

## DVD's FAQ's

### What is DVD?

DVD is the new generation of optical disc storage technology. DVD is essentially a bigger, faster CD that can hold cinema-like video, better-than-CD audio, still photos, and computer data. DVD aims to encompass home entertainment, computers, and business information with a single digital format. It has replaced laserdisc, is well on the way to replacing videotape and video game cartridges, and could eventually replace audio CD and CD-ROM. DVD has widespread support from all major electronics companies, all major computer hardware companies, and all major movie and music studios. With this unprecedented support, DVD became the most successful consumer electronics product of all time in less than three years of its introduction. In 2003, six years after introduction, there were over 250 million DVD playback devices worldwide, counting DVD players, DVD PCs, and DVD game consoles. This was more than half the numbers of VCRs, setting DVD up to become the new standard for video publishing.

It's important to understand the difference between the *physical formats* (such as DVD-ROM and DVD-R) and the *application formats* (such as DVD-Video and DVD-Audio). DVD-ROM is the base format that holds data. DVD-Video (often simply called DVD) defines how video programs such as movies are stored on disc and played in a DVD-Video player or a DVD computer. The difference is similar to that between CD-ROM and Audio CD. DVD-ROM includes recordable variations: DVD-R/RW, DVD-RAM, and DVD+R/RW. The application formats include DVD-Video, DVD-Video Recording (DVD-VR), DVD+RW Video Recording (DVD+VR), DVD-Audio Recording (DVD-AR), DVD Stream Recording (DVD-SR), DVD-Audio (DVD-A), and Super Audio CD (SACD). There are also special application formats for game consoles such as Sony PlayStation 2 and Microsoft Xbox

### What do the letters DVD stand for?

All of the following have been proposed as the words behind the letters DVD.

- Delayed, very delayed (referring to the many late releases of DVD formats)
- Diversified, very diversified (referring to the proliferation of recordable formats and other spinoffs)
- Digital venereal disease (referring to piracy and copying of DVDs)
- Dead, very dead (from naysayers who predicted DVD would never take off)
- Digital video disc (the original meaning proposed by some of DVD's creators)
- Digital versatile disc (a meaning later proposed by some of DVD's creators)
- Nothing

And the official answer is? "Nothing." The original acronym came from "digital video disc." Some members of the DVD Forum tried to express that DVD goes far beyond video by retrofitting the painfully contorted phrase "digital versatile disc," but this has never been officially accepted by the DVD Forum as a whole. The DVD Forum decreed in 1999 that DVD, as an international standard, is simply three letters. After all, how many people ask what VHS stands for? (Guess what, no one agrees on that one either.)

### What are the features of DVD-Video?

- Over 2 hours of high-quality digital video (a double-sided, dual-layer disc can hold about 8 hours of high-quality video, or 30 hours of VHS quality video).
- Support for widescreen movies on standard or widescreen TVs (4:3 and 16:9 aspect ratios).
- Up to 8 tracks of digital audio (for multiple languages, commentaries, etc.), each with as many as 8 channels.
- Up to 32 subtitle/karaoke tracks.
- Automatic seamless branching of video (for multiple story lines or ratings on one disc).
- Up to 9 camera angles (different viewpoints can be selected during playback).
- On-screen menus and simple interactive features (for games, quizzes, etc.).
- Multilingual identifying text for title name, album name, song name, cast, crew, etc.
- Instant rewind and fast forward (no "be kind, rewind" stickers and threats on rental discs)
- Instant search to title, chapter, music track, and timecode.
- Durable (no wear from playing, only from physical damage).
- Not susceptible to magnetic fields. Resistant to heat.
- Compact size (easy to handle, store, and ship; players can be portable; replication is cheaper than tapes or laserdiscs).
- Noncomedogenic.

Note: Most discs do not contain all features (multiple audio/subtitle tracks, seamless branching, parental control, etc.), as each feature must be specially authored. Some discs may not allow searching or skipping.

Most players support a standard set of features:

- Language choice (for automatic selection of video scenes, audio tracks, subtitle tracks, and menus).\*
- Special effects playback: freeze, step, slow, fast, and scan.
- Parental lock (for denying playback of discs or scenes with objectionable material).\*
- Programmability (playback of selected sections in a desired sequence).
- Random play and repeat play.
- Digital audio output (PCM stereo and Dolby Digital).
- Recognition and output of DTS Digital Surround audio tracks.
- Playback of audio CDs.

\* Must be supported by additional content on the disc.

Some players include additional features:

- Component video output (YUV or RGB) for higher quality picture.
- Progressive-scan component output (YUV or RGB) for highest quality analog picture.
- Digital video output (SDI, 1394, or DVI/HDMI) for perfect digital picture.
- Six-channel analog output from internal audio decoder (Dolby Digital, DTS, or MLP).
- Playback of Video CDs or Super Video CDs.
- Playback of MP3 CDs.
- Playback of MP3 DVDs.
- Playback of video files in other formats such as DivX and MPEG-4.
- Playback of Picture CDs and Photo CDs.
- Playback of Laserdiscs and CDVs.
- Reverse single frame stepping.
- Reverse play (normal speed).
- RF output (for TVs with no direct video input).
- Multilingual on-screen display.
- Multiple disc capacity.
- Digital zoom (2x or 4x enlargement of a section of the picture). This is a player feature, not a DVD disc feature.

## What's the quality of DVD-Video?

DVD has the capability to produce near-studio-quality video and better-than-CD-quality audio. DVD is vastly superior to consumer videotape and generally better than laserdisc. However, quality depends on many production factors. As compression experience and technology improves we see increasing quality, but as production costs decrease and DVD authoring software becomes widely available we also see more shoddily produced discs. A few low-budget DVDs even use MPEG-1 encoding (which is no better than VHS) instead of higher-quality MPEG-2.

DVD video is usually encoded from digital studio master tapes to MPEG-2 format. The encoding process uses *lossy* compression that removes redundant information (such as areas of the picture that don't change) and information that's not readily perceptible by the human eye. The resulting video, especially when it is complex or changing quickly, may sometimes contain visual flaws, depending on the processing quality and amount of compression. At average video data rates of 3.5 to 6 Mbps (million bits/second), *compression artifacts* may be occasionally noticeable. Higher data rates can result in higher quality, with almost no perceptible difference from the master at rates above 6 Mbps. As MPEG compression technology improves, better quality is being achieved at lower rates.

Video from DVD sometimes contains visible *artifacts* such as color banding, blurriness, blockiness, fuzzy dots, shimmering, missing detail, and even effects such as a face that "floats" behind the rest of the moving picture. It's important to understand that the term "artifact" refers to anything that is not supposed to be in the picture. Artifacts are sometimes caused by poor MPEG encoding, but artifacts are more often caused by a poorly adjusted TV, bad cables, electrical interference, sloppy digital noise reduction, improper picture enhancement, poor film-to-video transfer, film grain, player faults, disc read errors, and so on. Most DVDs exhibit few visible MPEG compression artifacts on a properly configured system.. If you think otherwise, you are misinterpreting what you see.

Some early DVD demos were not very good, but this is simply an indication of how bad DVD can be if not properly processed and correctly reproduced. In-store demos should be viewed with a grain of salt, since most salespeople are incapable of properly adjusting a television set.

Most TVs have the sharpness set too high for the clarity of DVD. This exaggerates high-frequency video and causes distortion, just as the treble control set too high on a stereo causes the audio to sound harsh. For best quality the sharpness control should be set very low. Brightness should also not be set too high. Some DVD players output video with a black-level setup of 0 IRE (Japanese standard) rather than 7.5 IRE (US standard). On TVs that are not properly adjusted this can cause some blotchiness in dark scenes. There may be an option in the player menu to use standard black level. DVD video has exceptional color fidelity, so muddy or washed-out colors are almost always a problem in the display (or the original source), not in the DVD player or disc.

DVD audio quality is superb. DVD includes the option of PCM (pulse code modulation) digital audio with sampling sizes and rates higher than audio CD. Alternatively, audio for most movies is stored as discrete, multi-channel surround sound using Dolby Digital or DTS audio compression similar to the digital surround sound formats used in theaters. As with video, audio quality depends on how well the processing and encoding was done. In spite of compression, Dolby Digital and DTS can be close to or better than CD quality.

### What are the disadvantages of DVD?

- Vagueness of the DVD specification and inadequate testing of players and discs has resulted in incompatibilities. Some movie discs don't function fully (or don't play at all) on some players.
- DVD recorders are more expensive than VCRs.
- DVD has built-in copy protection and regional lockout.
- DVD uses digital compression. Poorly compressed audio or video may be blocky, fuzzy, harsh, or vague.
- The audio downmix process for stereo/Dolby Surround may reduce dynamic range.
- DVD doesn't fully support HDTV.
- Some DVD players and drives can't read CD-Rs.
- Some DVD players and drives can't read recordable DVDs.
- Most DVD players and drives can't read DVD-RAM discs.
- Very few players can play in reverse at normal speed.
- Variations and options such as DVD-Audio, DVD-VR, and DTS audio tracks are not supported by all players.

### What DVD players and drives are available?

Some manufacturers originally announced that DVD players would be available as early as the middle of 1996. These predictions were woefully optimistic. Delivery was initially held up for "political" reasons of copy protection demanded by movie studios, but was later delayed by lack of titles. The first players appeared in Japan in November, 1996, followed by U.S. players in March, 1997, with distribution limited to only 7 major cities for the first 6 months. Players slowly trickled in to other regions around the world. Prices for the first players in 1997 were \$1000 and up. By the end of 2000, players were available for under \$100 at discount retailers. In 2003 players became available for under \$50. Six years after the initial launch, close to one thousand models of DVD players were available from over a hundred consumer electronics manufacturers.

Fujitsu supposedly released the first DVD-ROM-equipped computer on Nov. 6 in Japan. Toshiba released a DVD-ROM-equipped computer and a DVD-ROM drive in Japan in early 1997 (moved back from December which was moved back from November). DVD-ROM drives from Toshiba, Pioneer, Panasonic, Hitachi, and Sony began appearing in sample quantities as early as January 1997, but none were available before May. The first PC upgrade kits (a combination of DVD-ROM drive and hardware decoder card) became available from Creative Labs, Hi-Val, and Diamond Multimedia in April and May of 1997.

Today, every major PC manufacturer has models that include DVD-ROM drives. The price difference from the same system with a CD-ROM drive ranges from \$30 to \$200 (laptops have more expensive drives). Upgrade kits for older computers have been available over the years for \$100 to \$700 from companies such as [Creative Labs](#), [DynaTek](#), E4 (Elecede), [Hi-Val](#), [Leadtek](#), [Margi Systems](#) (for laptops), [Media Forte](#), [Pacific Digital](#), [Sigma Designs](#), [Sony](#), [Toshiba](#), [Utobia](#), and others. For more information about DVDs on computers, including writable DVD drives.

**Note:** If you buy a player or drive from outside your country (e.g., a Japanese player for use in the US) you may not be able to play region-locked discs on it.

The first DVD-Audio players were released in Japan by Pioneer in late 1999, but they did not play copy-protected discs. Matsushita (under the Panasonic and Technics labels) first released full-fledged players in July 2000 for \$700 to \$1,200. DVD-Audio players are now also made by Aiwa, Denon, JVC, Kenwood, Madrigal, Marantz, Nakamichi, Onkyo, Toshiba, Yamaha, and others. Sony released the first SACD players in May 1999 for \$5,000. Pioneer's first

DVD-Audio players released in late 1999 also played SACD. SACD players are now also made by Accuphase, Aiwa, Denon, Kenwood, Marantz, Philips, Sharp, and others.

More information on players and drives:

- CNET [DVD players](#) and [DVD-ROM drives](#)
- The [uk.media.dvd FAQ](#).
- [aus.dvd](#) (Australia/New Zealand/region 4 player info)
- Computer Shopper [DVD players](#) and [DVD-ROM drives](#)

### Which player should I buy?

There are many good players available. Video and audio performance in all modern DVD players is excellent. Personal preferences, your budget, and your existing home theater setup all play a large role in determining which player is best for you. Unless you have a high-end home theater setup, a player that costs under \$250 should be completely adequate. Make a list of things that are important to you (such as ability to play CD-Rs, ability to play Video CDs, 96 kHz/24-bit audio decoding, DTS Digital Out, internal 6-channel Dolby Digital decoder) to help you come up with a set of players. Then try out a few of the players in your price range, focusing on ease of use (remote control design, user interface, front-panel controls). Since there is not a big variation in picture quality and sound quality within a given price range, convenience features play a big part. The remote control, which you'll use all the time, can drive you crazy if it doesn't suit your style.

