Introduction to the Digital Video Camera

http://www.cla.purdue.edu/vpa/etb/
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Required hardware for this workshop:

Description	
Digital video camera, with as many manual setting options as possible (e.g. manual focus, exposure/aperture, shutter speed control)	

Introduction to the Digital Video Camera

The following is a collection of some features of a digital video camera. Since accessing these features will be different from camera to camera, I recommend reading the camera's manual on how to do this. This handout concentrates more on the ways most functions of a camera work and what they do rather than how to access them (i.e. which button to press where). The short explanations of these terms should help you in your first experiments with the camera.

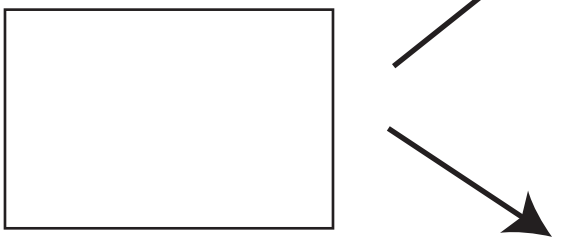
Digital:
In contrast to an analog video signal, which stores images and sound by way of variable waves encoded electrically on magnetic tape, digital video signals represent images and sound by a finite quantity of numbers. Analog signals lose a lot more information in the process of copying than digital data. You will be working with two different types of digital cameras: camcorders that record digitally onto a tape (miniDV) and camcorders that digitally record onto a digital storage medium (such as an SD card, an internal harddrive, etc.). The first type of camera (miniDV) records sound and images as uncompressed as possible, the second type of camera (memory card, harddrive based) always introduces some kind of compression in order to store A/V material. The user can set the amount of compression that will be applied. As a rule of thumb, 1 GB of storage space results in approx. 5 minutes of video in the best quality and the highest resolution (HD 1920x1080).

Picture resolution:
Not related to the system of recording A/V content (on tape or digital storage medium) but another source for differences in video cameras is their image resolution. SD (standard definition) NTSC video is 720x480 pixels in size (actual size on the computer to accommodate for pixel aspect ration differences for 4:3 aspect ratio is 720x540 and for 16:9 aspect ratio is 853x480). HD (high definition) video is 1920x1080 (sometimes 1440x1080 which is interpreted as 1920x1080 on the computer accommodating for the difference in the pixel aspect ratio) with an aspect ratio of 16:9. We will talk more about aspect ratio, pixel aspect ratio, pixel sizes and video formats (NTSC, PAL, etc. in the following workshop). For now it is important to know that we have to find ways to mix footage recorded in different sizes and different aspect ratios in a final portfolio of your work (interactive DVD).

The drawing on the following hopefully helps in showing the differences graphically:

CAMERA:

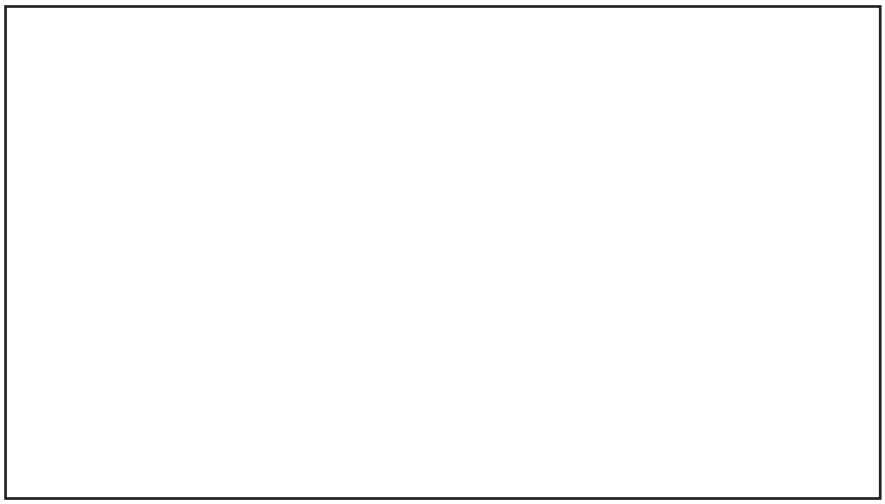
COMPUTER:



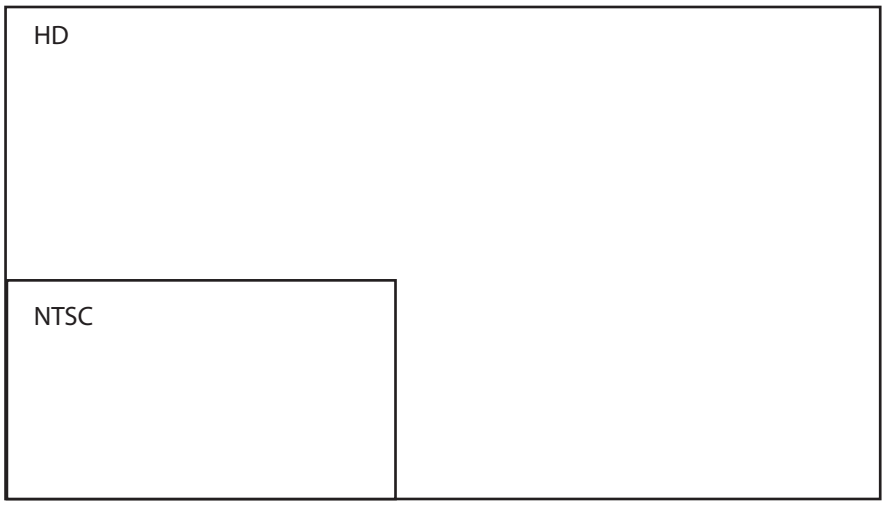
NTSC footage recorded at 720x480 pixels

NTSC footage 4:3 aspect ratio - 720x540 pixels

NTSC footage 16:9 aspect ratio - 853x480 pixels



footage recorded at 1920x1080 pixels (already 16:9 aspect ratio)



frame size comparison of NSTC 16:9 footage to HD 16:9 footage

CCD:
CCD means Charge-Coupled Device, a set of sensors that collect what the lens sees (the light coming through lens and iris). The CCD converts this image from the outside world into digital signals. Single chip digital cameras are equipped with only one such device (all colors are processed by only one chip). Three-chip cameras however posses one such chip for each prime color (additive color system): red green and blue. This results in an approximately 20 percent better image quality with regard to picture and color resolution.

Check Your Camera Settings:
miniDV camcorders:
SP/LP MODE - Use SP or Standard Play only.
Audio Sample Format – Use 16bit - not 12 bit!
Important! When recording onto a tape (miniDV) it is extremely important to maintain a consistent time-code on the tape, which is needed to digitize the correct portions of the tape later on. If you have a factory new tape you first need to "record" a time-code on it. Insert the tape into the camcorder and press the record button. The camera will record a time code onto the whole tape the first time it records something on it. You can then rewind the tape and start recording your actual footage on there.

HD camcorders with digital memory:
if possible always use 1920x1080 as your resolution (we will then scale down the videos in Final Cut Pro). You do not need to worry about time-code breaks for getting your footage into the computer.

Focus:
Good digital video cameras allow you to change the focus manually with a focus ring (often around the lens). Depending on the aperture it allows you to only focus on very few objects close together or a wide range of objects far apart from each other.

Zoom:
Digital video cameras offer optical zoom (through the lens) and digital zoom. The digital zoom works by increasing the number of pixels of an image without increasing the information that is held by each pixel. The image appears to be bigger but at the same it gets blurry and/or pixilated. This doesn't happen with the optical zoom, which uses optical techniques to view objects bigger. The digital zoom only sets in when the optical zoom is maxed out. Usually, if you press the zoom button harder the zoom will go faster, and the less pressure you use the slower the more gradual the zoom.

