Computer Science 1033 – Week 10

VIDEO

ROBERT DE NIRO
TAXI DRIVER

Just watch the first 2 minutes

"A good film is when the price of the dinner, the theatre admission and the babysitter were worth it." → Alfred Hitchcock

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Today

- Announcements
- Finish up animation → Flash
- Intro to video, TVs, resolution
- LOTS OF VIDEOS TONIGHT, sit back and enjoy ☺

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Announcements

- Major Assignment due Friday, December 1
  - You MUST make your animation using photoshop and supply the photoshop file (.psd)
- Sunday, December 17 at 10am – 2 hour
  - Bring:
    - Pencil (soft) and eraser
    - Student card
  - Do NOT bring: calculator, ipod, hat, etc..
- Web Assignment
  - Should be marked by Nov 28th

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Announcements

- Some nice ones so far:
- Student 1 (awesome layout but property titles and file names not done correctly ☹)
- Student 2 (AWESOME BUTTONS (and banner but look at the file names and property titles ☹))
- Student 3 (lovely attention to the text and layout!)
- Student 4 (great alignment but forgot headings and property titles)
- Student 5 (Beautiful, great attention to details)
- Student 6 (gorgeous banner!)
- Student 7 (great alignment, super cute banner but can you see the one thing I said NOT to do ☹ (and the property titles and references page had 2 issues – length of table and links could have been done slightly better))

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What is Video?

- A sequence of still images (photographs) that create the illusion of movement when played in succession.
- **Question**: What is each still image called?
- FPS
  - Movies on film → 24-30 fps
  - Computer Displayed Video → 12-15 fps
- Digital Video → each frame is a bitmapped graphic, stored as 0s and 1s

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Sampling and Quantizing of Motion

- Since each frame is just an image →
  - Each frame is sampled into a discrete samples and each sample becomes a pixel → **Sampling process**
    - Remember:
      - More samples means better quality (10 pixels by 10 pixels vs 200 pixels by 200 pixels)
      - More samples means bigger file sizes (10 pixels by 10 pixels vs 200 pixels by 200 pixels)
  - Each pixel gets assigned a colour, maybe just 2 colours(black and white→1bit colour) or maybe 16 million colour (24 bit colour!) → **Quantization process**
- **Question**: What else can we "**Sample**" with MOTION?

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Quantizing → Colour Compression In The Video

- For still images RGB is commonly used
- For video the model is YUV (YIQ) or YCbCr (for MPEG compression)
- Y → luminance (brightness)
- UV →(CbCr) chrominance (color/hue)
- **Question**: Black and White TV only used the _____ signal (fill in the blank with Y, U or V)
- **Question**: Which one will the human eye detect changes in more easily? How does this help us with compression?
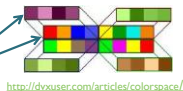
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- You may see that the compression used 4:1:1 Color Sampling Method what does this mean?
- Assume we have 16 pixels that we are looking at in blocks of 4→

http://dvxuser.com/articles/colorspace/

Color Sampling Method	Amount of Y (luminance)	Amount of U (color or hue)	Amount of V (color or hue)	Amount of Compression	Used in
4:4:4	4 samples	4 samples	4 samples	None 12 samples for each group of 4 pixels	
4:2:2	4 samples	2 samples	2 samples	Reduced from 8, 12 samples to 8, 33% reduction in storage	Digital Betacam format
4:2:0	4 samples	2 samples of either U or V, one scan line of U, then one scan line of V		12 to 6, 50% reduction in storage	HDV, MPEG-1, DVD, MPEG-2, PAL DV
4:1:1	4 samples	1 sample	1 sample	12 to 6, 50% reduction in storage	NTSC DV, miniDV digital camcorder

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Sampling of a frame→ need to know a little history

- Digital video often adheres to standards for TV broadcasting
- Regular Analog TV broadcasting began in the United States in 1939 using the NTSC standard.
- NTSC frame rate was originally 30fps but went down to 29.97 to accommodate for colour information.

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More history

- Experiments with High Definition TV began in the late 40s and 50s but it wasn't adopted by a single station till 1996.
- Before 1996 ALL TV was broadcast using **interlaced** display and **fields**
- The original ANALOG video choices made about TV display (frames per second, frame size, etc..) affect the standards that were picked for DIGITAL video!