Some players, especially cheaper models, don't properly play all discs. Before buying a player, you may want to test it with a few complex discs such as *The Matrix*, *The Abyss*, *Independence Day*, and *DVD Demystified*.

In certain cases, you might want to buy a DVD PC instead of a standard DVD player, especially if you want progressive video.

Here are a few questions to ask yourself.

- Do I want selectable sound tracks and subtitles, multiangle viewing, aspect ratio control, parental/multirating features, fast and slow playback, great digital video, multichannel digital audio, compatibility with Dolby Pro Logic receivers, on-screen menus, dual-layer playback, and ability to play audio CDs? This is a trick question, since all DVD players have all of these features.
- Do I want DTS audio? If so, look for a player with the "DTS Digital Out" logo.
- Do I want to play Video CDs? If so, check the specs for Video CD compatibility.
- Do I want to play recordable DVDs? If so, check the specs or compatibility reports for ability to read -R, -RW, +R, and +RW formats .
- Do I need a headphone jack?
- Do I want player setup menus in languages other than English? If so, look for a multilanguage setup feature. (Note: all players support on-disc multilanguage menus.)
- Do I want to play homemade CD-R audio discs? If so look for the "dual laser" feature.
- Do I want to replace my CD player? If so, you might want a changer that can hold 3, 5, or even hundreds of discs.
- Do I want to play discs from other countries? If so, beware of regions and TV formats.
- Do I want to control all my entertainment devices with one remote control? If so, look for a player with a programmable universal remote, or make sure your existing universal remote is compatible with the DVD player.
- Do I want to zoom in to check details of the picture or get rid of the black letterbox bars? If so, look for players with picture zoom.
- Do I have a DTV or progressive-scan display? If so, get a progressive-scan player.
- Do I want to play HDCDs? If so, check for the HDCD logo.
- Does my receiver have only optical or only coax digital audio inputs? If so, make sure the player has outputs to match.
- Do I care about black-level adjustment?
- Do I value special deals? If so, look for free DVD coupons and free DVD rentals that are available with many players.

For more information, read hardware reviews at Web sites such as [DVDFile](#) or in magazines such as [Widescreen Review](#). You may also want to read about user experiences at [Audio Review](#) and in online forums at [Home Theater Forum](#) and [DVDFile](#). There's more advice at [DVDBuyingGuide](#) and at [eCoustics.com](#), which also has a list of links to reviews on other sites.

### What's the difference between DVD-Audio discs and DVD-Music discs?

DVD-Music isn't actually an official DVD format, but it has become a commonly used name for a DVD-Video disc that contains primarily music. A DVD-Music disc plays in any standard DVD player with video or still pictures that accompany the audio a DVD-Audio disc contains special high-fidelity audio tracks that can only be played in DVD-Audio players

### Is DVD-Video a worldwide standard? Does it work with NTSC, PAL, and SECAM?

The MPEG video on a DVD is stored in digital format, but it's formatted for one of two mutually incompatible television systems: 525/60 (NTSC) or 625/50 (PAL/SECAM). Therefore, there are two kinds of DVDs: "NTSC DVDs" and "PAL DVDs." Some players only play NTSC discs, others play PAL and NTSC discs. Discs are also coded for different regions of the world. NTSC is the TV format used in Canada, Japan, Mexico, Philippines, Taiwan, United States, and other countries. PAL is the TV format used in most of Europe, most of Africa, China, India, Australia, New Zealand, Israel, North Korea, and other countries. (See the chart at [www.remoteviewing.com](http://www.remoteviewing.com) for a complete list.)

Almost all DVD players sold in PAL countries play both kinds of discs. These *multi-standard* players partially convert NTSC to a 60-Hz PAL (4.43 NTSC) signal. The player uses the PAL 4.43-MHz color subcarrier encoding format but keeps the 525/60 NTSC scanning rate. Most modern PAL TVs can handle this "pseudo-PAL" signal. A few multi-standard PAL players output true 3.58 NTSC from NTSC discs, which requires an NTSC TV or a multi-standard TV. Some players have a switch to choose 60-Hz PAL or true NTSC output when playing NTSC discs. There are a few *standards-converting* PAL players that convert from an NTSC disc to standard PAL output for older PAL TVs. Proper "on the fly" standards conversion requires expensive hardware to handle scaling, temporal conversion, and object motion analysis. Because the quality of conversion in DVD players is poor, using 60-Hz PAL output with a compatible TV provides a better picture than converting from NTSC to PAL. (Sound is not affected by video conversion.)

Most NTSC players can't play PAL discs, and most NTSC TVs don't work with PAL video. A very small number of NTSC players (such as Apex and SMC) can convert PAL to NTSC. External converter boxes are also available, such as the Emerson EVC1595 (\$350). High-quality converters are available from companies such as [TenLab](#) and [Snell and Wilcox](#).

Beware, some standards-converting players can't convert anamorphic widescreen video for 4:3 displays.

The latest software tools such as Adobe *After Effects* and Canopus *ProCoder* do quite a good job of converting between PAL and NTSC at low cost, but they are only appropriate for the production environment (converting the video before it is encoded and put on the DVD). See Snell and Wilcox's [The Engineer's Guide to Standards Conversion](#) and [The Engineer's Guide to Motion Compensation](#) for technical details of conversion.

There are three differences between discs intended for playback on different TV systems: picture dimensions and pixel aspect ratio (720x480 vs. 720x576), display frame rate (29.97 vs. 25), and surround audio options (Dolby Digital vs. MPEG audio). Video from film is usually encoded at 24 frames/sec but is preformatted for one of the two required display rates. Movies formatted for PAL display are usually sped up by 4% at playback, so the audio must be adjusted accordingly before being encoded. All PAL DVD players can play Dolby Digital audio tracks, but not all NTSC players can play MPEG audio tracks. PAL and SECAM share the same scanning format, so discs are the same for both systems. The only difference is that SECAM players output the color signal in the format required by SECAM TVs. Note that modern TVs in most SECAM countries can also read PAL signals, so you can use a player that only has PAL output. The only case in which you need a player with SECAM output is for older SECAM-only TVs (and you'll probably need a SECAM RF connection).

A producer can choose to put 525/60 NTSC video on one side of the disc and 625/50 PAL on the other. Most studios put Dolby Digital audio tracks on their PAL discs instead of MPEG audio tracks.

Because of PAL's higher resolution, the video usually takes more space on the disc than the NTSC version.

There are actually three types of DVD players if you count computers. Most DVD PC software and hardware can play both NTSC and PAL video and both Dolby Digital and MPEG audio. Some PCs can only display the converted video on the computer monitor, but others can output it as a video signal for a TV.

**Bottom line:** NTSC discs (with Dolby Digital audio) play on over 95% of DVD systems worldwide. PAL discs play on very few players outside of PAL countries.

### What about animation on DVD? Doesn't it compress poorly?

Some people claim that animation, especially hand-drawn cell animation such as cartoons and anime, does not compress well with MPEG-2 or even ends up larger than the original. Other people claim that animation is simple so it compresses better. Neither is true.

Supposedly the "jitter" between frames caused by differences in the drawings or in their alignment causes problems. An animation expert at Disney pointed out that this doesn't happen with modern animation techniques. And even if it did, the motion estimation feature of MPEG-2 would compensate for it.

Because of the way MPEG-2 breaks a picture into blocks and transforms them into frequency information it can have a problem with the sharp edges common in animation. This loss of high-frequency information can show up as "ringing" or blurry spots along edges (called the Gibbs effect). However, at the data rates commonly used for DVD this problem does not usually occur.

#### **Why do some discs require side flipping? Can't DVDs hold four hours per side?**

Even though DVD's dual-layer technology allows over four hours of continuous playback from a single side, some movies are split over two sides of a disc, requiring that the disc be flipped partway through. Most "flipper" discs exist because of producers who are too lazy to optimize the compression or make a dual-layer disc. Better picture quality is a cheap excuse for increasing the data rate; in many cases the video will look better if carefully encoded at a lower bit rate. Lack of dual-layer production capability is also a lame excuse; in 1997 very few DVD plants could make dual-layer discs, but this is no longer the case. Very few players can automatically switch sides, but it's not needed since most movies less than 4 hours long can easily fit on one dual-layer (RSDL) side.

The [Film Vault](#) at DVD Review includes a list of "flipper" discs. Note: A flipper is not the same as a disc with a widescreen version on one side and a pan & scan version or supplements on the other.

#### **Why is the picture squished, making things look too skinny?**

Answer: RTFM. You are watching an anamorphic picture intended for display only on a widescreen TV. You need to go into the player's setup menu and tell it you have a standard 4:3 TV, not a widescreen 16:9 TV. It will then automatically letterbox the picture so you can see the full width at the proper proportions.

In some cases you can change the aspect ratio as the disc is playing (by pressing the "aspect" button on the remote control). On most players you have to stop the disc before you can change aspect. Some discs are labeled with widescreen on one side and standard on the other. In order to watch the fullscreen version you must flip the disc over.

Apparently most players that convert from NTSC to PAL or vice-versa can't simultaneously letterbox (or pan and scan) an anamorphic picture. Solutions are to use a widescreen TV, a multistandard TV, or an external converter. Or get a better player.

#### **Do all videos use Dolby Digital (AC-3)? Do they all have 5.1 channels?**

Most DVD-Video discs contain Dolby Digital soundtracks. However, it's not required. Some discs, especially those containing only audio, have PCM tracks. It's possible --but rare-- for a 625/50 (PAL) disc to contain only MPEG audio. Discs with DTS audio are required to also include a Dolby Digital audio track (in a few rare cases they have a PCM track).

Don't assume that the Dolby Digital label is a guarantee of 5.1 channels. A Dolby Digital soundtrack can be mono, dual mono, stereo, Dolby Surround stereo, etc. For example, *Blazing Saddles* and *Caddyshack* have monophonic soundtracks, so the Dolby Digital soundtrack on these DVDs has only one channel. Some DVD packaging has small lettering or icons under the Dolby Digital logo that indicates the channel configuration. In some cases, there is more than one Dolby Digital version of a soundtrack: a 5.1-channel track and a track specially remixed for stereo Dolby Surround. It's perfectly normal for your DVD player to indicate playback of a Dolby Digital audio track while your receiver indicates Dolby Surround. This means the disc contains a two-channel Dolby Surround signal encoded in Dolby Digital format.

#### **Can DVDs have "laser rot"?**

Before DVDs there were laserdiscs, which were occasionally subject to what was commonly called *laser rot*: the deterioration of the aluminum layer due to oxidation or other chemical change. This usually results from the use of insufficiently pure metal for the reflective coating created during replication, but can be exacerbated by mechanical shear stress due to bending, warping or thermal cycles (the large size of laserdiscs makes them flexible, so that movement along the bond between layers can break the seal -- this is called *delamination*). Deterioration of the data

layer can be caused by chemical contaminants or gases in the glue, or by moisture that penetrates the plastic substrate.

Like laserdiscs, DVDs are made of two platters glued together, but DVDs are more rigid and use newer adhesives. DVDs are molded from polycarbonate, which absorbs about ten times less moisture than the slightly hygroscopic acrylic (PMMA) used for laserdiscs.

DVDs can have delamination problems, partly because some cases or players hold too tightly to the hub. Delamination by itself can cause problems (because the data layer is no longer at the correct distance from the surface) and can also lead to oxidation. Delamination may appear as concentric rings or a "stain" around the hub.

So far DVDs have had few "DVD rot" problems. There have been reports of a few discs going bad, possibly due to delamination, contaminated adhesive, chemical reactions, or oxidation of the reflective layer (see [mindspring.com/~yerington/](http://mindspring.com/~yerington/) and [www.andraste.org/discfault/discfault.htm](http://www.andraste.org/discfault/discfault.htm)). The most likely explanation for DVD deterioration is that during the early days of DVD (1997-2000), disc manufacturing processes and materials were not as good as they should have been. Many improvements have been made since then, so the minuscule problem has probably become even more minuscule.

