 40% by the end of 2002. Does this mean VCRs will soon be obsolete? Family libraries of VHS tapes of baby steps, weddings and graduations are not archived to other formats. Many households will continue to utilize VCRs to record television programming. As the price of DVD players/recorders decreases the average consumer is expected to adopt the technology.

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TRANSITION

TRANSITION

Transition of Technology *continued*

Hollywood now releases most films in both DVD and VHS formats for consumer rentals and purchases. There may be room for both, creating a co-existence similar to the audio cassette tape and CD-Audo format. Use of CD players and CD-ROM drives has been longer than the 1997 anyalsts first forecast of their discontinued use within two years. Bold steps in hardware, similar to Apple's elimination of the floppy disk drive from all its computers, may slingshot the DVD industry above the limited formats of CDs and VHS video tapes.

TRANSITION

TRANSITION

Transition of Technology *continued*

DVD players are being added to home entertainment centers and not eliminating CD players and VCRs but DVD-ROM drives are steadily replacing CD-ROM drives into the computer. DVD gamestations have mesmerized the young-at-heart with record numbers in sales of players and are backward compatible to existing CD-ROM games.

The question most asked by all institutions is when to commit to DVD. There is no simple answer. Some already have implemented the technology while others are on the fence. There is no guarantee that buying new DVD equipment or retrofitting CD equipment will realize an investment return in the next few years.

TRANSITION

Transition of Technology *continued*

The entertainment industry is pushing forward in the emerging DVD technology by taking financial risks on evolving standards. This allows business, schools and homes to adopting DVD as a media selection. In this transition of technology the DVD format will become the media of choice to convey an incredible range and volume of messages. In time it will replace the CD format. The DVD format will abound in homes and businesses from movies, product information to training. Moreover, it will become an indispensable staple for home entertainment, corporate communications and computer data storage by delivering digital information in a reliable and inexpensive fashion.

GLOSSARY

5.1 Channel Surround Sound: Term used to describe a discrete six-channel surround sound, where the "5" corresponds to the five full-frequency (20Hz – 20kHz) channels (left, right, center, left surround, right surround) and the "1" refers to the Low-Frequency Effects (LFE) channel. Examples include Dolby Digital and DTS.

Aberration: A variation in the focus of a laser beam that causes the laser beam to become diffused. The aberrations cause focusing errors in the laser pick-up and cause the DVD to be misread.

Academy: Name for 1.33:1 aspect ratio film.

AES/EBU Interface: The standard for digital audio signal transmission for professional use developed by the Audio Engineering Society (AES) and the European Broadcasting Union (EBU). The AES/EBU systems use 110-ohm balanced XLR cables. The consumer version of the digital audio transmission standard is called S/PDIF.

Amplifier: A device that provides power to a signal, ultimately resulting in powering loudspeakers in the case of home theater.

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Anamorphic: A lens used to "squeeze" a widescreen image onto an Academy shaped frame during the filming of a movie and used to "unsqueeze" the image during playback. Brandmarks include Cinemascope and Panavision.

Anamorphic DVD: Term used for a video process utilizing the same principle of "squeezing" and "unsqueezing" a frame on a DVD. A 1.78:1 aspect ratio frame is squeezed into an Academy shaped frame. During playback on a widescreen (1.78:1) TV, the picture is stretched horizontally to display the original high-resolution image. Only widescreen TVs can take advantage of anamorphic DVD. The term "enhanced for 16X9 televisions" or "enhanced for widescreen TVs" are other common terms for anamorphic DVD.

Artifact: An anomaly that occurs on a video image as a result of a problem in the film to video transfer, or problem with playback. A common artifact on DVD is pixelation, where individual pixels or groups of pixels produce an unnatural, "blocky" image.