Lens and iris:
The lens of a video camera gathers and concentrates light that falls from objects, persons, spaces, etc. onto an image processing chip in the camera. Between the lens and the image processing chip is the iris, which regulates how much light falls onto the chip. In its function the lens and iris of a video camera can be compared with the human eye - the image processing chip being the retina. Sometimes the iris is also referred to as aperture. The opening and closing of the iris/aperture has an interesting effect on the video camera's depth of field, too. An almost closed iris allows more objects at different distances to be in focus while with an almost fully opened iris only very few objects close together are in focus. However, depth of field is less pronounced in video than in film. The ideal aperture, or lens opening is generally f4 and f5.6.

Shutter:
The shutter is a device that opens and closes rapidly in front of the camera's lens. By increasing the speed of the shutter, faster movements are less blurry when recorded. However these faster shutter speeds also need more light. The normal shutter speed for

video is 1/60 sec. You can increase the shutter speed in order to achieve a sharper picture. 1/30 sec tends to produce video “trails” while 1/200 sec may cause “fits” in your video.

Gain:
To make the camera more sensitive to the incoming light adjust the gain. You use it when the scene has insufficient light (at night) It is better to light a scene since what you are doing is amplifying the signal which also increases the amount of “noise” or grain in the picture which you want to avoid.

White Balance:
Only the human eye adapts rapidly to changing light conditions and changing "temperatures" of light, Neon light has a different temperature than candlelight. The first being rather blue, the second one rather red. The human brain adapts colors to these changing light conditions on the fly, not so the video camera. The white balance function allows you to calibrate the video camera for certain light temperatures (e.g. filming in natural light and then filming inside with neon lights). This calibration process is done on a white surface as a reference.

Mixing Daylight and Incandescent Light:
Often when shooting inside you may need to mix daylight with incandescent light. For example, if you are shooting in a room with a window. If the window does not illuminate your subject sufficiently or is unflattering, you may use a light from a light kit to boost the illumination to an appropriate level.

When mixing indoor and outdoor lights, you may put a blue gel over the lamp to match the qualities of light. Regardless, you must white balance your camera as if you where shooting in daylight.

Lighting:
A video camera cannot handle contrasts very well. Video has a CONTRAST RATIO of 20:1. That means that the darkest part of your picture cannot be more then 20 times darker then the lightest part, otherwise tones will not reproduce correctly. Hot spots will glow and distort and darker spots will look black and grainy. The human eye can handle a contrast ration of 100:1. (film is 40:1) What looks good to the eye often looks terrible on video.

Most cameras have automatic aperture. It takes an average reading of the quality of light for an entire scene and adjusts the aperture based on that average. Avoid heavily backlit subjects. Conversely, try to avoid black backgrounds. The camera will open up the aperture to compensate for the black background and skin tones will be washed out and distorted. In both circumstances, zoom in all the way and set exposure.

For outdoor shots, first check to see where the light is. Do not shoot directly into the sun or a background light or your subject will be to dark. Conversely, watch that direct hard sunlight does not wash out your subject’s features.

Accessories

Tripod:
Use it whenever necessary! Hand Held Operation: If you choose to shoot handheld, remember that when you are zoomed in all the way in, the camera shakes and jiggles

are magnified intensely. Please contact Kathy Evans in the slide library for video tripods, sometimes, depending on your scene and location you can also use a stack of books or other objects as improvised tripods.

External Microphones and Headphones:
It is essential that you wear headsets and listen carefully. Position your subject to avoid distracting background noises. Try to have your microphone pointed away from sources of noise- traffic, air-conditioning, fans, refrigerators.
The built-in microphones are very limited and are really only for picking up ambient sounds. They are nearly useless for recording speech. To set your recoding level, record someone speaking loudly nearby. Increase the manual sound level (audio gain) as much as you can without causing distortion. Above 0dB will be distorted.

Omnidirectional microphone: coverage in all directions (ambient sound)

Cardioid microphone: heart-shaped pick-up pattern. Optimized to pick up sound directly in front of it with some sensitivity to either side.

Shotgun microphone: Directionally sensitive, captures what you point at and minimizes sound from other sources

Later on during the editing of the videos on the computers in the lab it is absolutely necessary to bring your own headphones!