There are also occasional reports of "cloudiness" or "milky" in DVDs, which can be caused by improper replication. An example is when the molten plastic cools off too fast or isn't under enough pressure to completely fill all the bumps in the mold (see this [archived article](#) from [TapeDisc Business](#) for more). Minimal clouding doesn't hurt playback and doesn't seem to deteriorate. If you can see something with your naked eye it is probably not oxidation or other deterioration.

The result of deterioration is that a disc which played perfectly when it was new develops problems later, such as skipping, freezing, or picture breakup. If a disc seems to go bad, make sure it's not dirty, scratched, or warped. Try cleaning it and try playing it in other players. If the disc consistently has problems, it may have deteriorated. If so, there's nothing you can do to fix it, so you should try to get a replacement from the supplier.

#### **Which titles are pan & scan only? Why?**

Some titles are available only in pan & scan because there was no letterbox or anamorphic transfer made from film. Since transfers cost \$50,000 to \$100,000, studios may not think a new transfer is justified. In some cases the original film or rights to it are no longer available for a new transfer. In the case of old movies, they were shot full frame in the 1.37 "academy" aspect ratio so no widescreen version can be created. Video shot with TV cameras, such as music concerts, is already in 4:3 format.

There is a list of pan & scan titles in the [Film Vault](#) at DVD Review and in the [Internet Movie Database](#) (which also includes discs with both widescreen and pan & scan versions).

#### **Why does playback sometimes freeze for a second?**

Some movies, especially those over two hours long or encoded at a high data rate, are spread across two layers on one side of the disc. When the player changes to the second layer, the video and audio may freeze for a moment as the laser refocuses and finds its place. The length of the pause depends on the player and on the layout of the disc. The disc producer usually tries to choose a point where the pause will be less noticeable. The pause is not a defect in the player or the disc.

There is a list of layer switch points in the [Film Vault](#) at DVD Review. Please send new times to [info@dvdreview.com](mailto:info@dvdreview.com).

#### **The disc says Dolby Digital. Why do I get 2-channel surround audio?**

Some discs (many from Columbia TriStar) have 2-channel Dolby Surround audio (or plain stereo) on track one and 5.1-channel audio on track two. Some studios create separate sound mixes optimized for Dolby Surround or stereo, and they feel the default track should match the majority of sound systems in use. Unless you specifically select the 5.1-channel track (with the audio button on the remote or with the on-screen menu) the player will play the default 2-channel track. (Some players have a feature to automatically select the first 5.1 track.)

Dolby Digital doesn't necessarily mean 5.1 channels.

#### **Why doesn't the repeat A-B feature work on some discs?**

Almost all features of DVD such as search, pause, and scan can be disabled by the disc, which can prevent the player from searching back to the beginning of a segment. If the player uses time search to repeat a segment, then a disc

with fancy non-sequential title organization will not have timecode information the player needs to search. In many cases the authors don't even realize they have prevented the use of the repeat feature.

### What's the difference between first, second, and third generation DVD?

There is no meaningful answer to this question, since you'll get a different response from everyone you ask. The terms "2nd generation" and "3rd generation," and so on refer both to DVD-Video players and to DVD-ROM drives. In general, they simply mean newer versions of DVD playback devices. The terms haven't been used (yet) to refer to DVD products that can record, play video games, or so on.

According to some people, second-generation DVD players came out in the fall of 1997 and third-generation players are those that came out in the beginning of 1998. According to others, the second generation of DVD will be HD players that won't come out until 2003 or so. Many conflicting variations occur between these extremes, including the viewpoint that DTS-compatible players or Divx players or progressive-scan players or 10-bit video players or players that can play *The Matrix* constitute the second, third, or fourth generation.

Things are a little more clear cut on the PC side, where second generation (DVD II) usually means 2x DVD-ROM drives that can read CD-Rs, and third generation (DVD III) usually means 5x (or sometimes 2x or 4.8x or 6x) DVD-ROM drives, a few of which can read DVD-RAMs, and some of which are RPC2 format. Some people refer to RPC2 drives or 10x drives as fourth generation.

### What's a hybrid DVD?

Do you really want the answer to this one? Ok, you asked for it...

1. A disc that works in both DVD-Video players and DVD-ROM PCs. (More accurately called an *enhanced DVD*)
2. A DVD-ROM disc that runs on Windows and Mac OS computers. (More accurately called a *cross-platform DVD*.)
3. A DVD-ROM or DVD-Video disc that also contains Web content for connecting to the Internet. (More accurately called a *WebDVD* or *Enhanced DVD*.)
4. A disc that contains both DVD-Video and DVD-Audio content or SACD content. (More accurately called a *universal* or *AV DVD*. The DVD-Audio standard allows this. The SACD standard does not officially allow video, so it's unclear what a given SACD player will do with a hybrid SACD+DVD-Video disc.) Other variations of this hybrid would be a disc with both DVD-Audio and SACD content, or a disc with all three formats.
5. A disc with two layers, one that can be read in DVD players and one that can be read in CD players. (More accurately called a *legacy* or *CD-compatible* disc.) There are at least three variations of this hybrid, although most aren't commercially available:
  1. A 0.9- to 1.2-mm CD substrate bonded to the back of a 0.6 mm DVD substrate. One side can be read by CD players, the other side by DVD players. The resulting disc is 0.6 mm thicker than a standard CD or DVD, which can cause problems in players with tight tolerances, such as portables. Sonopress, the first company to announce this type, calls it DVDPlus. It's colloquially known as a fat disc. There's a variation in which an 8-cm data area is embedded in a 12-cm substrate so that a label can be printed on the outer ring.
  2. A 0.6-mm CD substrate bonded to a semitransparent 0.6 mm DVD substrate. Both layers are read from the same side, with the CD player being required to read through the semitransparent DVD layer, causing problems with some CD players. The trick is to make the semitransparent layer "invisible" to 780-nm CD lasers. This is the format used for hybrid SACDs.
  3. A 0.6-mm CD substrate, with a special refractive coating that causes a 1.2 mm focal depth, bonded to the back of a 0.6 mm DVD substrate. One side can be read by CD players, the other side by DVD players.
  4. A 0.6-mm DVD substrate bonded to a CD+DVD hybrid substrate (#2 in this subsection). This disc would be readable by SACD and CD players on one side and by standard DVD players on the other (since most standard DVD players are confused by a hybrid disc with only a semitransparent layer).
6. A disc with two layers or two sections one containing pressed (DVD-ROM) data and one containing rewritable (DVD-RAM or other) media for recording. (More accurately called a *DVD-PROM*, *mixed-media*, or *rewritable sandwich* disc.)
7. A disc with two layers on one side and one layer on the other. (More accurately called a *DVD-14*.)
8. A disc with an embedded memory chip for storing custom usage data and access codes. (More accurately called a *chipped DVD*.)
9. A disc that has a foreign language dubbed audio track and also has subtitles in that language.

Did I miss any?

### What's the deal with DTS and DVD?

Digital Theater Systems Digital Surround is an audio encoding format similar to Dolby Digital. It requires a decoder, either in the player or in an external receiver. Some people claim that, because of its lower compression level, DTS sounds better than Dolby Digital. Others claim there is no meaningfully perceptible difference, especially at the typical data rate of 768 kbps, which is 60% more than Dolby Digital. Because of the many variances in production, mixing, decoding, and reference levels, it's almost impossible to accurately compare the two formats (DTS usually produces a higher volume level, causing it to sound better in casual comparisons).

DTS originally did all encoding in house, but as of October 1999 DTS encoders became available for purchase. DTS titles are often considered to be specialty items intended for audio enthusiasts, so some DTS titles are also available in a Dolby Digital-only version.

DTS is an optional format on DVD. Contrary to uninformed claims, the DVD specification has included an ID code for DTS since 1996 (before the spec was even finalized). Because DTS was slow in releasing encoders and test discs, players made before mid 1998 (and many since) ignore DTS tracks. A few demo discs were created in 1997 by embedding DTS data into a PCM track (the same technique used with CDs and laserdiscs), and these are the only DTS DVD discs that work on all players. New DTS-compatible players arrived in mid 1998, but theatrical DTS discs using the DTS audio stream ID did not appear until January 7, 1999 (they were originally scheduled to arrive in time for Christmas 1997). *Mulan*, a direct-to-video animation (not the Disney movie) with DTS soundtrack appeared in November 1998. DTS-compatible players carry an official "DTS Digital Out" logo.

Dolby Digital or PCM audio is required on 525/60 (NTSC) discs, and since both PCM and DTS together don't usually leave enough room for quality video encoding of a full-length movie, essentially every disc with a DTS soundtrack also carries a Dolby Digital soundtrack. This means that all DTS discs will work in all DVD players, but a DTS-compatible player and a DTS decoder are required to play the DTS soundtrack. DTS audio CDs work on all DVD players, because the DTS data is encapsulated into standard PCM tracks that are passed untouched to the digital audio output. DTS discs often carry a Dolby Digital 2.0 track in Dolby Surround format instead of a full Dolby Digital 5.1 track.

#### Why is the picture black and white?

You are probably trying to play an NTSC disc in a PAL player, but your PAL TV is not able to handle the signal. If your player has a switch or on-screen setting to select the output format for NTSC discs, choosing PAL (60 Hz) may solve the problem.

You may have connected one of the component outputs (Y, R-Y, or B-Y) of your DVD player to the composite input of your TV.

#### Why are both sides fullscreen when one side is supposed to be widescreen?

Many DVD's are labeled as having widescreen (16:9) format video on one side and standard (4:3) on the other. If you think both sides are the same, you're probably seeing uncompressed 16:9 on the widescreen side. It may look like 4:3 full-frame, but if you look carefully you'll discover that the picture is horizontally compressed. The problem is that your player has been set for a widescreen TV.

#### Why are the audio and video out of sync?

There have been numerous reports of "lip sync" problems, where the audio lags slightly behind the video or sometimes precedes the video. Perception of a sync problem is highly subjective; some people are bothered by it while others can't discern it. Problems have been reported on a variety of players (notably the Pioneer 414 and 717 models, possibly all Pioneer models, some Sony models including the 500 series and the PS2, some Toshiba models including the 3109, and some PC decoder cards). Certain discs are also more problematic (notably *Lock, Stock, and Two Smoking Barrels*; *Lost In Space*; *TRON*; *The Parent Trap*; and *Austin Powers*).

The cause of the sync problem is a complex interaction of as many as four factors

1. Improper sync in audio/video encoding or DVD-Video formatting.
2. Poor sync during film production or editing (especially post-dubbing or looping).
3. Loose sync tolerances in the player.
4. Delay in the external decoder/receiver.

Factor 1 or 2 usually must be present in order for factor 3 or 4 to become apparent. Some discs with severe sync problems have been reissued after being re-encoded to fix the problem. In some cases, the sync problem in players can be fixed by pausing or stopping playback and then restarting, or by turning the player off, waiting a few seconds, then turning it back on.

A good way to test your player is to simultaneously listen to the analog and digital outputs (play the digital output through your stereo and the analog output through your TV). If the audio echoes or sounds hollow, then the player is delaying the signal and is thus the main cause of the sync problem.

Unfortunately, there is no simple answer and no simple fix. More complaints from customers should motivate manufacturers to take the problem more seriously and correct it in future players or with firmware upgrades. Pioneer originally stated that altering the audio-visual synchronization of their players "to compensate for the software quality would dramatically compromise the picture performance." Since then Pioneer has fixed the problem on its new players. If you have an older model, check with Pioneer about an upgrade.

For many more details, see Michael D's [Pioneer Audio Sync](#) page.

### Why does the picture alternate between light and dark?

You are seeing the effects of Macrovision copy protection, probably because you are running your DVD player through your VCR or VCR/TV combo.

### How do I find "Easter eggs" and other hidden features?

Some DVD movies contain hidden features, often called Easter eggs. These are extra screens or video clips hidden in the disc by the developers. For example, Dark City includes scenes from Lost in Space and the Twin Peaks movie buried in the biography pages of William Hurt and Keifer Sutherland. There's also an amusing "Shell Beach" game entwined throughout the menus. On Mallrats, perhaps indicating that DVD has already become too postmodern for its own good, there's a hidden clip of the director telling you to stop looking for Easter eggs and do something useful.