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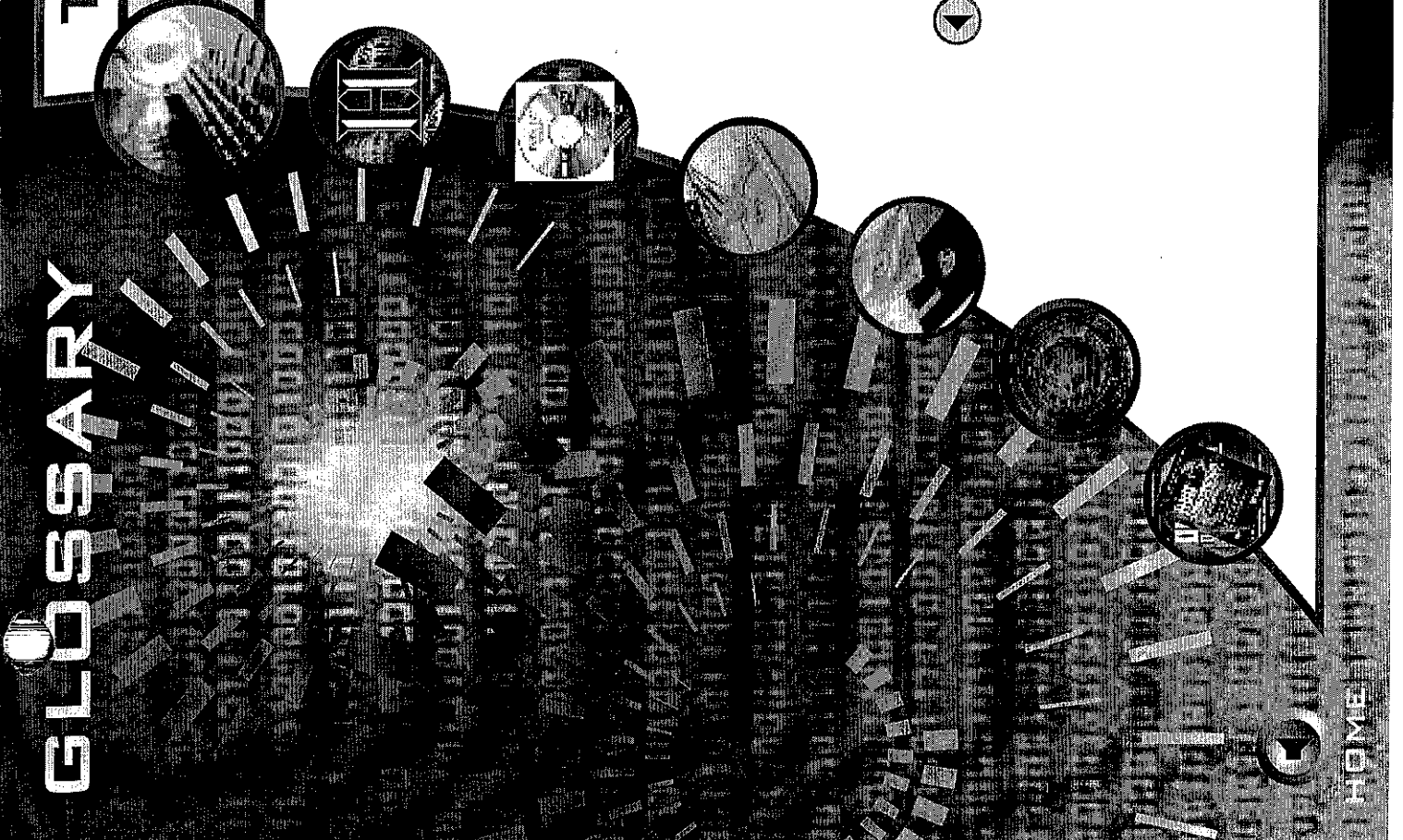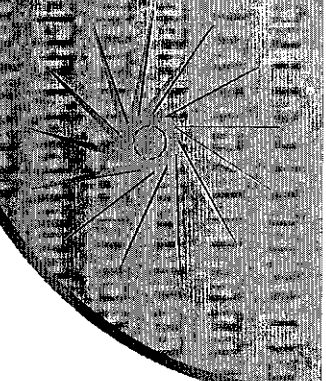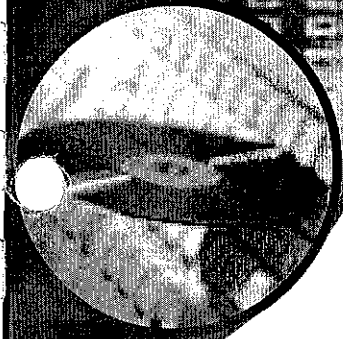
GLOSSARY

Aspect Ratio: The ratio of width to height of a rectangle. Usually used when describing a screen used for playing back film or video. For example, a screen with an aspect ratio of 1.33:1 means that the width of the screen is 1.33 times longer than the height. Common aspect ratios for film and video are 1.33:1 (Academy), 1.78:1 (widescreen TV and HDTV), and 2.35:1 (Cinemascope.)

Audio Frequency: Frequencies within the range of human hearing (20 Hz to 20kHz.)

Audio Streams: DVD has the ability to hold a maximum of eight audio streams on a single disc. This allows DVDs to have up to eight different language tracks for multiple languages and/or director's commentary.

Authoring: It is the process of creating video (MPEG-2) from film to DVD.