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How did the original TV display work?

- Our eyes see phosphor dots on the screen.
- An electron beam (gun) activates the dots. The gun scans through the dots horizontally
- A complete scan is when the gun starts at the top left and scans several times horizontally till it gets to the bottom right
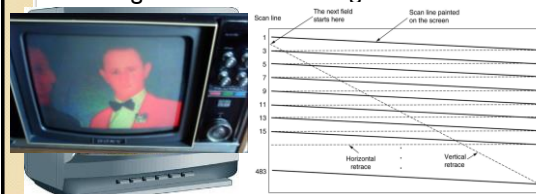
- The scan only draws every OTHER line (1,3, 5, …479) then starts back at the top and draws the even lines (2,4,…480).
  - Thus two passes
  - Each pass is called a *field*
  - The process is called *interlaced display*
- This way it can cheat the eye, while the phosphor dots are disappearing, it is drawing the line underneath.

http://www.crutchfield.com/Learn/learningcenter/home/understanding-resolution.html   Slide 13 of 40

NTSC Standards

- Review → watch from minute 1 to 3 and then 6min to 9:30
- The frame size of NTSC standard DV frame is 720 pixels by 480 pixels
  - Frame Aspect Ratio is 4:3
  - Pixels are distorted (not square) because 720:480 is actually 3:2 ratio, thus must change the pixel aspect ratio
- High Definition for NTSC:
  - 1440 X 1080
  - 1280 X 720
  - Frame Aspect Ratio is 16:9
  - 1440:1080 → ratio is (4:3) 1.333 (pixels are not square)
  - 1280:720 → ratio is 16:9 (pixel are square ☺)
- http://en.wikipedia.org/wiki/Aspect_ratio_(image)#Visual_comparisons
- Ratio Review → watch 0:48-3:40and watch 16:10-17:25

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The image on the left simulates the picture resolution of an old-fashioned TV, while the image on the right simulates high-definition TV. Notice the soft edges and jagged lines in the non-HD image.

480i
640 x 480 pixels

720p
1280 x 720 pixels

1080p
1920 x 1080 pixels
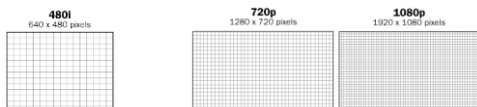
2000's TVs

- **Question**: On a HD TV, what does the circled area mean?

https://www.youtube.com/

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2010's TVs

- **Newer TVs are 4K** → 4K resolution (4096 x 2160 → 4 K refers to WIDTH now???)
  https://www.youtube.com/watch?v=RodCjVf-5AE
  - Best Buy – Search for TVs
  - PROBLEMS
    - There is not a lot of 4K content yet (no cable, some Netflix (House of Cards))
    - Even if you have 4K content, old HDMI cords can't transfer something like Netflix to your TV fast enough
    - Most camcorders can't create 4K content and even if they can it will likely only be 15 frames per second (although the iphone6 does allow this now)

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2010's TVs

- 4K TVs are VERY expensive
- If you hook it up to your computer (as a monitor), you will need pretty amazing graphic cards when playing games to see a difference.
- Even have ones that are 8K →
  http://www.whathifi.com/news/4k-tv-japan-aims-8k-broadcasts-2016
- *It is sort of like having a Lamborghini and driving it in downtown Toronto at 5pm ☺*
- change the quality on this video

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2010s TVs are a bit of OVERKILL!

- **50-inch screen**:
  - the benefits of **720p vs. 480p** start to become apparent at viewing distances **closer than 14.6 feet** and become fully apparent at **9.8 feet**.
  - **1080p vs. 720p** start to become apparent when **closer than 9.8 feet** and become fully apparent at **6.5 feet**.
  - 6.5 feet is closer than most people will sit to their 50″ plasma TV … so, most consumers will not be able to see the full benefit of their 1080p TV.
- https://www.youtube.com/watch?v=tq6yduCQTYk

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High Retina Display

- Based on the idea of a "skinny triangle"
- If the angle at the top of the triangle is 1degree, then you need to be able to have at least 53 pixels on the base of the triangle for the human eye not to detect the pixels:

> 53 pixels

> 53 pixels

1 degree angle
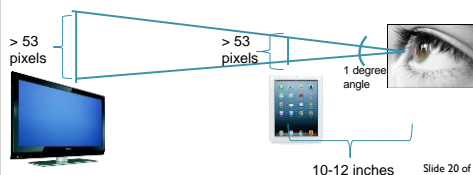
10-12 inches

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2010's Small Devices Matter Too!