It's more fun to search for hidden features on your own, but if you need some help, the best list is at [DVD Review](#).

### How do I get rid of the black bars at the top and bottom?

The black bars are part of the *letterbox* process, and in many cases you can't get rid of them. If you set the display option in your player to pan & scan (sometimes called fullscreen or 4:3) instead of letterbox, it won't do you much good since almost no DVD movies have been released with this feature enabled. If you set the player to 16:9 widescreen output it will make the bars smaller, but you will get a tall, stretched picture on a standard TV.

In some cases, there may be both a fullscreen and a letterbox version of the movie on the same disc, with a variety of ways to get to the fullscreen version (usually only one works, so you may have to try all three):

1. Check the other side of the disc (if it's two-sided)
2. Look for a fullscreen choice in the main menu
3. Use the "aspect" button on the remote control

DVD was designed to make movies look as good as possible on TV. Since most movies are wider than most TVs, letterboxing preserves the format of the theatrical presentation. (Nobody seems to complain that the top and bottom of the picture are cut off in theaters.) DVD is ready for TVs of the future, which are widescreen. For these and other reasons, many movies on DVD are only available in widescreen format.

About two thirds of widescreen movies are filmed at 1.85 (flat) aspect ratio or less. In this case, the actual size of the image on your TV is the same for a letterbox version and a full-screen version, unless the pan & scan technique is used to zoom in (which cuts off part of the picture). In other words, the picture is **the same size**, with extra areas visible at the top and bottom in the fullscreen version. In more other words, letterboxing covers over the part of the picture that was also covered in the theater, or it allows the entire widescreen picture to be visible for movies wider than 1.85, in which case the letterboxed picture is smaller and has less detail than a pan & scan version would.

If there's not a fullscreen version of the movie on the disc, one solution is to use a DVD player with a zoom feature to enlarge the picture enough to fill the screen. This will cut off the sides of the picture, but in many cases it's a similar effect to the pan and scan process. Just think of it as "do-it-yourself pan and scan."

For a detailed explanation of why most movie fans prefer letterboxing, see the [Letterbox/Widescreen Advocacy Page](#). For an explanation of anamorphic widescreen and links to more information and examples on other Web sites.

The best solution to this entire mess might be the [FliKFX Digital Recomposition System](#), "the greatest advance in entertainment in 57 years."

## How should I clean and care for DVDs?

Since DVDs are read by a laser, they are resistant to fingerprints, dust, smudges, and scratches. However, surface contaminants and scratches can cause data errors. On a video player, the effect of data errors ranges from minor video artifacts to frame skipping to complete unplayability. So it's a good idea to take care of your discs. In general treat them the same way as you would a CD.

Your player can't be harmed by a scratched or dirty disc unless globs of nasty substances on it actually hit the lens. Still, it's best to keep your discs clean, which will also keep the inside of your player clean. Don't attempt to play a cracked disc, as it could shatter and damage the player. It doesn't hurt to leave the disc in the player, even if it's paused and still spinning, but leaving it running unattended for days on end might not be a good idea.

In general, there's no need to clean the lens on your player, since the air moved by the rotating disc keeps it clean. However, if you use a lens cleaning disc in your CD player, you may want to do the same with your DVD player. It's advisable to use a cleaning disc specifically designed for DVD players, because there are minor differences in lens positioning between DVD and CD players.

Periodic alignment of the pickup head is not necessary. Sometimes the laser can drift out of alignment, especially after rough handling of the player, but this is not a regular maintenance item.

## Care and feeding of DVDs

Handle only at the hub or outer edge. Don't touch the shiny surface with your popcorn-greasy fingers.

Store in a protective case when not in use. Don't bend the disc when taking it out of the case, and be careful not to scratch the disc when placing it in the case or in the player tray.

Make certain the disc is properly seated in the player tray before you close it.

Keep discs away from radiators, heaters, hot equipment surfaces, direct sunlight (near a window or in a car during hot weather), pets, small children, and other destructive forces. The DVD specification recommends that discs be stored at a temperature between -20 to 50 °C (-4 to 122 °F) with less than 15 °C (27 °F) variation per hour, at relative humidity of 5 to 90 percent. Artificial light and indirect sunlight have no effect on replicated DVDs since they are made of polycarbonate, polymer adhesives, and metal (usually aluminum or gold), none of which are significantly affected by exposure to light. Exposure to bright sunlight may affect recordable DVDs, specifically write-once DVDs (DVD-R and DVD+R) that use light-sensitive dyes. Magnetic fields have no effect on DVDs, so it's ok to leave them sitting on your speakers.

Coloring the outside edge of a DVD with a green marker (or any other color) makes no difference in video or audio quality. Data is read based on pit interference at 1/4 of the laser wavelength, a distance of less than 165 nanometers. A bit of dye that on average is more than 3 million times farther away is not going to affect anything.

NIST has prepared a [1-page guide](#) and a [50-page guide](#) to disc care.

## Cleaning and repairing DVDs

If you notice problems when playing a disc, you may be able to correct them with a simple cleaning.

- Do not use strong cleaners, abrasives, solvents, or acids.
- With a soft, lint-free cloth, wipe gently in only a radial direction (a straight line between the hub and the rim). Since the data is arranged circularly on the disc, the micro scratches you create when cleaning the disc (or the nasty gouge you make with the dirt you didn't see on your cleaning cloth) will cross more error correction blocks and be less likely to cause unrecoverable errors.
- Don't use canned or compressed air, which can be very cold and may thermally stress the disc.
- For stubborn dirt or gummy adhesive, use water, water with mild soap, or isopropyl alcohol. As a last resort, try peanut oil. Let it sit for about a minute before wiping it off.
- There are commercial products that clean discs and provide some protection from dust, fingerprints, and scratches. CD cleaning products work as well as DVD cleaning products.

If you continue to have problems after cleaning the disc, you may need to attempt to repair one or more scratches. Sometimes even hairline scratches can cause errors if they just happen to cover an entire error correction (ECC) block. Examine the disc to find scratches, keeping in mind that the laser reads from the bottom. There are essentially two methods of repairing scratches: 1) fill or coat the scratch with an optical material; 2) polish down the scratch. There are many commercial products that do one or both of these, or you may wish to do it yourself with polishing

compounds or toothpaste. The trick is to polish out the scratch without causing new ones. A mess of small polishing scratches may cause more damage than a big scratch. As with cleaning, polish only in the radial direction.

Libraries, rental shops, and other venues that need to clean a lot of discs may wish to invest in a commercial polishing machine that can restore a disc to pristine condition after an amazing amount of abuse. Keep in mind that the data layer on a DVD is only half as deep as on a CD, so a DVD can only be repolished about half as many times.

### What's a progressive DVD player?

A progressive-scan DVD player converts the interlaced (480i or 576i) video from DVD into progressive (480p or 576p) format for connection to a progressive-scan display (31.5 kHz or higher). Progressive players work with all standard DVD titles, but look best with film source. The result is a significant increase in perceived vertical resolution for a more detailed and film-like picture. Since computers use progressive-scan monitors, DVD PCs are by definition progressive-scan players, although quality varies quite a bit.

There's enormous confusion about whether DVD video is progressive or interlaced. Here's the one true answer: Progressive-source video (such as from film) is usually encoded on DVD as interlaced field pairs that can be reinterleaved by a progressive player to recreate the original progressive video.

You must use a progressive-scan display in order to get the full benefit of a progressive-scan player. However, all progressive players also include interlaced outputs, so you can use one with a standard TV until you upgrade to a progressive TV. (You may have to use a switch on the back of the player to set it to interlaced output.)

Toshiba developed the first progressive-scan player (SD5109, \$800) in mid 1998, but didn't release it until fall of 1999 because of copy protection concerns. Panasonic also released a progressive-scan player (DVD-H1000, \$3000) in fall of 1999. Many manufacturers have released progressive models since then at progressively cheaper prices (pun intended). It's also possible to buy an external *line multiplier* to convert the output of a standard DVD player to progressive scanning.

Converting interlaced DVD video to progressive video involves much more than putting film frames back together. There are essentially three ways to convert from interlaced to progressive:

- 1- *reinterleaving* (also called *weave*). If the original video is from a progressive source, such as film, the two fields can be recombined into a single frame.
- 2- *Line doubling* (also called *bob*). If the original video is from an interlaced source, simply combining two fields will cause motion artifacts (the effect is reminiscent of a zipper), so each line of a single field is repeated twice to form a frame. Better line doublers use *interpolation* to produce new lines that are a combination of the lines above and below. The term line doubler is vague, since cheap line doublers only bob, while expensive line doublers (those that contain digital signal processors) can also weave.
- 3- *Field-adaptive* deinterlacing, which examines individual pixels across three or more fields and selectively weaves or bobs regions of the picture as appropriate. Chips to do this used to cost \$10,000 and up, but the feature is now appearing in consumer DVD players.
- 4- And there's also a fourth way, called *motion-adaptive* deinterlacing, which examines MPEG-2 motion vectors or does massive image processing to identify moving objects in order to selectively weave or bob regions of the picture as appropriate. Most systems that do this well cost \$50,000 and up (aside from the cool but defunct Chromatic Mpack2 chip).

There are three common kinds of deinterlacing systems:

- 1- *Integrated*. This is usually best, where the deinterlacer is integrated with the MPEG-2 decoder so that it can read MPEG-2 flags and analyze the encoded video to determine when to bob and when to weave. Most DVD computers use this method.
- 2- *Internal*. The digital video from the MPEG-2 decoder is passed to a separate deinterlacing chip. The disadvantage is that MPEG-2 flags and motion vectors may no longer be available to help the deinterlacer determine the original format and cadence. (Some internal chips receive the `repeat_first_field` and `top_field_first` flags passed from the decoder, but not the `progressive_scan` flag.)
- 3- *External*. Analog video from the DVD player is passed to a separate deinterlacer (line multiplier) or to a display with a built-in deinterlacer. In this case, the video quality is slightly degraded from being converted to analog, back to digital, and often back again to analog. However, for high-end projection systems, a separate line multiplier (which scales the video and interpolates to a variety of scanning rates) may achieve the best results.

Most progressive DVD players use an internal deinterlacing chip, usually from Genesis/Faroudja. Some use MPEG decoders with integrated deinterlacing. Some, such as Toshiba's "Super Digital Progressive" players and Panasonic's progressive-scan player add 4:4:4 chroma oversampling, which provides a slight quality boost from DVD's native 4:2:0 format. Add-on internal deinterlacers such as the Cinematrix and [MSB Progressive Plus](#) are available to convert existing players to progressive-scan output. [Faroudja](#), [Silicon Image](#) (DVDO), and [Videon](#) (Omega) line multipliers are examples of external deinterlacers.

A progressive DVD player has to determine whether the video should be line-doubled (*bobbed*) or reinterleaved (*weaved*). When reinterleaving film-source video, an NTSC DVD player also has to deal with the difference between film frame rate (24 Hz) and TV frame rate (30 Hz). Since the 2-3 pulldown trick can't be used to spread film frames across video fields, there are worse motion artifacts than with interleaved video. However, the increase in resolvable detail more than makes up for it. Advanced progressive players such as the Princeton PVD-5000 and DVD computers can get around the problem by displaying at multiples of 24 Hz such as 72 Hz, 96 Hz, and so on.

A progressive player also has to deal with problems such as video that doesn't have clean cadence (as when it's edited after being converted to interlaced video, when bad fields are removed during encoding, when the video is speed-shifted to match the audio track, and so on). Another problem is that many DVDs are encoded with incorrect MPEG-2 flags, so the reinterleaver has to recognize and deal with pathological cases. In some instances it's practically impossible to determine if a sequence is 30-frame interlaced video or 30-frame progressive video. For example, the documentary on *Apollo 13* is interlaced video encoded as if it were progressive. Other examples of improper encoding are *Titanic*, *Austin Powers*, *Fargo*, *More Tales of the City*, the *Galaxy Quest* theatrical trailer, and *The Big Lebowski* making-of featurette.