Average Bit Rate: Average volume of data (variable bit rate DVD system) measured over time. DVD uses variable bit rates for optimized storage capacity on a disc.

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B-frame: Bi-directional frame. The frame in an MPEG sequence created by comparing the difference between the current frame and the frames before and after it.

Bandwidth: The range of frequencies a device operates within. The wider the bandwidth, the better the performance. Bandwidth is measured in kHz.

Bass: Frequencies in the lower part of the audio spectrum (20 Hz - 160 Hz.)

Binding Post: The termination point of an amplifier or loudspeaker where the speaker cable is connected.

Bit: A binary digit that indicates 0 for "off" and 1 for "on."

Bit Rate: An indication of the amount of data processed for some time period. Usually measured in bits per second (bps.) Also called Data Rate. The higher the rate the better the picture/sound.

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Bitstream: A stream of data meant to be processed sequentially. Dolby Digital sound on a DVD is encoded onto a bitstream for processing.

Bonded Disc: In order to make a DVD more resilient, and less likely to warp, two 0.6mm layers are permanently bonded together. This also allows DVDs to be two-sided.

Calibration: Within the context of home video, calibration means adjusting the video display to adhere to a standard, usually NTSC. Within the context of audio, calibration means adjusting the sound level of each individual channel to match the level of all other channels.

Camera Angles: Scenes can be shot from different angles and played back to give the viewer the ability to see the scenes from different perspectives. DVD can support up to nine different camera angles to be recorded on a disc.

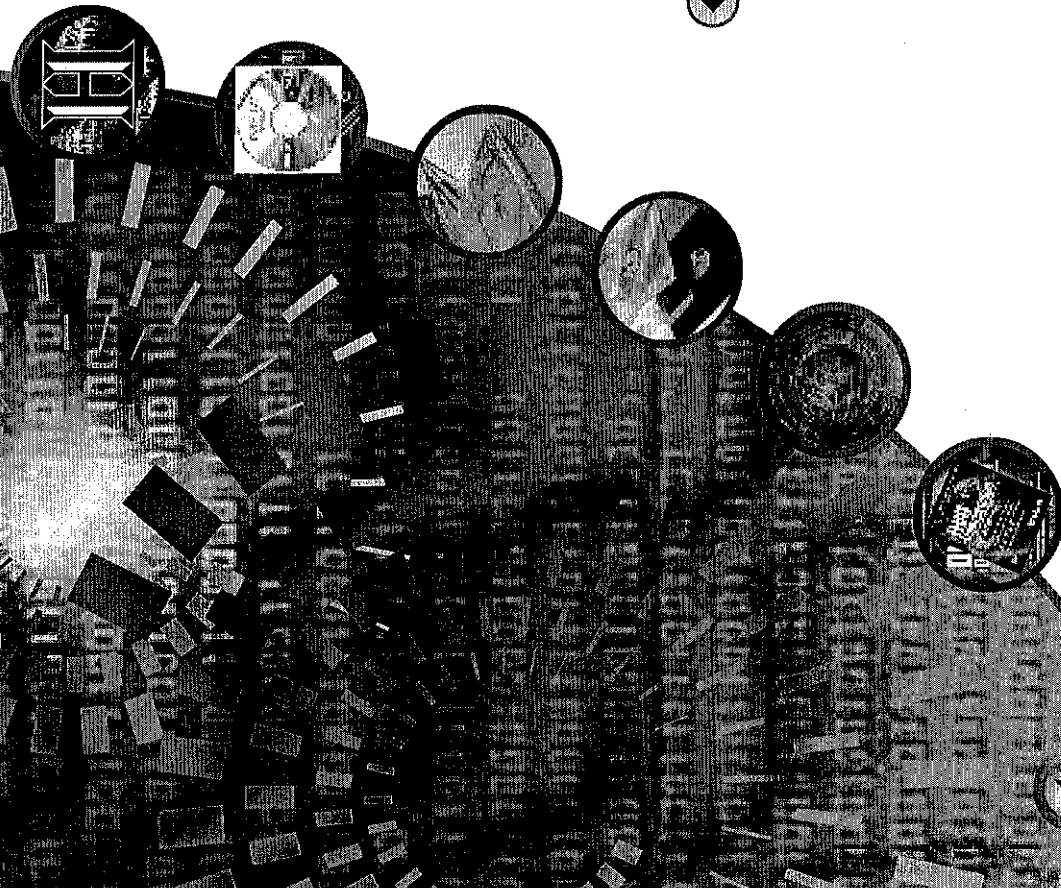GLOSSARY

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Center Channel: The channel in a surround sound setup that is directly in front of the viewer. The center channel speaker "anchors" sound that should be coming from the front of the screen. Most dialog in a DVD is played through the center channel.

