

DIGITAL VIDEO

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Finer Movies!

ARE EASY TO MAKE WITH PRECISION-BUILT



Revere
8^{mm} EQUIPMENT

It's easy to take and show the finest color or black-and-white movies with Revere 8mm equipment. Just three easy steps to take movies—place film in camera ... sight through view-finder ... press starter button—it's easier than taking most snapshots. Average scene costs 10 cents. Projector operation—equally as simple. See your dealer for demonstration or write for literature.

REVERE CAMERA COMPANY
320 E. 21st Street
Chicago, Illinois

REVERE "80" PROJECTOR
Gives brilliant screen illumination—sharp, steady movies. With 500-watt lamp and F 1.6 lens, \$65.00.

REVERE "85" PROJECTOR
DeLuxe with 500-watt lamp, F 1.6 lens and case \$75.00.

REVERE "99" CAMERA
8mm Turret Camera—with turret-head, an extra view-finder and one F 2.5 lens, \$65.00.

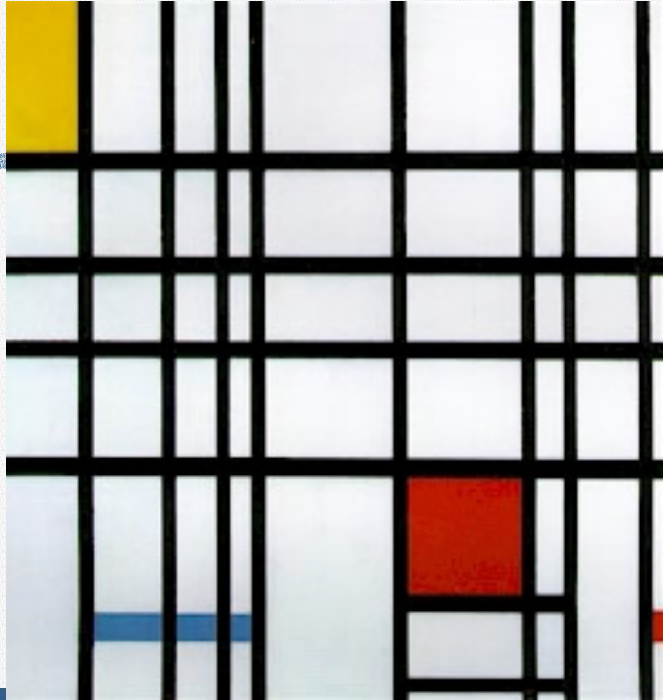
REVERE "88" CAMERA
Takes finest 8mm movies. Eastman-type spool and spindles. With F 3.5 lens \$32.50.

8^{mm} Movies are Economical

presentation
by Arthur Max

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Introduction



is dead!"
Paul Delaroc
when he sa

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Introduction

Analog video is dead.

- **Digital video is better and cheaper.**
Digital camcorders costing less than \$1000 capture videos equal to or better than professional analog cameras costs 10 times as much



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Introduction

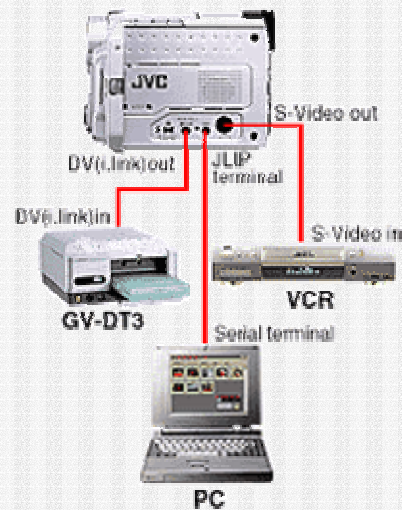
■ Flexible System

A digital camcorder slips into the video capture/playback chain **without disturbing any of the other elements**. This is entirely different, for instance, in digital still photography, where almost every link in the chain has to change before film-photography is dead.

You can buy and use one without changing any other part of your system until you choose to do so. Even if you change nothing else, you'll have a smaller, lighter, more creative camera and sharper videos. If you eventually upgrade your VCR and TV to models based on newer technologies, your videos will be just that much better.

Introduction

Video editing is greatly simplified because the video can be transferred to the computer without conversion, digitally edited on-line, and then copied back to a digital tape. Not only is it easy, there is no loss of image quality as there is in the analog world.