One problem is that many TVs with progressive input don't allow the aspect ratio to be changed -- they assume all progressive-scan input is anamorphic. When a non-anamorphic (4:3) picture is sent to these TVs they distort it by stretching it out! Before you buy a DTV, make sure that it allows aspect ratio adjustment on progressive input. Or get a player with an *aspect ratio control* option that "windowboxes" 4:3 video into a 16:9 rectangle by squeezing it horizontally and adding black bars on the side. Because of the added scaling step this degrades picture quality, but at least it gets around the problem.

Just as early DVD computers did a poor job of progressive-scan display of DVDs, the first generations of progressive consumer players are also a bit disappointing. But as techniques improve, and as DVD producers become more aware of the steps they must take to ensure good progressive display, and as more progressive displays appear in homes, the experience will undoubtedly improve, bringing home theaters closer to real theaters.

For more on progressive video and DVD, see [part 5](#) and [player ratings](#) in the excellent [DVD Benchmark](#) series at Secrets of Home Theater and High Fidelity.

### How do the parental control and multi-rating features work?

DVD includes parental management features for blocking playback and for providing multiple versions of a movie on a single disc. Players (including software players on PCs) can be set to a specific parental level using the onscreen settings. If a disc with a rating above that level is put in the player, it won't play. In some cases, different programs on the disc have different ratings. The level setting can be protected with a password.

A disc can also be designed so that it plays a different version of the movie depending on the parental level that has been set in the player. By taking advantage of the seamless branching feature of DVD, objectionable scenes are automatically skipped over or replaced during playback. This requires that the disc be carefully authored with alternate scenes and branch points that don't cause interruptions or discontinuities in the soundtrack. There is no standard way to identify which discs have multi-rated content.

Unfortunately, very few multi-rating discs have been produced. Hollywood studios are not convinced that there is a big enough demand to justify the extra work involved (shooting extra footage, recording extra audio, editing new sequences, creating branch points, synchronizing the soundtrack across jumps, submitting new versions for MPAA rating, dealing with players that don't properly implement parental branching, having video store chains refuse to carry discs with unrated content, and much more). If this feature is important to you, let the studios know. A list of studio addresses is available at [DVD File](#), and there's a Studio and Manufacturer Feedback area at [Home Theater Forum](#). You might also want to visit the [Viewer Freedom](#) site.

Multi-ratings discs include *Kalifornia*, *Crash*, *Damage*, *Embrace of the Vampire*, *Poison Ivy*, *Species II*. In most cases these discs provide "un-cut" or unrated versions that are more intense than the original theatrical release. Discs that use multi-story branching (not always seamless) for a director's cut or special edition version include *Dark Star*, *Stargate SE*, *The Abyss*, *Independence Day*, and *Terminator 2 SE* (2000 release). Also see multipath movies at [Brilliant Digital](#).

Another option is to use a software player on a computer that can read a playlist telling it where to skip scenes or mute the audio. Playlists can be created for the thousands of DVD movies that have been produced without parental control features. [ClearPlay](#) seems to be the most successful product of this type. A shareware Cine-bit DVD Player did this, but it has been withdrawn apparently because of legal threats from [Nissim](#), who seem determined to stifle the very market they claim to support. A Canadian company, [Select Viewing](#), is releasing software for customized DVD playback on Windows PCs. A few similar projects are under development.

Yet another option is [TVGuardian](#), a device that attaches between the DVD player and the TV to filter out profanity and vulgar language. The box reads the closed caption text and automatically mutes the audio and provides

substitute captions for objectionable words. (Note that current versions of these devices don't work with digital audio connections, and don't work with DVDs without NTSC Closed Captioning.)

### Which discs include multiple camera angles?

There's a euphemism in the DVD industry, where "multi-angle titles" --spoken with the right inflection-- means adult titles. However, apart from thousands of XXX-rated discs, not very many mainstream DVDs have multiple angles, since it takes extra work and limits playing time (a segment with two angles uses up twice as much space on the disc).

Short Cinema Journal vol. 1 was one of the first to use camera angles, in the animated "Big Story," which is also available on the DVD Demystified first edition [sample disc](#). *Ultimate DVD* (Gold or Platinum) is another sample disc with examples of angles. [King Crimson: Deja Vroom](#) has excellent angles, allowing you to focus on any of the musicians. Other multi-angle music discs include *Dave Matthews Band: Listener Supported*, *Metallica Cunning Stunts*, *Sarah McLachlan Mirrorball*. Some movies, such as *Detroit Rock City* (KISS video), *Ghostbusters SE*, *Mallrats*, *Suicide Kings*, *Terminator 2 SE*, and *Tomorrow Never Dies SE* use multiple angles in supplements. Some discs, especially those from Buena Vista, use the angle feature to show credits in the selected language (usually with the angle key locked out).

You can get an incomplete list of multi-angle discs by doing an [extended search](#) at DVD File or other sites with searchable databases.

### Is it ok to put labels or magnetic strips on DVDs?

Labels and adhesive strips are dangerous because they can unbalance the disc and cause errors, or even damage a player, especially if they peel off while the disc is spinning. Pressure-sensitive adhesives break down over time, so it's possible for labels to come loose after a few years. Libraries and DVD rental outlets often want to label discs or attach magnetic strips for security, but it's best not to use them at all. If you must, use a ring-shaped "donut" label that goes around the center of the disc. As long as the circular label doesn't interfere with the player clamping onto the hub, it should be ok. If you have to use a non-circular sticker, place it as close to the center as possible to minimize unbalancing. Placing a second sticker straight across from the center will also help. Writing with a marker in the clear (not reflective) area at the hub is better than using a sticker, although there's not much room to write. Write only in the area inside a 44-mm diameter. Writing anywhere else on the disc is risky, since the ink could possibly eat away the protective coating and damage the data layer underneath.

In most cases a better alternative for security is a case that can only be opened with special equipment at the register or checkout counter. Barcodes, stickers, and security strips can be placed on the case without endangering discs (or players). This is especially good for double-sided discs, which have no space for stickers.

There are full-size round labels designed to go on recordable CDs and DVDs, but they have been known to cause problems. As DVD-ROM drives get faster and faster, destabilization of the disc by a label may cause read errors. A better (but more expensive) solution is to use an inkjet disc printer ([IMT](#), [Odxion](#), [Primera](#), [Rimage](#), [Trace Affex](#)) with printable-surface discs. Some drives have the HP [LightScribe](#) feature, where if you have software that supports LightScribe, and you use special LightScribe discs with a photosensitive label side, after you record the disc you can put it back in the drive upside down to "etch" a label on the disc.

### What's the difference between Closed Captions and subtitles?

Closed Captions (CC) are a standardized method of encoding text into an NTSC television signal. The text can be displayed by a TV with a built-in decoder or by a separate decoder. All TVs larger than 13 inches sold in the US since 1993 have Closed Caption decoders. Closed Captions can be carried on DVD, videotape, broadcast TV, cable TV, and so on.

Even though the terms *caption* and *subtitle* have similar definitions, *captions* commonly refer to on-screen text specifically designed for hearing impaired viewers, while *subtitles* are straight transcriptions or translations of the dialogue. Captions are usually positioned below the person who is speaking, and they include descriptions of sounds (such as gunshots or closing doors) and music. *Closed* captions are not visible until the viewer activates them. *Open* captions are always visible, such as subtitles on foreign videotapes.

Closed Captions on DVDs are carried in a special data channel of the MPEG-2 video stream and are automatically sent to the TV. You can't turn them on or off from the DVD player. Subtitles, on the other hand, are DVD subpictures, which are full-screen graphical overlays. One of up to 32 subpicture tracks can be turned on to show text or graphics on top of the video. Subpictures can also be used to create captions. To differentiate from NTSC Closed Captions and from subtitles, captions created as subpictures are usually called "captions for the hearing impaired."

If this is all too confusing, just follow this advice: To see Closed Captions, use the CC button on the TV remote. To see subtitles or captions for the hearing impaired, use the subtitle button on the DVD remote or use the onscreen menu provided by the disc. Don't turn both on at once or they'll end up on top of each other. Keep in mind that not all DVDs have Closed Captions or subtitles. Also, some DVD players don't reproduce Closed Captions at all.

See DVD File's [A Guide to DVD Subtitles and Captioning](#), Gary Robson's [Caption FAQ](#), and Joe Clark's [DVD Accessibility](#) for more about Closed Captions. Note that DVD does not support PAL Teletext, the much-improved European equivalent of Closed Captions.

### What do the "D" codes on region 2 DVDs mean?

Some non-U.S. discs from Warner, MGM, and Disney are marked with a distribution zone number. "D1" identifies a UK-only release. These often have English-only soundtracks with BBFC censoring. "D2" and "D3" identify European DVDs that are not sold in the UK and Ireland. These often contain uncut or less cut versions of films. "D4" identifies DVDs that are distributed throughout all of Europe (region 2) and Australia/New Zealand (region 4).

### What's firmware and why would I need to upgrade it?

DVD players are simple computers. Each one has a software program that controls how it plays discs. Since the software is stored on a chip, it's called firmware. Some players have flaws in their programming that cause problems playing certain DVDs. In order to correct the flaws, or in some cases to work around authoring errors on popular discs, the player must be upgraded with a replacement firmware chip. This usually has to be done in a factory service center, although some players can be upgraded simply by inserting a CD.

### Are there discs to help me test, optimize, or show off my audio/video system?

A few DVDs are designed specifically for testing and optimizing video and audio playback. Some also demonstrate special features of DVD:

- AVIA Guide to Home Theater, [Ovation Software](#) (extensive video and audio test patterns and setup tutorials)
- Video Essentials, [Joe Kane Productions](#) (the original system optimization disc, from the master)
- Ultimate DVD series, [Henninger Interactive](#) (examples of many DVD features, plus test and demo material)
- [DVD Demystified demo disc](#) (examples of almost every DVD feature, plus demo material)

Here are a few movies that work especially well for demonstrating DVD's video and audio quality:

- *Dinosaur* - Direct-to-DVD digital transfer gives sharp, clear images; good bass on footsteps and fights.
- *The Eagles: Hell Freezes Over* - Outstanding 5.1-channel music (DTS only, Dolby Digital tracks are 2-channel).
- *The Fifth Element* - Excellent video, especially in beginning desert scenes, with stellar audio as well.
- *Gladiator* - Stunning surround audio with brilliantly mixed orchestration.
- *O Brother, Where Art Thou* - Beautiful color and incredible detail (check out facial stubble) with well-rendered shadows.
- *Terminator 2: Judgment Day (Ultimate Edition)* - Great video for shadows and reds; highly dimensional audio.
- *Toy Story 2* - Perfect all-digital transfer results in sharp, rich images; sound effects are nicely staged.
- *U-571* - Intense surround effects. Earthshaking bass makes a great subwoofer demo.

Films on Disc has a list of [ISF DVD citations](#) -- examples of the best of the craft.

### What do Sensormatic and Checkpoint mean?

Sensormatic and Checkpoint are two point-of-sale security systems. The names refer to the little metal tags that are inserted into DVD packaging to set off an alarm if you go through the sensors at the store entrance without having the tags deactivated during checkout. The tags are placed in the packages at the replication plant so that it doesn't have to be done at the store. This is called *source tagging*.

### What are Superbit, Infinifilm, and other variations of DVD?

There is one single DVD-Video standard. However, within the DVD-Video format there is a great deal of flexibility in the way discs can be created. Different studios have come up with brand names for their particular implementations

of advanced features. There's nothing extraordinary about any particular variation, other than a studio spending a lot of time and effort making it work well and promoting it. These kinds of advanced DVDs should play on most players but may reveal more player bugs than standard discs.

**Superbit** DVDs, from Columbia TriStar, use a high data rate for the video to improve picture quality. Additional language tracks and other extras are left off the disc to make room for more video data and for a DTS audio track. In most cases the difference is subtle, but it does improve the experience on high-end players and progressive-scan displays. See [superbitdvd.com](http://superbitdvd.com) for marketing fluff.

**Infinifilm** DVDs, from New Line, let you watch a movie with pop-ups that direct you to extra content such as an interview, behind-the-scenes-footage, or historical information. See [infinifilm.com](http://infinifilm.com) for more hype.