Channel: An individual (discrete) audio track. In the case of 5.1 Dolby Digital, there are six discrete channels.

Chapter: DVDs are indexed by chapter, similar to the way a CD has a track. DVD players allow you to skip to a particular chapter (scene).

CinemaScope: The brandmark for the anamorphic film process developed by 20th Century Fox. The process was duplicated by Panavision, and is identified in film credits as "Filmed In Panavision."

Coaxial: A type of connection used for consumer digital audio, which uses an RCA jack. The coaxial cable is an impedance-constant, two-conductor cable with either a stranded or solid core. For DVD digital audio, use a coaxial cable that has an impedance of 75-ohms (with 75-ohm connectors).

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ColorStream: The component video connections for Toshiba DVD and TVs.

Color Temperature: The measure of a light source color in degrees Kelvin (K). Lower temperatures are redder in color, while higher temperatures are bluer in color. A properly calibrated display device measures 6500 degrees Kelvin.

Component Video: Component video offers the highest video quality available on DVD. Component video is a 3-channel system that is either RGB or color-difference. DVD component video is color-difference. Signals using color-difference contain the color component of the picture minus the brightness component.

Composite Video: An analog signal that contains the combined signals for luminance (black and white) and chrominance (color) components. This is the standard for broadcast TV, VHS and Laserdisc.

Connector: The terminating end of a cable.

Copy Protection: A process, like Macrovision, used to prevent illegal duplication of video (including DVD).

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DAC: Digital to Analog Converter. A device that converts digital pulses (PCM) to analog signals.

Decoder: A device that decodes compressed audio (e.g. Dolby Digital) or video (e.g. MPGE-2) and produces the original information.

Digital Comb Filter: To produce highly accurate Chrominance and Luminance signal separation, the chrominance and luminance signals are converted to a digital medium. This produces enhanced color purity and reduced dot craw.

Dipole: A type of loudspeaker, designed to reproduce diffuse surround sound. This type of speaker has identical drivers, that are 180 degrees out of phase with each other and radiate in opposite directions. This type of speaker is better suited for Dolby ProLogic surround sound than Dolby Digital.

Direct View: A display device that uses tube technology, as opposed to projection (front or rear) technology. Discrete Surround Sound: A type of surround sound where all channels are independent in their ability to play sound. Six channel surround sound (like Dolby Digital) can play six discrete channels to create an enveloping surround sound environment.