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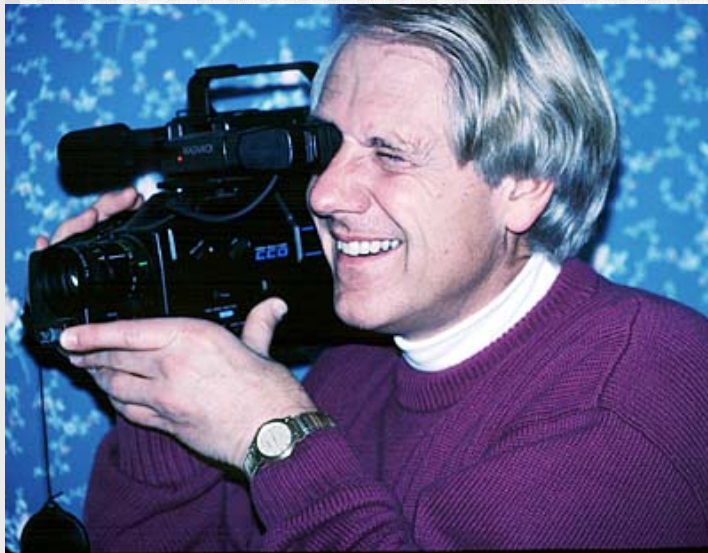
Why Digital Video ?

Digital video really began in 1994 when Sony, Panasonic, and more than 50 other companies agreed on a DV tape format. The first DV cameras, mainly for professional use, were introduced in 1995. Ever since, the prices of DV camcorders have been falling while their quality, features, and popularity have been increasing. By the late 1990s, prices had fallen to the point where DV began to make inroads into the consumer video market.

But why digital video ?

Why Digital Video ?

- **DV offers better image quality.** The images are sharper and the color is richer and more accurate. At least twice as good as VHS and competitive with broadcast quality video.
- **DV cameras are smaller** than other formats, with some even fitting into a shirt pocket.



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Why Digital Video ?

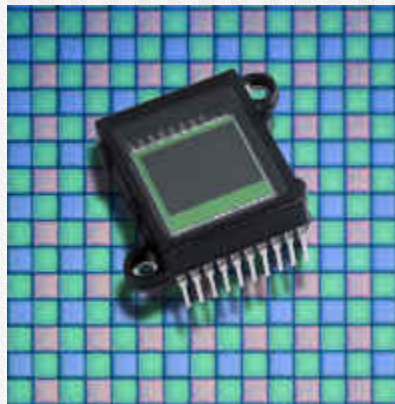
- Copies of digital videos, and copies of copies, are **as sharp as the original**.
- Digital videos have audio that's **CD quality**.

Why Digital Video ?

- Digital video uses **component color sampling** to retain three times as much color information as analog VHS and S-VHS video. The net result is brighter and truer colors.
- **Time Base Correction** stabilizes the picture, virtually eliminating video jitters.
- **Error Correction** fills in missing video data, providing seamless, professional-looking video.

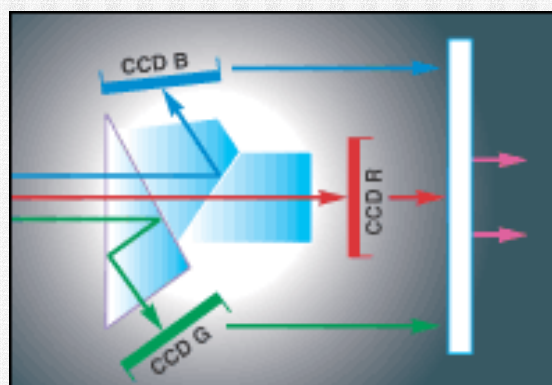
CCD

- The CCD is the camcorders "film." It captures the light falling on it and converts it to electrical signals. The CCDs surface is divided like a grid, into small pixels. Each pixel represents one pixel in the capture image.



- **CCDs** come in various sizes and resolutions. The higher the resolution, as specified in pixels, the sharper the images will be. Most cameras use 1/4- or 1/3-inch CCDs with between 270,000 and 680,000 pixels. However, camcorders with 1 million pixels have been introduced.

CCD



- Consumer level DV cameras usually use a single CCD to capture the video. However, high-end cameras often use three, one for each of the primary colors red, green, and blue, or one chip may handle the luminance signal while the other two divide the chrominance signal between them. Cameras with three CCDs give better detail and color but cost more than cameras with a single CCD.

CCD

- CCDs can be judged also by the minimum recommended illumination needed to record an image, the **lux rating**. 1 lux is the light from one candle about one yard away from the subject. Ratings are 1 through 5 with lower numbers indicating better performance in low-light situations. Although cameras with lux ratings of 2 or 3 will work in dim light, the video loses contrast and color. One way cameras boost the lux level is by amplifying the signal off the CCD. Called increasing **gain**, this makes the camera more sensitive, but also introduces noise that detracts from the video's quality.
- Related to the lux rating is the **signal-to-noise ratio**. As the video signal coming from the CCD is amplified to improve the lux rating, noise is also amplified. Better camcorders have a higher signal-to-noise ratio so you get better images in low light. Cameras with a low signal to noise ratio produce images in low light that appear grainy.