### I don't know the parental control password for my player. What do I do?

Most DVD players allow you to lock out discs above a certain rating. The rating level is protected by a password so that children (or spouses) can't change it. If you don't know the password you won't be able to play some discs. You might be able to clear the password by resetting the player (see the user manual) or unplugging it for a few days. In some cases you might be able to use the default password (0000, 9999, or 3308). Otherwise you'll have to call the customer service number of the manufacturer and see if they can help you. Make sure you speak in a deep voice so they don't think you are a kid trying to hack into his parents' player.

### Can my DVD player get a virus?

There's almost no chance your DVD player can be infected with a virus of the kind that infect computer software. DVD players have simple computers in them that run commands from the disc as it plays, but memory is reset when you press Stop or eject the disc. The firmware in some DVD players can be upgraded by inserting a special disc, so it's theoretically possible someone could make a disc that damages the firmware of a player, but it's highly unlikely and would only have an effect on a few models.

---

## DVD's relationship to other products and technologies

### Will DVD replace VCRs?

Eventually. DVD player sales exceeded VCR sales in 2001. DVD recorders will hasten the death of VCRs once the price difference is small enough. DVDs have many advantages over tapes, such as no rewinding, quick access to any part of a recording, and fundamentally lower technology cost for hardware and disc production. Some projections show DVD recorder sales passing VCR sales in 2005. By 2010 VHS may be as dead as vinyl records were in 2000.

### Will DVD replace CD?

CD-ROMs and recordable CDs will probably never disappear since they are cheaper and can be used instead of DVD when the extra capacity isn't needed. Likewise CD audio discs will probably never be replaced by DVD-Video or DVD-Audio discs since CDs are cheap and simple to make. However, DVD-ROM drives and recordable DVD drives will eventually replace CD-ROM drives and CD-RW drives in computers. Most manufacturers plan to cease CD drive production in favor of DVD drives once they are cheap enough. Because DVD-ROM drives can read CD-ROMs, and because DVD recordable drives can write CD-R and CD-RW discs, there is a compatible forward migration path.

### Can CD-R writers create DVDs?

No. DVD uses a smaller wavelength of laser to make smaller pits in tracks that are closer together. The DVD laser must also focus more tightly and at a different level. In fact, a CD-R made on a CD-R writer may not be readable by a DVD-ROM drive. It's unlikely there will be "upgrades" to convert CD-R drives to DVD-R, since this would cost more than purchasing a new DVD-R drive.

### Is CD compatible with DVD?

This is actually many questions with many answers, covered in the following sections.  
[Note the differentiation between DVD (general case) and DVD-ROM (computer data).]

### Is CD audio (CD-DA) compatible with DVD?

Yes. All DVD players and drives will read audio CDs (Red Book). This is not actually required by the DVD spec, but so far all manufacturers have made their DVD hardware read CDs.

On the other hand, you can't play a DVD in a CD player. (The pits are smaller, the tracks are closer together, the data layer is a different distance from the surface, the modulation is different, the error correction coding is new, etc.) Also, you can't put CD audio data onto a DVD and have it play in DVD players. (Red Book audio frames are different than DVD data sectors.)

#### **Is CD-ROM compatible with DVD-ROM?**

Yes. All DVD-ROM drives will read CD-ROMs (Yellow Book). Software on a CD-ROM will run fine in a DVD-ROM system.

However, DVD-ROMs are not readable by CD-ROM drives.

#### **Is CD-R compatible with DVD?**

Sometimes. The problem is that most CD-Rs (Orange Book Part II) are "invisible" to DVD laser wavelength because the dye used to make the CD-R doesn't reflect the beam. Some first-generation DVD-ROM drives and many DVD players can't read CD-Rs. The formulation of dye used by different CD-R manufacturers also affects readability. That is, some brands of CD-R discs have better reflectivity at DVD laser wavelength, but even these don't reliably work in all players.

The common solution is for the DVD player or drive to use two lasers at different wavelengths: one for reading DVDs and the other for reading CDs and CD-Rs. Variations on the theme include Sony's "dual discrete optical pickup" with switchable pickup assemblies with separate optics, dual-wavelength lasers (initially deployed on Sony's Playstation 2), Samsung's "annular masked objective lens" with a shared optical path, Toshiba's similar shared optical path using an objective lens masked with a coating that's transparent only to 650-nm light, Hitachi's switchable objective lens assembly, and Matsushita's holographic dual-focus lens. The MultiRead logo guarantees compatibility with CD-R and CD-RW media, but unfortunately, few manufacturers are using it.

Bottom line: If you want a DVD player that can read CD-R discs, look for a "dual laser," "twin laser," or "dual optics" feature.

An effort to develop CD-R "Type II" media compatible with both CD and DVD wavelengths was abandoned.

DVD-ROM drives can't record on CD-R or any other media, but a few combination DVD-ROM/CD-RW drives can write to CD-R and CD-RW. Most newer recordable DVD drives can also record on CD-R or CD-RW.

CD-R burners can't read or write DVD discs of any kind.

#### **Is CD-RW compatible with DVD?**

Usually. CD-Rewritable (Orange Book Part III) discs have a smaller reflectivity difference, requiring new automatic-gain-control (AGC) circuitry in CD-ROM drives and CD players. Most existing CD-ROM drives and CD players can't read CD-RW discs. The OSTA MultiRead standard addresses this, and some DVD manufacturers have suggested they will support it. The optical circuitry in even first-generation DVD-ROM drives and DVD players is usually able to read CD-RW discs, since CD-RW does not have the "invisibility" problem of CD-R.

Most newer recordable DVD drives can also record on CD-R or CD-RW.

CD-RW burners can't read or write DVD discs of any kind.

#### **Is Video CD compatible with DVD?**

Sometimes. It's not required by the DVD spec, but it's trivial to support the Video CD (White Book) standard since any MPEG-2 decoder can also decode MPEG-1 from a Video CD. About two thirds of DVD players can play Video CDs. Most Panasonic, RCA, Samsung, and Sony models play Video CDs. Japanese Pioneer models play Video CDs but American models older than the DVL-909 don't. Toshiba players older than models 2100, 3107, and 3108 don't play Video CDs.

VCD resolution is 352x288 for PAL and 352x240 for NTSC. The way most DVD players and Video CD players deal with the difference is to chop off the extra lines or add blank lines. When playing PAL VCDs, the Panasonic and RCA NTSC players apparently cut 48 lines (17%) off the bottom. Sony NTSC players scale all 288 lines to fit.

Because PAL VCDs are encoded for 25 fps playback of 24 fps film, there is usually a 4% speedup. Playing time is shorter, and the audio is shifted up in pitch unless it was digitally processed before encoding to shift the pitch back to normal. This also happens with PAL DVDs.

All DVD-ROM computers can play Video CDs (with the right software).

Standard VCD players can't play DVDs.

Note: Many Asian VCDs carry two soundtracks by putting one language on the left channel and another on the right. The two channels are mixed together into a stereo system unless you adjust the balance or disconnect one input to get only one channel.

For more on Video CD, see Glenn Sanderse's [Video CD FAQ](#) at [CDPage](#), or Russil Wvong's [Video CD FAQ](#).

### Is Super Video CD compatible with DVD?

Not generally. Super Video CD (SVCD) is an enhancement to Video CD that was developed by a Chinese government-backed committee of manufacturers and researchers, partly to sidestep DVD technology royalties and partly to create pressure for lower DVD player and disc prices in China. The final SVCD spec was announced in September 1998, winning out over C-Cube's China Video CD (CVD) and HQ-VCD (from the developers of the original Video CD). In terms of video and audio quality, SVCD is in between Video CD and DVD, using a 2x CD drive to support 2.2 Mbps VBR MPEG-2 video (at 480x480 NTSC or 480x576 PAL resolution) and 2-channel MPEG-2 Layer II audio. As with DVD, it can overlay graphics for subtitles. It's technically easy to make a DVD-Video player compatible with SVCD, but it's being done mostly on Asian DVD player models. The Philip's DVD170 player can be upgraded (using a special disc) to play SVCD discs.

SVCD players can't play DVDs, since the players are based on CD drives.

See Jukka Aho's [Super Video CD Overview](#) and [Super Video CD FAQ](#) for more info.

### Is Picture CD or Photo CD compatible with DVD?

Sometimes. Because Picture CDs and Photo CDs are usually on CD-R media, they suffer from the CD-R problem. That aside, some DVD players can play Picture CDs. Only a few can play Photo CDs.

Most DVD-ROM drives will read Picture CDs or Photo CDs (if they read CD-Rs) since it's trivial to support the XA and Orange Book multisession standards. Picture CDs are designed to work with Windows. Photo CDs require specific support from an application or an OS.

Photos can be put on recordable DVDs using the DVD-Video slideshow feature, which works on all DVD players.

### Is CD-i compatible with DVD?

In general, no. DVD players do not play CD-i (Green Book) discs. Philips once announced that it would make a DVD player that supported CD-i, but it never appeared. Some people expected Philips to create a "DVD-i" format in an attempt to breathe a little more life into CD-i (and recover a bit more of the billion or so dollars they invested in it). A DVD-ROM PC with a CD-i card should be able to play CD-i discs.

There are also "CD-i movies" that use the CD-i Digital Video format that was the precursor to Video CD. Early CD-i DV discs won't play on DVD players or VCD players, but newer CD-i movies, which use the standard VCD format, will play on any player that can play VCDs.

See Jorg Kennis' [CD-i FAQ](#) for more information on CD-i.

### Is Enhanced CD compatible with DVD?

Yes. DVD players will play music from enhanced music CDs (Blue Book, CD Plus, CD Extra), and DVD-ROM drives will play music and read data from enhanced CDs. Older ECD formats such as mixed mode and track zero (pregap, hidden track) should also be compatible, but there is a problem with Microsoft and other CD/DVD-ROM drivers skipping track zero.

### Is CD+G compatible with DVD?

Only a few players, such as the Pioneer DVL-9 player and Pioneer karaoke DVD models DV-K800 and DVK-1000, support CD+G discs. Most DVD players don't support this mostly obsolete format. All DVD-ROM drives can read the CD+G information, but special software is required to make use of it.

### Is CDV compatible with DVD?

Sort of. CDV, sometimes called Video Single, is actually a weird combination of CD and laserdisc. Part of the disc contains 20 minutes of digital audio playable on any CD or DVD player. The other part contains 5 minutes of analog video and digital audio in laserdisc format, playable only on a CDV-compatible laserdisc player. Pioneer's combination DVD/laserdisc players are the only DVD players that can play CDVs.

Standard laserdisc/CDV players can't play DVDs.

### Is MP3 compatible with DVD?

Not officially. MP3 is the MPEG Layer 3 audio compression format. (MP3 is not MPEG-3, which doesn't exist.) The DVD-Video spec allows only Layer 2 for MPEG audio (MP2). However, MP3 files can be played from DVD on any computer with a DVD-ROM drive, and many DVD players (particularly those manufactured in Asia) can play MP3 CDs. However, most DVD players can't play MP3 DVDs, because they are shortsightedly designed to only look for MP3 files on CDs. Check the [player list](#) at DVDRHelp.com for players that can play MP3 CDs or MP3 DVDs.

### Is HDCD compatible with DVD?

Yes. Pacific Microsonics' [HDCD](#) (high-definition compatible digital) is an encoding process that enhances audio CDs so that they play normally in standard CD and DVD players (and allegedly sound better than normal CDs) yet produce an extra 4 bits of precision (20 bits instead of 16) when played on CD and DVD players equipped with HDCD decoders.

### Is laserdisc compatible with DVD?

No. Standard DVD players will not play laserdiscs, and you can't play a DVD disc on any standard laserdisc player. (Laserdisc uses analog video, DVD uses digital video; they are very different formats.)

Pioneer makes combo players that play laserdiscs and DVDs (and also CDVs and audio CDs).

### Will DVD replace laserdisc?

When this question was first entered in the FAQ in 1996, before DVD was available, many people wondered if DVD would replace laserdisc, the 12-inch optical disc format that had been around since 1978. Some argued that DVD would fail and its adherents would come groveling back to laserdisc. After DVD was released, it soon became clear that it had doomed laserdisc to quick obscurity. Pioneer Entertainment, the long-time champion of laserdisc, abandoned laserdisc production in the U.S. in June of 1999. This was sooner than even Pioneer thought possible (in September 1998, Pioneer's president Kaneo Ito said the company expected laserdisc products to be in the market for another one-and-a-half to two years), although Pioneer did continue to release small runs in Japan until 2001.

