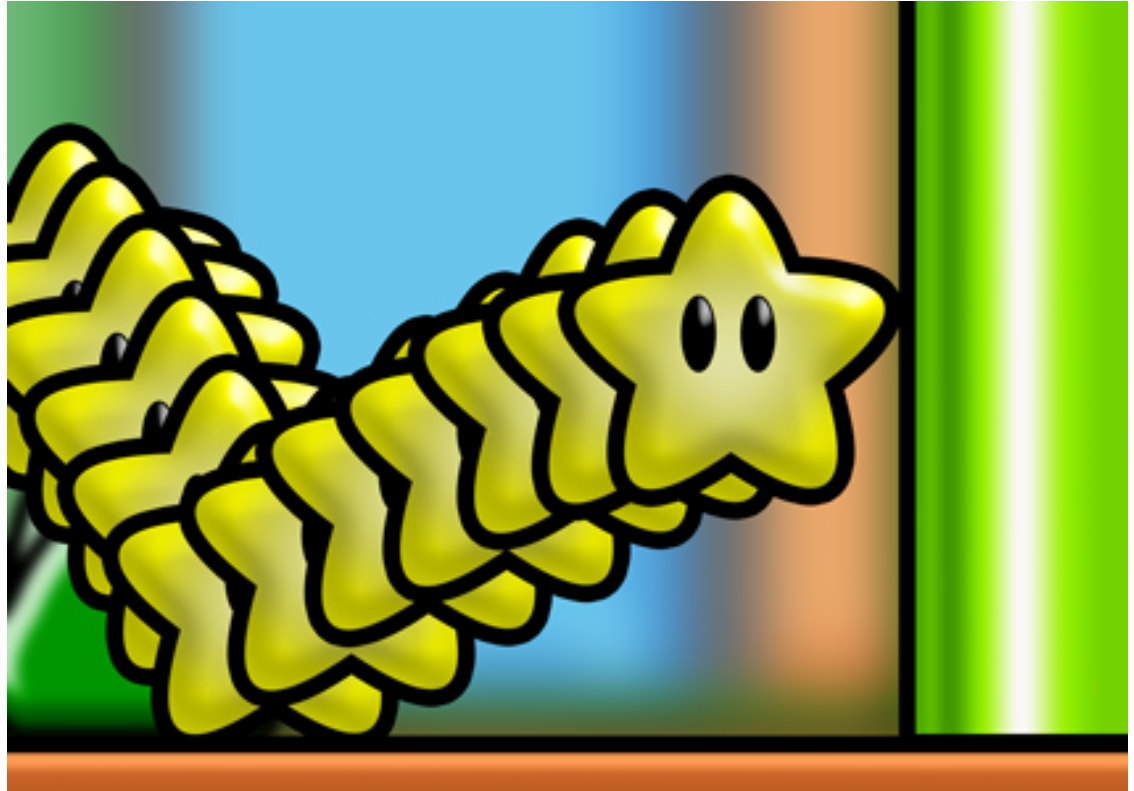


Computer Displays II

DM2112

Digital Entertainment Systems





Computer Displays II

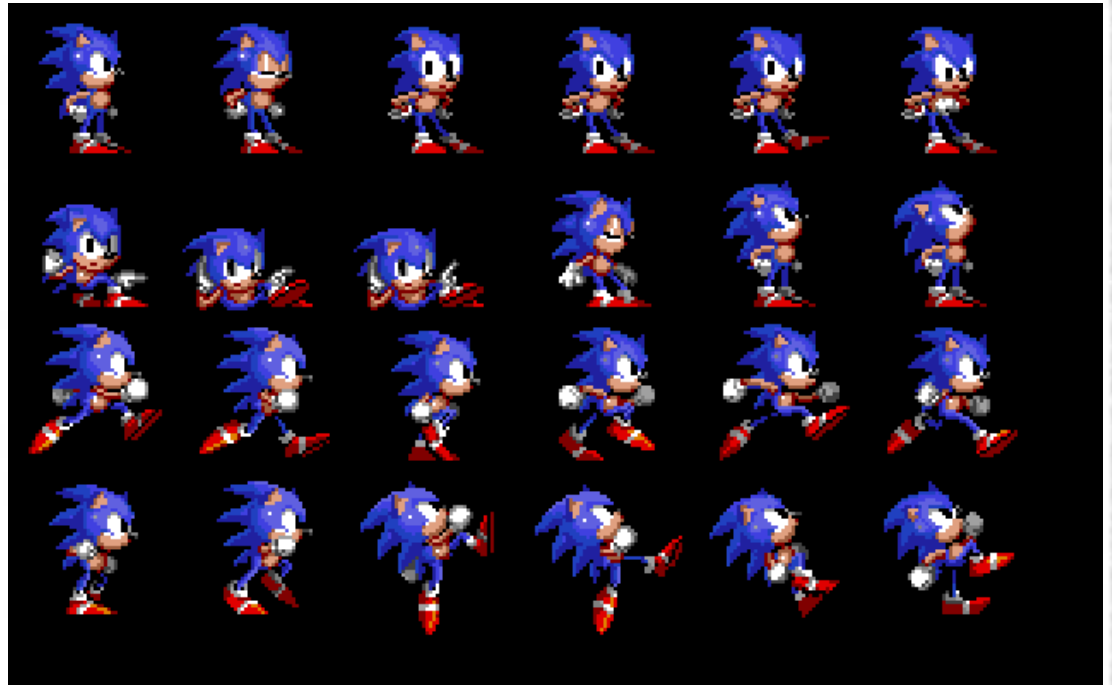
FRAMES PER SECOND





Frames Per Second

- Aka FPS
 - Illusion of motion created
 - Each frame is a still image
 - Displaying frames in quick succession



Frames Per Second

- NTSC format
 - Analog television system
 - US TV standard
 - Displays 30 interlaced frames per second (60 fields per second)
 - 30p (progressive format)