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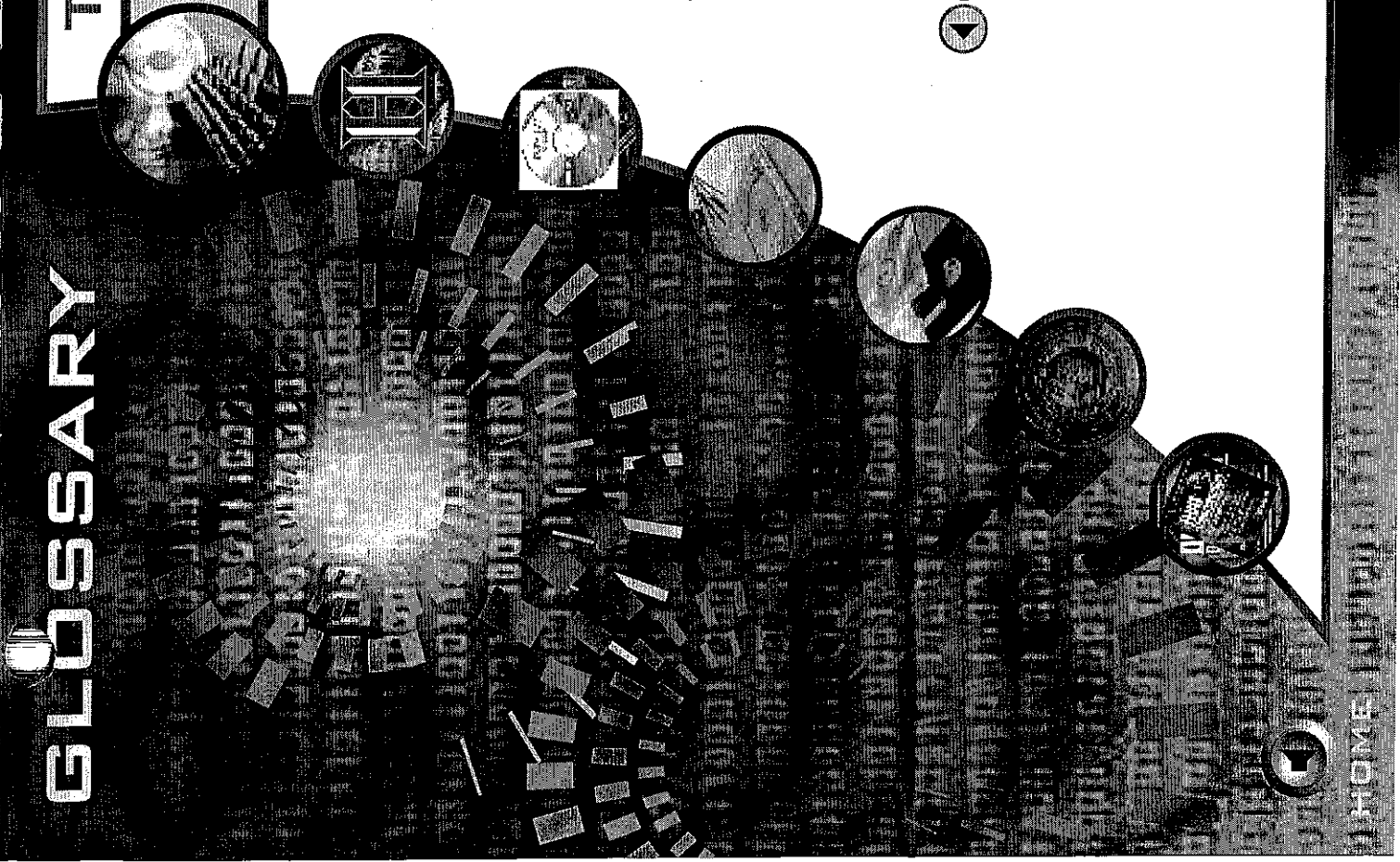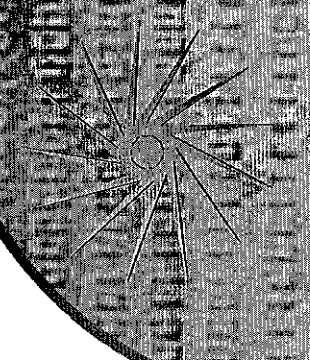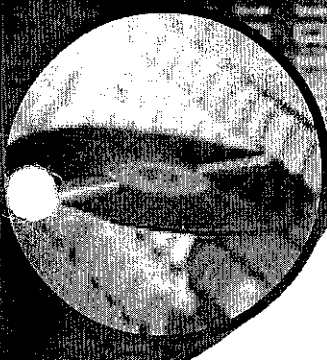
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Dolby Digital (formerly AC-3): Now known as Dolby Digital, this technology developed by Dolby Laboratories creates a digital bitstream of from one to six discrete source channels. When Dolby Digital is working in six-channel mode (5.1), five channels are full-frequency (20Hz-20kHz) while one channel is dedicated to low-frequencey effects (LFE). Dolby Digital uses a lossy compression (around 12 to 1) algorithm and usually has a bit rate of 384 Kbps. Dolby Digital is the standard audio format for DVD and HDTV and is optionally supported on Laserdisc.

Dolby ProLogic: An active matrixed surround sound technology that derives four channels (left, right, center, surround) from a two-channel source. The left, right, and center channels are full-frequency, while the surround channel is limited frequency and mono. Dolby ProLogic is the home theater equivalent of Dolby Stereo for films.

Downmix: The ability to playback mono, stereo, or multi-channel surround sound from an encoded soundtrack, depending on the playback system.

(A) (B) (C) (D) (E) (F) (G) (H) (I) (J) (L) (M) (N) (O) (P) (R) (S) (T) (V) (W) (X) (Y)

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DTS Digital Surround: A high data rate, 5.1 channel surround sound technology developed by Digital Theater Systems. The DTS digital surround sound used data rates of 1.44 Mbps, nearly four times higher than Dolby Digital (384 kbps). It also uses a significantly less compression ratio of (3 to 1 vs Dolby Digital's 12 to 1).

DVD: The term DVD officially doesn't stand for anything, although it is often said to stand for Digital Versatile Disc or Digital Video Disc. DVDs are a 6-inch disc capable of storing 4.7, 8.5, 9.4 or 17 gigabytes of data. DVD uses MPEG-2 video compression and Dolby Digital, or DTS audio.