- On small devices (iPads, etc) Apple claims all that matters is that if something is 10-12 inches away you need at least 300 ppi (high retina display)
  - http://www.makeuseof.com/tag/how-does-the-retina-display-work/ (watch Steve Jobs video)
  - http://www.macworld.com/article/2063344/retina-ipad-mini-review-high-density.html (just watch the first minute)

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High Retina Display

Display Type	PPI	Example	Resolution
Desktop	100-110	iMac	1280 by 1024
Standard laptop	100-134	Standard Macbook	1366 x 768
Standard Tablet	130	iPad 1	1024 by 768
Smartphone	160	HTC Wildfire	320 × 480
Retina iPad	264	iPad 3	2048 x 1536
Retina iPhone	326	iPhone 4S	640×960
Windows tablet	216	Surface Pro 3	2160x1440

- For small devices, you need to be able to read (e.g. magazines on your iPad), so you need sharp crisp text, that is why the resolution is so good. Don't need to read off a TV for long periods of time! (just watch till about 2 min)
- COOL SITE → http://isthisretina.com

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Need to keep your design in mind:

- Imagine an image that is 100 pixels by 100 pixels on your desktop (at 1280 by 1024 , 20 inch monitor) compared to the same image on your high retina iPad 3(2048 x 1536, 9.7 inches) → **Question: what will happen to that image?**

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- Really old TVs →480 Scan Lines
- 2000s TV→ 720 or 1080 lines
  - Progressive NOT interlaced!

CRT Display

Flat-panel Display

Scan Line
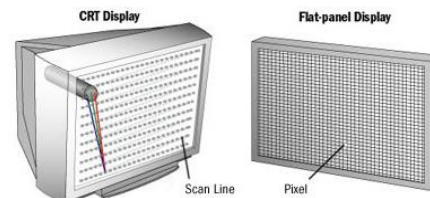
Pixel

CRT images are typically slightly out of focus at the screen's edges because the electron gun's beam is at a greater angle. A flat-panel TV's perfectly flat grid of pixels can produce images that are very accurate and consistent from corner to corner.

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Displaying Digital Video

- Can display video on:
  - ◦ Computer → don't need to worry about NTSC standards
  - ◦ TV
  - ◦ DVD
- Not all digital video must conform to NTSC standards. Digital video that will primarily be played on a computer does not have to conform, BUT digital video that will be used in DVD playback needs to conform.

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Displaying Digital Video on a Computer

- Even though it doesn't have to be, digital video that is displayed on a computer is still very tied to analog TV standards.
- **Question**: What are the typical sizes of video that you embed into your webpages?

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Capturing the Video

- Assume we want to play our video on TV or on the computer, HOW do we capture the video to then later display it? Usually use: CAMCORDERS
- If we use an:
  - ◦ **Analog Camcorder**, we had to convert video to digital BEFORE we can put it on our computer to edit. To convert analog video to digital video we need a *Video Capture Card*
  - ◦ **Digital Video Camcorder,** no need to convert!

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Digital Video Camcorders

- Most Digital Video Camcorders (DV Camcorders), do a little bit of compression right inside the camera. DV25 is the most common DV compression used by today's camcorders.
  - ◦ DV25 Format Specs:
    - · Pixel Dimension is 720 X 480 (note this is 3:2 ratio)
    - · Frame Aspect Ratio either 4:3 or 16:9
    - · Data Rate: 25 mega bits per second (that's why it is DV25)
    - · Frame Rate: 29.97 fps
    - · Colour Sampling: YUV 4:1:1
- · Now there are 4K Camcorders with better specs BUT be carefully, they are very resource intensive!