 - 30 FPS



Frames Per Second

- PAL format
 - Analog television system
 - Displays 25 interlaced frames per second (50 fields per second)
 - 25p (progressive format)
 - 25 FPS



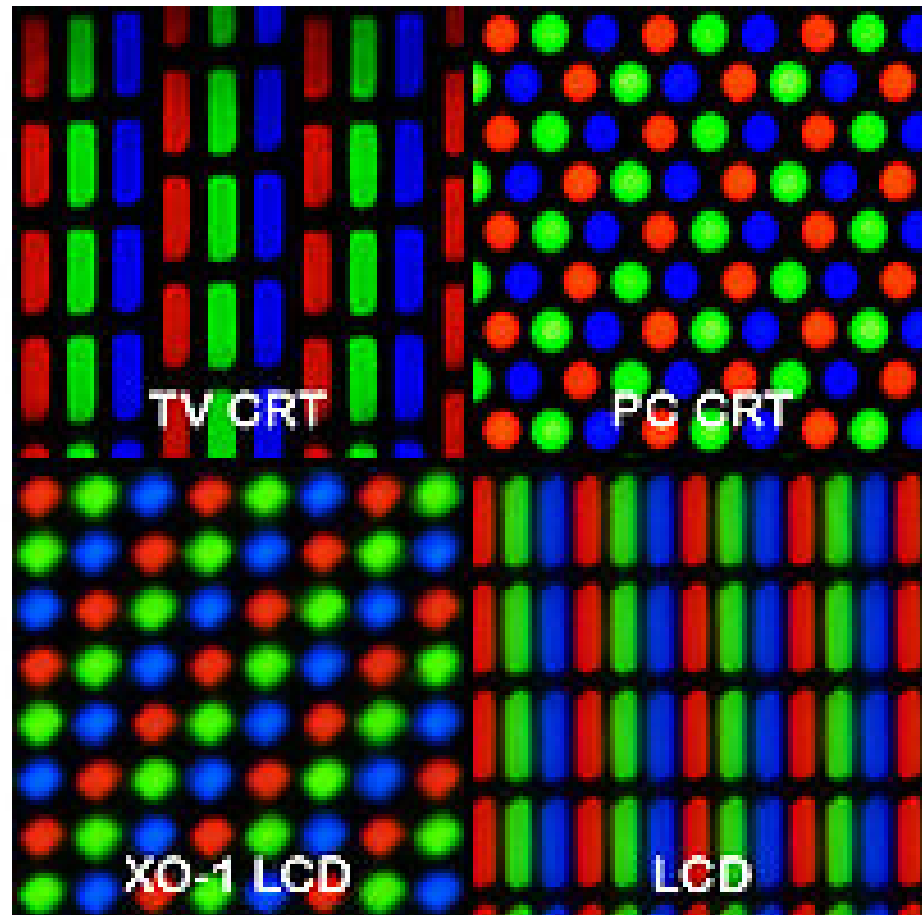
Frames Per Second

- In Games development
 - We aim for 60 frames per second
 - 30 to 60 fps is considered acceptable
 - Low fps does not give illusion of motion effectively
 - Makes user feel hard to interact with the game
 - Consoles usually have FPS locked
 - Halo 3 has 30 fps max