**DVD-5:** Single-sided/single-layer DVD with 4.7 GB storage capability.
DVD-9: Single-sided/dual-layer DVD with 8.5 GB storage capability.
DVD-10: Double-sided/single-layer DVD with 9.4 GB storage capability.
DVD-18: Double-sided/dual-layer DVD with 17 GB storage capability.

DVD-R: Write-once DVD-Recordable discs with 3.8 GB storage capacity per side.

DVD-RAM: Rewriteable DVD disc with 2.6 GB storage capacity per side.

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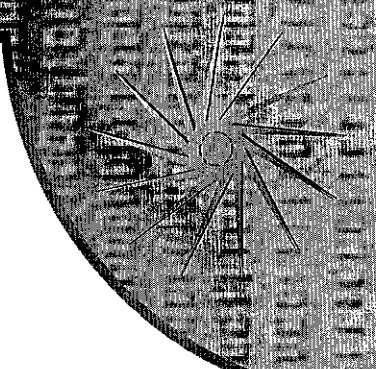
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Error Correction: A digital circuit that corrects errors during the retrieving/decoding process.

FPS: Frames Per Second. Rate at which motion video frames are displayed.

Frame: A complete, individual picture in a motion video.

Full-Frame: Used to describe showing the entire Academy shaped frame. This results in seeing more of the original image than was shown in the theater, where the top and bottom was masked off to display the film in widescreen. Often (erroneously) used interchangeably with pan-and-scan.

Glitch: A noticeable audio or visual anomaly during DVD playback.

GOP: Group of Pictures.

HDTV: High Definition Television.

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I-frame: Also called I picture. I-frames identify the frame's background and are the initial reference frames for bi-directional (B-frame) and predicted frames (P-frame).

Jump: An anomoly that causes the DVD player to "skip" ahead.

LaserDisc: A 12-inch optical disc originally called LaserVision. Laserdisc offers 425 lines of horizontal resolution, which results in picture quality that is superior to vhs tape (260 lines of resolution), but not quite as good a s DVD (480 lines of resolution).

Laserrot: A physical problem with a disc, caused by a manufacturing defect, that causes a laserdisc to become unplayable.

Letterbox: A term used to describe the presentation of widescreen films on an Academy aspect ratio (1.33:1) display. Black bars are used at the top and bottom of the picture to create an image that is widescreen.

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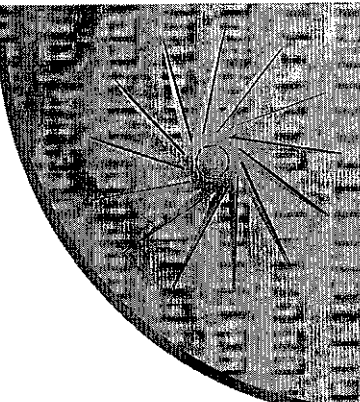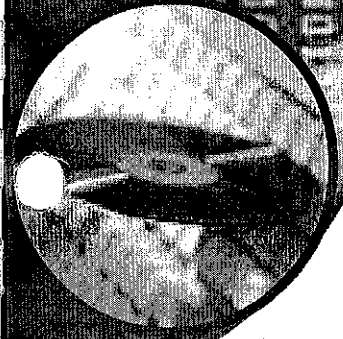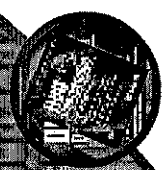
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LFE: Low Frequency Effects. This the surround sound channel used in 5.1 channel surround sound (like Dolby Digital and DTS) used to reproduce low frequency (5-120Hz) sounds. A subwoofer is used to play back the sound.

Lossless Compression: A compression algorithm that does lose any of the original data because of the compression process. The original image or sound is completely preserved.

Lossy Compression: A compression algorithm that gets rid of some information for the sake of making a smaller copy of the original. There are elements of the original sound or picture that are lost when compressed.

Macrovision: Copy protection scheme used to protect DVDs and videotapes from illegal duplication.

Matrix Decoding: A process of decoding multiple channels (i.e. four in the case of Dolby ProLogic) from a 2-channel source.

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Matte: The "black bars" on a widescreen video being displayed on a 1.33:1 display (i.e. standard TV). "Soft" mattes are using in film playback to mask off the top and bottom of a film (1.33:1) before it is projected to make it appear widescreen. "Hard" mattes are actually printed on the film and can not be removed during playback.

Mono: Short for monaural. Sound that comes from a single channel.

MPEG: Moving Picture Experts Group. Sets the standards for video compression.

MPEG-1: A 30 fps system with a 6 to 1 compression ratio. MPEG-1 achieves approximately 1/4 the resolution of broadcast TV and is too slow for processing high quality moving images.