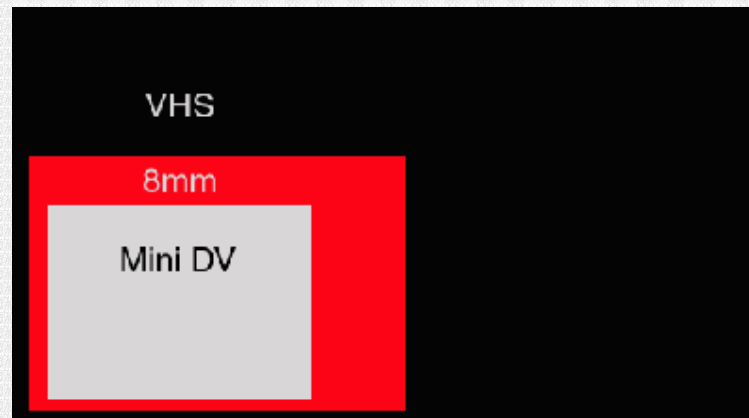
Camera Features

- **Image stabilization** minimizes the effect of small hand movements. When handholding at long focal lengths, it's impossible to avoid camera shake and blur. Image stabilization is done either electronically using digital circuits or optically using a variable prism or lens group within the lens.



DV Cassette

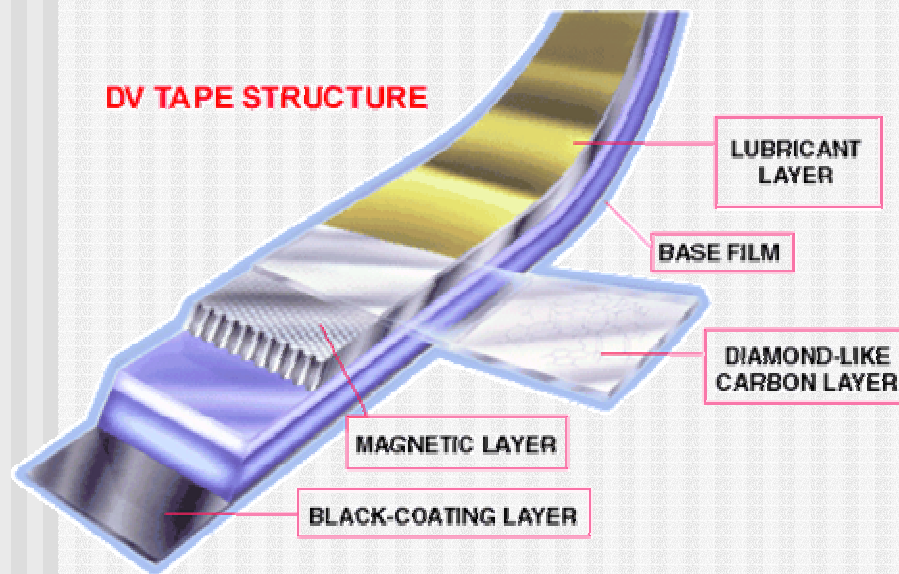
- Digital video is recorded on a tape called a **Mini DV** Cassette (DVC) that occupies less than half the volume of a 8mm cassette and holds one hour of video—an amazing 11GB of data on a tape 65 meters long. It's this small cassette size that makes possible much smaller and more portable camcorders.



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DV Tape

- The recording tape is a metal evaporated (ME) tape that's both stronger and longer lasting than previous tapes. DVC ME tape is also layered:



- The base layer has two magnetic layers of evaporated metal for higher image quality.
- The magnetic portion is covered by a hard layer of carbon that protects it.
- A back coating reduces friction and provides smoother tape movement.

Comparisons

- Lines of **horizontal resolution**. It has 500 lines, about twice the resolution of VHS and 8mm video and 25% better than S-VHS or Hi-8.
- DV cameras store video in **component** format, which produces better color accuracy than the **S-Video** format used by S-VHS/Hi-8 cameras and especially the **composite** format used by 8mm/VHS cameras. DV's component format reproduces colors without smear or blur. Colors stay where they belong and don't spill over into adjacent areas. The reason for this is that component video sends the three primary colors (red, green, and blue) on separate wires within the cable.

Comparisons

DV has a much better **signal to noise ratio** so the image is much clearer with less static.