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Format Comparison

Format	Lines of Resolution
VHS, VHS-C (Beta) → Analog Camcorders	240
8mm	240
Hi 8mm	400
Most older TVs (before 1995)	480
Digital Video Recorders – Mini DV	480
High Definition TV and High Definition Digital Video Camcorders	720 or 1080
4K Camcorders now!	http://epfilms.tv/top-10-professional-video-cameras-reviews-4k-edition-best-pro-camcoders/

http://www.youtube.com/watch?v=GIXM2DF0dEM

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Watching old movies in HD?

- How can we see Blu Ray movies that were made in the 60s? Everything made back then was blurry, so how can we now see it in HD?

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Watching old movies in HD?

- It's not a conspiracy, nor aliens ☺
- Movies back then were filmed on actual film strips (35mm, 65mm, etc.)
- Film was analog, not digital, so it didn't have "pixels" or a "resolution"
- Analog film captured a great amount of detail, more than was shown on the TV versions Now when they want to make a Blu Ray, they can use the original film
- HD Versions of Old Movies

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What to capture

- Some tips for the pre-production stage:
  - Plan out what you are going to shot
  - Gather resources you will need (props…)
  - Think about sound/music
  - Make a storyboard of your ideas →
  - Think about composition

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Using Video Editing Software

- **Sample of Video Editing Software**
- **Step 1** → Import captured video, images and sound into the project
- **Step 2** → Arrange the material on the timeline
  - Trim clips as need
  - Might remove/trim some sound and add music, etc…
- **Step 3** → Apply transitions, special effects. Some common ones:
  - Straight Cut → butt up two clips right against each other with no transition
  - Dissolve → fade from one clip to the next.
  - Adding titles, credits, captions
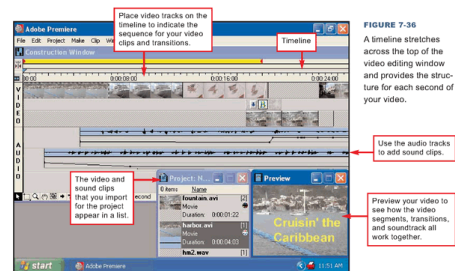- **Step 4** → **Question**: What is step 4?

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FIGURE 7-36
A timeline stretches across the top of the video editing window and provides the structure for each second of your video.

Place video tracks on the timeline to indicate the sequence for your video clips and transitions.

Timeline

Use the audio tracks to add sound clips.

The video and sound clips that you import for the project appear in a list.

Preview your video to see how the video segments, transitions, and soundtrack all work together.

Cruisin' the Caribbean

A Little History of Camcorders

Before 1967 NOTHING was portable (had to use tripods)
1967 → Sony came up with first portable black and white camcorder (needed BIG shoulders)
1971 → first cassettes (didn't need to load reels)
1976 → Beta vs. VHS race is on!
At this point: camera is separate from audio recording which is separate from playback

More History

1984 JVC GR-C1
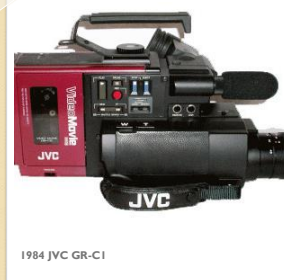
1982 → combine video, sound recording and playback (**cam**era re**corder**)
1985 → ½ million sold, within 3 years 3 million are sold. First Sony Handicam. JVC introduced smaller videocassette thus smaller camcorder
NOTE: Copying and editing of analog video loses quality!
1989 → Super VHS format introduced, better editing, no deterioration of the quality. (aka Beta killer) Sony introduced Hi8

More History

1995 → first digital video cameras (Panasonic and Sony)

2000 → New format DV (500 lines of resolution). Smaller cameras BUT better images

2001→ Most camcorders record at 5fps, now you can get 30fps with 640X480 resolution (almost as good as 35 mm film)

Now → don't use tapes, now use mini DVD, hard drives, sticks (cell phones) and wifi for transfer

Flip Video → http://www.theflip.com/en-us/

Let's Review

- What was the *Frame Rate* fo
- What is the *Frame Ratio* for
- What is the *Frame Ratio* for
- What does 1080p mean?
- What was the last major m released in VHS format?
  ◦ Laura has not seen it ☺
  ◦ It was released in 2005
  ◦ It was partly filmed in Millbrook, Ontario
  ◦ It starred Viggo Mortensen
  ◦ When do you think DVDs will disappear ☺ ?
  ◦ Before 2020?
  ◦ After 2020?

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