MPEG-2: The video compression technique used for DBS (satellite TV) and DVD. Multichannel Surround Sound: Used to describe audio playback systems with more than two channels (stereo). Examples include Dolby Digital, Dolby ProLogic, DTS, SDDS.

Multi-Language: This feature allows up to eight different audio tracks to be mastered on a single DVD. The user can then select the language track desired.

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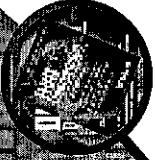
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NTSC: National Television Standards Committee. The committee that established the standard for color television in North America.

Numerical Aperture: A number that represents the lens aperture of a laser pick-up device.

Optical Output: In the case of DVD, this connection is used to connect the DVD digital output to a surround sound processor via a TOSLINK cable to process DVD sound (Dolby Digital).

P-frame: P-frames are constructed by analyzing previous frames and estimating where objects will be in the next frame. P-frames can predict where static and dynamic parts of the frame are. The P-frames are then used in the MPEG-2 decoding process to optimize motion transitions.

PAL: Phase Alternate Line. The standard for color television in many parts of the world outside of North America.

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Pan-And-Scan: Technology used to produce an Academy (1.33:1) shaped image from a widescreen image. The process uses an Academy shaped "mask" to determine which part of the original film should be transferred to video. Depending on how wide the original film is, the Pan-And-Scan transfer can lose as much as 50% of the original image. The process is generally disliked by videophiles, because the resulting video does not adequately represent the original presentation of the film.

Panavision: Brandmark for the processes of filming a widescreen (2.35:1) aspect ratio film onto 35mm film using anamorphic lenses.

PCM: Pulse Code Modulation. An uncompressed digital representation of an analog signal. This is the standard format for CD and DVD audio. CD is 16-bit and DVD can support up to 24-bit.

Perceptual Coding: Technique used by Dolby Digital to remove sound information that would not be detected by the human ear. This ability to reduce unnecessary sound results in greater compression.

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Pits and Lands: The surface of the DVD has pits and flat surfaces (lands) that are read by the DVD player's laser beam and translated to a binary stream which is then decoded for audio and video playback.

Pixel: The smallest picture element of an image.

Progressive Scan: A video scanning system that displays all lines of a frame in one pass as opposed to interlacing the lines (alternating the lines, showing half of the picture each pass).

Resolution: In DVD, resolution is the number of pixels in the height and width of the picture frame. DVD resolution is 720X480.

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Regional Coding: A method by which DVD playback is restricted by geographic region. Studios use the regional coding to better control the timing of a DVD release around the world. The DVD regions are defined as:

Region 1 - United States of America, Canada

Region 2 - Europe, including France, Greece, Turkey, Egypt, Arabia and South Africa

Region 3 - Korea, Thailand, Vietnam, Borneo and Indonesia

Region 4 - Australia and New Zealand, Mexico, the Caribbean, and South America

Region 5 - India, Africa, Russia and former USSR countries

Region 6 - Peoples Republic of China

Region 7 - Reserved

Region 8 - Special international venues (airplanes, cruise ships, etc.)

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RF: Radio Frequency.

RF Output: Used on a laserdisc player to carry the Dolby Digital signal over a coaxial cable.

RSDL: Reverse Spiral Dual Layer. A type of DVD that allows twice (8.5 GB) the ordinary amount of DVD data per side.

S/PDIF: Sony/Philips Digital Interface. The standard for transmitting digital data (like Dolby Digital) on consumer-grade components. Uses either a 75-ohm coaxial or TOSLINK optical cable.

Sampling: Process of creating a digital representation of an analog signal. Standard CD PCM is sampled at a rate of 44.1 kHz (44,100 "samples" of the sound are taken per second).

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Timbre Matching: Making sure that loudspeakers in a surround sound setup have equivalent tonal characteristics. This helps to ensure that sound is uniform as sound moves between speakers.

Toslink: A plastic fiber optic cable used for S/PDIF (e.g. DVD optical output).

Variable Bit Rate: The flow of data being processed on a DVD can be variable, depending on the complexity of the information being processed. Fast moving, dynamic scenes require a high data rate, while a static (non-moving) image requires a lower data rate.

Widescreen: An image with an aspect ratio greater than 1.33:1. Can include aspect ratios: 1.66:1, 1.85:1, and 2.35:1.

XLR Connector: A 3-pin connector used for a balanced audio cable. Used in pro-audio equipment and AES/EBU digital audio.

Y/C: Another term for S-Video. The cable carries the luminance ("Y") and chrominance ("C") on separate channels.