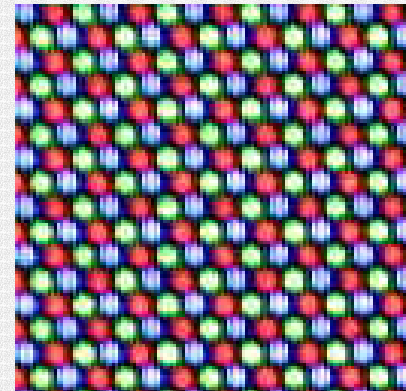
	DV	S-VHS/Hi8	8mm/VHS
Lines of Resolution	500	400-420	240-250
Color Signal	Component	S-Video	Composite
Signal-to-Noise	60	45-46	43-45

Painting images on the screen

- A television picture is made up of 25 or 30 pictures per second flashing on the screen.
- Each frame is "painted" onto the TV screen by electron guns that scan the screen one line at a time, moving from top to bottom.
- In NTSC only 480 of the 525 available scan lines are used for the picture, and in PAL's only 576 of the 625 scan lines. The other lines are used for information about the picture.

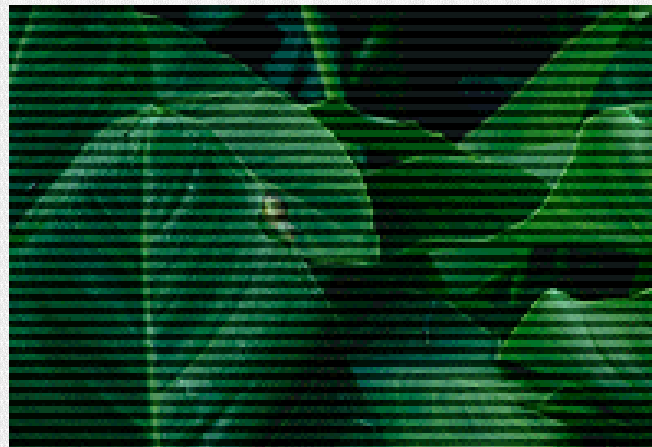
Interlaced X Progressive Scan

- When the electron gun in the CRT paints the image on the screen, it actually illuminates dots on a phosphorus coating on the back of the screen. These dots slowly fade as the beam moves on. During the early days of TV, the dots would fade too much before the beam got around to painting them again so the image seemed to flicker.



Interlaced X Progressive Scan

- To fix this problem the image wasn't painted from top to bottom, one line at a time. Instead, the odd lines were painted first and then the even lines. **Interlacing** the image in this way prevented the bothersome flicker. Since each frame of the movie or video was now painted in two parts, the parts were called **fields** and two fields are combined to make a **frame**.



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Interlaced X Progressive Scan

- Computer monitors and High Definition TV have found ways to avoid flicker problems so they don't need to interlace images the same way as traditional TV sets. To capture non-interlaced images, the camera must be able to capture a **progressive scan**.

What is Video Resolution ?

- The term **resolution** refers to the ability of an imaging system to capture fine details. The higher the resolution, the sharper the images.
- The **vertical resolution** of a digital video image is determined by the number of scan lines in the image.
- The **horizontal resolution** is the rate at which the moving beam can turn on and off to paint "dots" of color on the screen. This can happen only so fast because it takes time for the circuits to switch from black to white. The horizontal resolution is calculated only for a horizontal distance that's equal to the picture height. This allows screen formats with different aspect ratios to be compared on the same scale.

Pulse Code Modulation

- DV camcorders record superb sound using a process called **Pulse Code Modulation** (PCM) .
- Two channel, or **16-bit stereo** is used when you want the highest quality sound.
- Four channel, or two **12-bit stereo**, has a little less quality, but lets you use two stereo channels instead of one. You can use one channel when recording and then use the other to add music or narration later.

DV Format

- The first stage uses **DCT** compression, a lossless technique which strips away information that cannot be seen by the human eye. It then separates the information from each pixel into **brightness** and **colour** and then samples this, favouring brightness over colour, which gives a colour representation that's **acceptable to the human eye but cuts down the data by a third**. This is achieved by converting the RGB colour information for each pixel into a YUV colour space - Y for brightness, and U and V for colour. The Y value is sampled four times, the U and V twice (YUV 4:2:2).

DV Format

- The video then gets further reduced as the DV codec optimises the formula to YUV 4:2:0, bunching colour information from adjacent pixels in **4x4 blocks**. The human eye finds subtle variations in colour hard to detect, so in well-lit natural surroundings the difference is imperceptible. Finally, the hardware compression system on the camera compresses the video down further using an algorithm similar to M-JPEG.

DV Format - Future

- However, **DCT isn't the last word in compression**, just a standard whose early development and suitability for real-time codecs chips attracted attention at the right time. Other currently under-developed technologies do promise better pictures at lower data rates. They include **wavelet** and **fractal algorithms**. These alternatives are unlikely to overthrow DCT in broadcasting and consumer electronics. But in the broadband network delivery systems which are likely to replace traditional broadcasting, it's a different story. With increasingly powerful CPUs becoming commonplace, appropriate real-time decoder software can be delivered with the content.

Questions ?

- If you have any question do not hesitate to ask... him !



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