Laserdisc still fills niches in education, training, and video installations, but it's fading even there. Existing laserdisc players and discs will be around for a while, though essentially no new discs are being produced. There were about 18,000 laserdisc titles in the US and a total of over 35,000 titles worldwide that could be played on over 7 million laserdisc players. (See Julien Wilk's [Laserdisc Database](#) for the most extensive list of titles.) It took DVD several years to reach this level, and there are still rare titles available on laserdisc but not on DVD. One bright point is that laserdiscs can now be had at bargain prices.

### How does DVD compare to laserdisc?

- Features: DVD has the same basic features as CLV LD (scan, pause, search) and CAV LD (freeze, slow) and adds branching, multiple camera angles, parental control, video menus, interactivity, etc., although some of these features are not available on all discs.
- Capacity: Single-layer DVD holds over 2 hours, dual-layer holds over 4 hours. CLV LD holds one hour per side, CAV holds half an hour. A CAV laserdisc can hold 104,000 still images. DVD can hold thousands of still pictures accompanied by hundreds of hours of audio and text.
- Convenience: An entire movie fits on one side of a DVD, so there's no need to flip the disc or wait for the player to do it. DVDs are smaller and easier to handle. DVD players can be portable, similar to CD players. Discs can be easily and cheaply sent through the mail. On the other hand, laserdiscs have larger covers for better art and text.

- Noise: Most LD players make a whirring noise that can be heard during quiet segments of a movie. Most DVD players are as quiet as CD players.
- Audio: LD can have better quality on Dolby Surround soundtracks stored in uncompressed PCM format. DVD has better quality on Dolby Digital or music only (PCM). LD has 2 audio tracks: analog and digital, whereas DVD has up to 8 audio tracks. LD uses PCM audio sampled with 16 bits at 44.1 kHz. DVD LPCM audio can use 16, 20, or 24 bit samples at 48 or 96 kHz (although PCM is not used with most movies). LD has surround audio in Dolby Surround, Dolby Digital (AC-3), and DTS formats. 5.1-channel surround sound is available by using one channel of the analog track for AC-3 or both channels of the digital track for DTS. DVD uses the same Dolby Digital surround sound, usually at a higher data rate of 448 kbps, and can optionally include DTS (at data rates up to 1536 kbps compared to LD's 1411 kbps, but in practice DTS data rates are often 768 kbps). DVD players convert Dolby Digital to Dolby Surround. The downmixing, combined with the effects of compression, often results in lower-quality sound than from LD Dolby Surround tracks.
- Video: DVD usually has better video. LD suffers from degradation inherent in analog storage and in the composite NTSC or PAL video signal. DVD uses digital video, and even though it's heavily compressed, most professionals agree that when properly and carefully encoded it's virtually indistinguishable from studio masters. This doesn't mean that the video quality of DVD is always better than LD. Only that it can be better. Also keep in mind that the average television is of insufficient quality to show much difference between LD and DVD. Home theater systems or HDTVs are needed to take full advantage of the improved quality.
- Resolution: In numerical terms DVD has 345,600 pixels (720x480), which is 1.3 times LD's approximately 272,160 pixels (567x480). Widescreen DVD has 1.7 times the pixels of letterboxed LD (or 1.3 times anamorphic LD). As for lines of horizontal resolution, DVD has about 500 whereas LD has about 425. In analog output signal terms, typical luma frequency response maintains full amplitude to between 5.0 and 5.5 MHz. This is below the 6.75 MHz native frequency of the MPEG-2 digital signal. Chroma frequency response is one-half that of luma. Laserdisc frequency response usually begins to fall off at 3 MHz. (All figures are for NTSC, not PAL.)
- Legacy titles: Some movies on laserdisc will probably never appear on DVD (see Julien Wilk's [Laserdisc Database](#)).
- Availability: DVD players and discs are available for purchase and rental in thousands of outlets and on the Internet. LD players and discs are becoming hard to find.
- Price: Low-cost DVD players are cheaper than the cheapest LD player. Most movies on DVD cost less than on LD.
- Restrictions: For those outside the US, regional coding is a definite drawback of DVD. For some people Macrovision copy protection is an annoyance. Laserdisc has no copy protection and does not have regional differences other than PAL vs. NTSC.
- Recordable: DVD recorders are increasingly affordable. Laserdisc recording, at a low of \$250 per disc, was never available to general consumers.

For more laserdisc info, see Leopold's FAQ at [www.cs.tut.fi/~leopold/Ld/FAQ/index.html](http://www.cs.tut.fi/~leopold/Ld/FAQ/index.html), and Bob Niland's FAQs and overview at [www.access-one.com/rjn/laser/laserdisc.html](http://www.access-one.com/rjn/laser/laserdisc.html) (overview reprinted from Widescreen Review magazine).

### Can I modify or upgrade my laserdisc player to play DVD?

No. DVD circuitry is completely different, the pickup laser is a different wavelength, the tracking control is more precise, etc. No hardware upgrades have been announced, and in any case they would be more expensive than buying a DVD player to put next to the laserdisc player.

### Does DVD support HDTV (DTV)? Will HDTV make DVD obsolete?

Short answers: Partially. No.

First, some quick definitions: HDTV (high-definition TV) encompasses both analog and digital televisions that have a widescreen 16:9 aspect ratio and approximately 5 times the resolution of standard TV (double vertical, double horizontal, wider aspect). DTV (digital TV) applies to digital broadcasts in general and to the U.S. ATSC standard in specific. The ATSC standard includes both standard-definition (SD) and high-definition (HD) digital formats. The notation H/DTV is often used to specifically refer to high-definition digital TV.

In December of 1996 the FCC approved the U.S. DTV standard. HDTVs became available in late 1998, but they are still expensive and won't become widespread for many years. DVDs are not HD, but they look great on HDTVs. Over 80 percent of the 2 million DTV sets sold in the U.S. in 2002 did not have tuners, indicating that their owners got them for watching DVDs.

DVD-Video does not directly support HDTV. No digital HDTV standards were finalized when DVD was developed. In order to be compatible with existing televisions, DVD's MPEG-2 video resolutions and frame rates are closely tied to

NTSC and PAL/SECAM video formats. DVD does use the same 16:9 aspect ratio of HDTV and the Dolby Digital audio format of U.S. DTV.

HDTV in the U.S. is part of the ATSC DTV format. The resolution and frame rates of DTV in the US generally correspond to the ATSC recommendations for SD (640x480 and 704x480 at 24p, 30p, 60p, 60i) and HD (1280x720 at 24p, 30p, and 60p; 1920x1080 at 24p, 30p and 60i). (24p means 24 progressive frames/sec, 60i means 60 interlaced fields/sec [30 frames/sec].) The current DVD-Video spec covers all of SD except 60p. It's expected that future DVD players will output digital video signals from existing discs in SDTV formats. The HD formats are 2.7 and 6 times the resolution of DVD, and the 60p version is twice the frame rate. The ITU-R is working on BT.709 HDTV standards of 1125/60 (1920x1035/30) (same as SMPTE 240M, similar to Japan's analog MUSE HDTV) and 1250/50 (1920x1152/25) which may be used in Europe. The latter is 5.3 times the resolution of DVD's 720x576/25 format. HD maximum data rate is usually 19.4 Mbps, almost twice the maximum DVD-Video data rate. In other words, DVD-Video does not currently support HDTV video content.

HDTV will not make DVD obsolete. Those who postpone purchasing a DVD player because of HDTV are in for a long wait. It will take many years before even a small percentage of homes have HDTV sets. The [CEA](#) expects 10 percent of U.S. households to have HDTV in 2003, 20 percent by 2005, and 30 percent by 2006.

HDTV sets include analog video connectors (composite, s-video, and component) that work with all DVD players and other existing video equipment such as VCRs. Existing DVD players and discs will work perfectly with HDTV sets and provide a much better picture than any other prerecorded consumer video format, especially when using a progressive-scan player. Since the cheapest route to HDTV reception will be HDTV converters for existing TV sets, broadcast HDTV for many viewers will look no better than DVD.

HDTV displays support digital connections such as HDMI (DVI) and IEEE 1394/FireWire, although standardization is not quite finished. Digital connections for audio and video provide the best possible reproduction of DVDs, especially in widescreen mode. The DVD Forum finalized specifications for supporting 1394 and HDMI in 2002, and players with DVI/HDMI digital outputs appeared in 2003. When the DVD stream recording (SR) format is finalized, DVD-SR players may be usable as "transports" that output any kind of A/V data (even formats developed after the player was built) to different sorts of external displays or converters.

The interesting thing many people don't realize is that DTV happened sooner, faster, and cheaper on PCs. A year before any consumer DTV sets came out you could buy a DVD PC with a 34" VGA monitor and get gorgeous progressive-scan movies for under \$3000. The quality of a good DVD PC connected to a data-grade video projector can beat a \$30,000 line-doubler system. (See [BroadbandMagic](#), [Digital Connection](#), and [Sleekline](#) for product examples. Video projectors are available from [Barco](#), [Dwin](#), [Electrohome](#), [Faroudja](#), [InFocus](#), [Projectavision](#), [Runco](#), [Sharp](#), [Sony](#), [Vidikron](#), and others.)

Eventually the DVD-Video format will be upgraded to an HD-DVD format.

### What is Divx?

There are two Divxes. The original was a pay-per-view version of DVD. The later claimant of the name (spelled DivX), is a video encoding format.

### The original Divx

Depending on whom you ask, Divx (Digital Video Express, first known as ZoomTV) was either an insidious evil scheme for greedy studios to control what you see in your own living room or an innovative approach to video rental that would have offered cheap discs you could get almost anywhere and keep for later viewings.

Developed by Circuit City and a Hollywood law firm, Divx was supported by Disney (Buena Vista), Twentieth Century Fox, Paramount, Universal, MGM, and DreamWorks SKG, all of which also released discs in "open DVD" format, since the Divx agreement was non-exclusive. Harman/Kardon, JVC, Kenwood, Matsushita (Panasonic), Pioneer, Thomson (RCA/Proscan/GE), and Zenith announced Divx players, though some never came to market. (Divx models are Panasonic X410, Proscan PS8680Z, RCA RC5230Z and RC5231Z, and Zenith DVX2100.) The studios and hardware makers supporting Divx were given incentives in the form of guaranteed licensing payments totaling over \$110 million. Divx discs were manufactured by Nimbus, Panasonic, and Pioneer. Circuit City lost over \$114 million (after tax writeoffs) on Divx.

Divx was a pay-per-viewing-period variation of DVD. Divx discs sold for \$4.50. Once inserted into a Divx player the disc would play normally (allowing the viewer to pause, rewind, even put in another disc before finishing the first disc) for the next 48 hours, after which the "owner" had to pay \$3.25 to unlock it for another 48 hours. A Divx DVD player, which cost about \$100 more than a regular player, had to be hooked up to a phone line so it could call an 800 number for about 20 seconds during the night once each month (or after playing 10 or so discs) to upload billing information. Most Divx discs could be converted to DivxSilver status by paying an additional fee (usually \$20) to

allow unlimited plays on a single account (as of Dec 1998, 85% of Divx discs were convertible). Unlimited-playback DivxGold discs were announced but never produced. Divx players can also play regular DVD discs, but Divx discs do not play in standard DVD players. Divx discs are serialized (with a barcode in the standard Burst Cutting Area) and in addition to normal DVD copy protection they employ watermarking of the video, modified channel modulation, and triple DES encryption (two 56-bit keys) of serial communications. Divx technology never worked on PCs, which undoubtedly contributed to its demise. Because of the DES encryption, Divx technology may not have been allowed outside the U.S.