REFERENCES

BOOKS

Labarge, Ralph. **DVD Authoring and Production.** N.P. CMP Books, Aug. 2001.

Taylor, Jim. **DVD Demystified (with DVD).** 2nd ed. vol. 1 Nashville: McGraw-Hill Professional Publishing, 2000.

PERIODICALS

Breznican, Anthony. "Cinematic Knowledge in a Disc." **The Capital-Journal.** 16 Sept. 2001, Sunday Ed., G1.
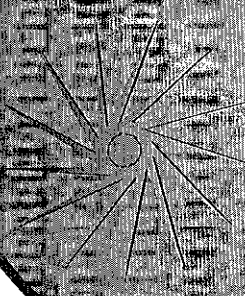
Olson, Catherine A. "DVD Revives Studio's Long-Dormant Back Catalogs." **DVD Works.** Dec. 2000: 8+.

Zaccaria, Joy. "Selling DVD in the Real and Virtual Worlds." **DVD Works.** Dec. 2000: 20.
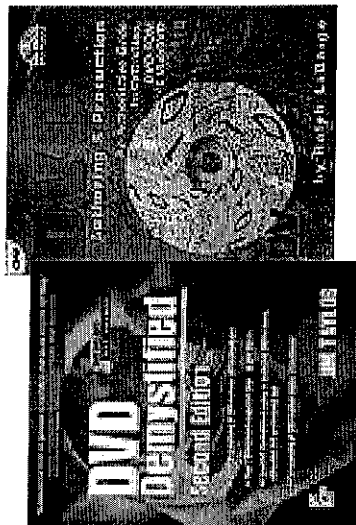
THE AGE OF DVD

REFERENCES

ONLINE ARTICLES

Poor, Alfred. "21st Century Storage." **PC Magazine**. N.D. Oct. 2001 <http://www.pcworld.com>.

Wong, May. "Digital Versatile Disc Sales Boom." **Dailynews.Yahoo** 3 Dec. 2001. 7 Dec. 2001 <http://dailynews.yahoo.com>.
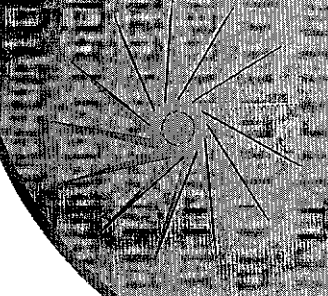
ONLINE SOURCES

AM Newswire, Inc. **DVD Insider – Your source for DVD News, reviews, giveaways and DVD Newsletter**. 1997. Oct. 2001 <http://www.dvdinsider.com>.

Boirun, Rob. **Burnworld.com – Everything you need to know about CD and DVD recording**. Dec. 2001 <http://www.burnworld.com>

REFERENCES

ONLINE SOURCES *continued*

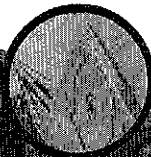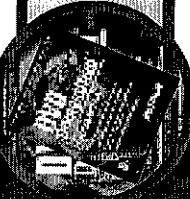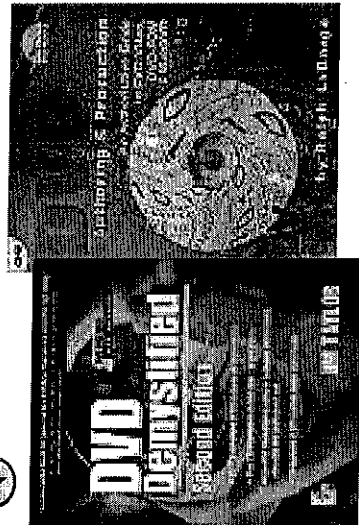**CD Manufacturing, CD Duplication, and Manufacturing, UK, France, Italy, USA.** 12 Dec. 1999. Dec. 2001 <http://www.disctronics.co.uk>.

Cinram International Inc. Oct. 2001 <http://www.cinram.com>.

Dvant Digital 8/8/00. Oct. 2001 <http://www.dvant.com>.

DVD Net Source Home Page. 2001. Oct. 2001 <http://www.storageworld.com>

DVDTown.com – The Resource for DVD Reviews. Dec. 2001 <http://www.dvdtown.com>

REFERENCES

CREDITS

Software
Adobe Photoshop 5.5 & 6.0
Adobe Illustrator 9.01
Macromedia Flash 4.0 & 5.0
Sound Forge

Tutorials & Sound Clips
<http://www.flashkit.com>

Images
<http://gallery.yahoo.com>, <http://www.amazon.com>

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