Divx was originally announced for summer 1998 release. Limited trials began June 8, 1998 in San Francisco, CA and Richmond, VA. The only available player was from Zenith (which at the time was in Chapter 11 bankruptcy), and the promised 150 movies had dwindled to 14. The limited nationwide rollout (with one Zenith player model and 150 movies in 190 stores) began on September 25, 1998. By the end of 1998 about 87,000 Divx players (from four models available) and 535,000 Divx discs were sold (from about 300 titles available). The company apparently counted the five discs bundled with each player, which means 100,000 additional discs were sold. By March 1999, 420 Divx titles were available (compared to over 3,500 open DVD titles). All things considered, Divx players were selling well and titles were being produced with impressive speed.

On June 16, 1999, less than a year after initial product trials, Circuit City withdrew its support and Divx announced that it was closing down. Divx did not confuse or delay development of the DVD market nearly as much as many people predicted (including yours truly). In fact, it probably helped by stimulating Internet rental companies to provide better services and prices, by encouraging manufacturers to offer more free discs with player purchases, and by motivating studios to develop rental programs.

When it closed down, the company offered \$100 rebate coupons to all owners of Divx players. This made the players a good deal, since they can play open DVDs just as well as other low-end players that cost more. On July 7th, 2001, Divx players dialed into the central billing computer, which decommissioned them. (Divx players not connected to phone lines have expired their playback allowance.) Divx discs are no longer playable in any players.

For more information see the [Divx Owner's Association](#).

#### Advantages of Divx:

- Viewing could be delayed, unlike rentals.
- Discs need not be returned. No late fees.
- You could watch the movie again for a small fee. Initial cost of "owning" a disc was reduced.
- Discs could be unlocked for unlimited viewing (Divx Silver), an inexpensive way to preview before deciding to purchase.
- The disc is new; no damage from previous renters.
- The "rental" market was opened up to other retailers, including mail order.
- Studios got more control over the use of their content.
- You received special offers from studios in your Divx mailbox.
- Divx players (with better quality and features than comparable players) were a steal after Divx went out of business.

#### Disadvantages of Divx :

- Higher player cost (about \$100 more at first, about \$50 later).
- Although discs did not have to be returned, the viewer still had to go to the effort of purchasing the disc. Cable/satellite pay per view is more convenient.
- Higher cost than for regular DVD rental (\$3 to \$7 vs. \$2 to \$4). There were few obstacles to the company raising prices later, since it had a monopoly.
- Casual quick viewing (looking for a name in the credits, playing a favorite scene, watching supplements) required paying a fee.
- Most Divx titles were pan & scan without extras such as foreign language tracks, subtitles, biographies, trailers, and commentaries.
- The player had to be hooked to your phone line, possibly requiring a new jack in your living room or a phone extension cable strung across it. (Players required a connection once a month or so, so you could periodically connect it to a phone line.)
- Divx couldn't be used in mobile environments, such as a van or RV, unless you took it out and connected it to a phone line about once a month.
- The Divx central computer collected information about your viewing habits, as do cable/satellite pay-per-view services and large rental chains. (According to Divx, the law did not allow them to use the information for resale and marketing.)
- Divx players included a "mailbox" for companies to send you unsolicited offers (spam).

- Those who didn't lock out their Divx player could receive unexpected bills when their kids or visitors played Divx discs.
- Divx discs wouldn't play in regular DVD players or on PCs with DVD-ROM drives. Some uninformed consumers bought Divx discs only to find they wouldn't play in their non-Divx player.
- Unlocked Silver discs would only work in players on the same account. Playback in a friend's Divx player would incur a charge. (Gold discs, which were never released, would have played without charge in all Divx players.)
- There was no market for used Divx discs.
- Divx discs became unplayable after June 2001.
- Divx players were never available outside the U.S. and Canada.

### The new DivX

In March 2000, a DVD redistribution technology called DivX;-) appeared. (Yes, the smiley face was originally part of the name, which was a take-off on the original Divx format. The perpetrators should be drawn and quartered for the stupid joke, which has caused untold confusion.) DivX was originally a simple hack of Microsoft's MPEG-4 video codec, combined with MP3 audio, allowing decrypted video from a DVD to be re-encoded for downloading and playing in [Windows Media Player](#). Work on DivX evolved through [Project Mayo](#) and a version originally called DivX Deux into an open-source initiative known as OpenDivX, based on the [MPEG-4 standard](#). Out of all this came [DivXNetworks](#), a company that has turned [DivX](#) into an extensive video encoding and delivery system based on proprietary implementations of MPEG-4. A variation called [3ivx](#) has also made the jump from open source to commercial. [XviD](#) seems to be the remaining alternative that's still open source.

Some DVD players can play files encoded in DivX format. See [www.divx.com/hardware](http://www.divx.com/hardware).

### [2.11] How can I record from DVD to videotape?

Why in the world would you want to degrade DVD's beautiful digital picture by copying it to analog tape? Especially since you lose the interactive menus and other nice features.

If you really want to copy to VHS, hook the audio/video outputs of the DVD player to the audio/video inputs of your VCR, then record the disc to tape. You'll discover that most of the time the resulting tape is garbled and unwatchable. This is because of the Macrovision feature designed to prevent you from doing this.

### [2.12] Will high-definition DVD or 720p DVD make current players and discs obsolete?

Not for a long time. HD-DVD is just becoming available. HD stands for both high density (more data on a disc) and high definition (better quality picture). The first commercial Blu-ray HD-DVD recorders appeared in Japan in April of 2003, over 7 years after DVD was introduced there. The recorders are designed for home recording only (not for playing pre-recorded HD movies), and only work with Japan's digital HD broadcast system.

New DVD formats will slowly supersede the original DVD format, but new players will play old DVD discs and will often make them look even better (with progressive-scan video and picture processing). However, new HD-DVD discs won't be playable in older DVD players (unless they are special hybrid discs in both HD and SD format). Your collection of standard DVDs will be playable for many years to come, and titles will only become "obsolete" in the sense that you might want to replace them with new high-definition versions. Consider that U.S. HDTV was anticipated to be available in 1989, yet it was not finalized until 1996 and did not appear until 1998. Has it made your current TV obsolete yet?

Ironically, computers supported HDTV before settop players, because 2x DVD-ROM drives coupled with appropriate playback and display hardware met the 19 Mbps data rate needed for HDTV. This led to various "720p DVD" projects, which use the existing DVD format to store video in 1280x720 or 1920x1080 resolution at 24 progressive frames per second. It's possible that 720p DVDs can be made compatible with existing players (which would only recognize and play the 480-line line data).

Note: The term [HDVD](#) has already been taken for "high-density volumetric display."

Some have speculated that a "double-headed" player reading both sides of the disc at the same time could double the data rate or provide an enhancement stream for applications such as HDTV. This is currently impossible since the track spirals go in opposite directions (unless all four layers are used). The DVD spec would have to be changed to allow reverse spirals on layer 0. Even then, keeping both sides in sync, especially with MPEG-2's variable bit rate, would require independently tracking heads, precise track and pit spacing, and a larger, more sophisticated track buffer. Another option would be to use two heads to read both layers of one side simultaneously. This is technically feasible but has no advantage over reading one layer twice as fast, which is simpler and cheaper.

## What effect will FMD have on DVD?

Very little, as predicted from the beginning in this FAQ. [Constellation 3D](#) ran out of money in mid 2002. The various reports of fluorescent multilayer disc (FMD) causing the early death of DVD were wildly exaggerated and not founded in reality.

Fluorescent multilayer technology, which can be used in cards or discs, aims a laser at fluorescent dye, causing it to emit light. Since it doesn't depend on reflected laser light, it's possible to create many data layers (C3D prototyped 50 layers in its lab). It can use the same 650 nm laser as DVD, so FMD drives could be made to read DVDs. In June 2000, C3D announced a program to make FMDs with 25 GB per side that would be readable by DVD drives with a "minor and inexpensive modification." C3D later said players would be available by mid 2001. FMD was very cool technology, but it was new, with no track record, developed by one small company. DVD is based on decades of optical storage technology development by dozens of companies. The monumental task of changing entire production infrastructures over to a new format was too much for C3D, even with tens of millions of dollars and some large partners.

## [2.14] How does MPEG-4 affect DVD?

MPEG-4 is a video encoding standard designed primarily for low-data rate streaming video, although it's actually more efficient than MPEG-2 at DVD and HDTV data rates. MPEG-4 also provides for advanced multimedia with *media objects*, but most implementations only support simple video (*Simple Visual Profile*). There's also MPEG-4 part 10, also known as H.264 (and also known as JVT or AVC), which is an even better video encoding standard.

DVD uses MPEG-2 video encoding. Standard DVD players don't recognize the MPEG-4 video format. MPEG-4 files can be stored on DVD-ROM for use on computers. For example, DivX uses MPEG-4.

It's possible that MPEG-4 or H.264 will be used in a future, high-definition version of DVD. In any case, it will probably not appear before 2005 at the earliest.

For more about MPEG, see Tristan's [MPEG.org](#) site and the [MPEG home page](#).

## [2.15] What's WebDVD or Enhanced DVD?

WebDVD is the simple but powerful concept of combining DVD content with Internet technology. It combines the best of DVD (fast access to high-quality video, audio, and data) with the best of the Internet (interactivity, dynamic updates, and communication). In general, WebDVD refers to enhancing a DVD with HTML pages, links and scripting, or enhancing a Web site with content from a local DVD drive. WebDVD is not a trademarked term of AOL-Warner, Microsoft, or any other company. Variations on the WebDVD concept are known as iDVD, eDVD, Connected DVD, and so on. It's not a new idea --it's been done with CD-ROM for years-- but the differences with DVD are that the quality of the audio and video are finally better than TV, and the discs can be played in low-cost settop players.

Almost all WebDVD implementations are currently for PCs, but some new DVD players are adding WebDVD features. A working group of the DVD Forum is creating a standardized WebDVD format for set-top DVD players, to be known as Enhanced DVD.

Most professional authoring systems include rudimentary tools for adding HTML enhancements to DVD. For fancier WebDVD development there are a variety of tools.

For more on WebDVD, see Phil DeLancie's [EMedia article](#). Good examples of WebDVD sites are [Mars: The Red Planet](#), [Stargaze](#), and [DVD Demystified](#). The authors of these sites (Ralph LaBarge and Jim Taylor) encourage you to copy their code as a starting place for your own WebDVD creations. You can request a copy of the *WebDVD Demystified* disc from [DVD.Learn](#).

## [2.16] What's a Nuon player?

Nuon was a specialized "media processor" chip, designed by VM Labs, that was powerful enough to play DVDs and video games. The chip was originally intended for video game consoles, but was hitched to DVD's wagon when the game market dried up and the DVD market exploded. Some DVD players from Samsung, Thomson (RCA), and Toshiba were built on Nuon technology. The extra processing power in a Nuon player enabled special features such as graphical overlays, digital zoom, and live thumbnails. Some DVD movies were produced with added content designed specifically for the Nuon platform. As of the beginning of 2002, four Nuon-enhanced DVD movies were available: *The Adventures of Buckaroo Banzai (Special Edition)*, *Bedazzled*, *Dr. Doolittle 2*, and *Planet of the Apes*.

In December 2001 VM Labs filed for Chapter 11 bankruptcy, and in March 2002 the company's assets were purchased by [Genesis Microchip](#). A new division, Nuon Semiconductor, was formed to market Nuon chips under the Aries name. On July 24, 2002, Genesis laid off the entire Nuon division. RIP.

### **[2.17] What effect will D-VHS have on DVD?**

D-VHS (the D stands for data or digital), the digital successor to VHS tape, was first announced in 1995 but didn't appear outside of Japan until 1998. At the time D-VHS decks could only record pre-encoded bit streams such as from a digital satellite receiver. In 2001 the D-Theater format was released, which standardized MPEG compression and copy protection, paving the way for the release of pre-recorded movies on D-VHS tape in 2002. D-Theater became the first format for viable commercial distribution of movies in high-definition. Quality is excellent, with a resolution of 1280x720p (2.7 times NTSC DVD, 2.2 times PAL DVD) or 1920x1080i (roughly 4 times NTSC DVD, 3.5 times PAL DVD). However, consumers have shown a distinct preference for discs instead of tapes, so D-VHS will never become more than a niche product. Since HD-DVD began to arrive in 2003 consumers other than early adopters and HD aficionados are choosing to wait for the next generation of DVD for pre-recorded movies and for home recording of HD programs.

---