Lecture 10
Computer Displays II

PIXELS



Display Concepts

- Commonly used display surfaces
 - Printers
 - Paper
 - Monitors
 - Cathode Ray Tube
 - Flat Panel Display



Pixels

- Let's say we divide the display surfaces
 - Into rows and columns
 - Each cell will represent 1 part of an image
 - This is what we called Pixel
 - The distinct number of pixels for each dimension
 - Makes up the display resolution



Pixels

- Basic building blocks of every digital image
- More pixels in a photo mean the better your image will look
 - Image made up of few large pixels
 - Pixelated (Jagged and Unclear)



If you are making a small print, fewer pixels are required. It doesn't need to be the more the better.



Pixels

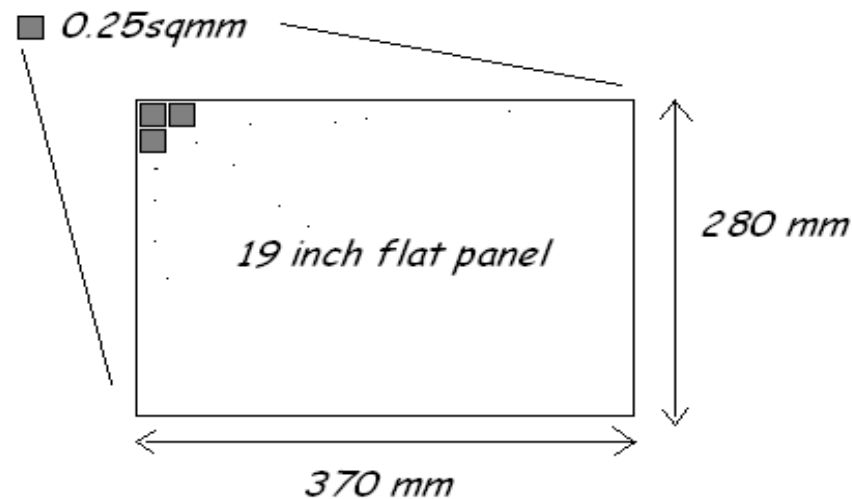
- Number of pixels in display surfaces
 - Display surface size
 - Height
 - Width
 - Pixel size
 - Pixel has no size and shape
 - Dependent on device used to display/print it
- Resolution
 - Number of pixels displayed per linear measurement unit
 - Usually given as PPI (Pixels per Inch)



Pixels

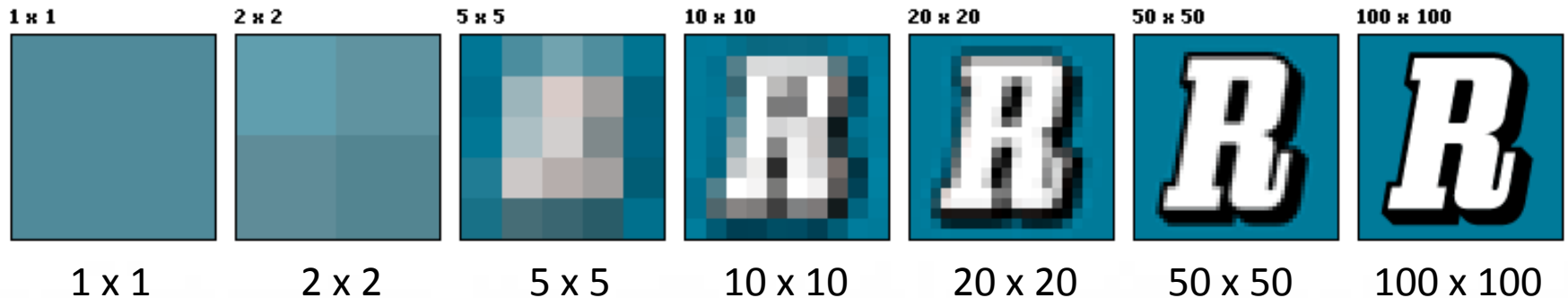
- If display pixels are 0.25mm^2 , total number of pixels:

$$(280\text{mm} \times 370\text{mm}) / 0.25 = 414,400$$



Different Display Resolution

- When we do scaling of images
 - We are changing pixel resolutions of the image
 - May result in problems



- In games, we want to minimize image size without damaging quality



Colour Information

- We can use Bits to contain colour information
- If we use more bits to display each pixel's information,
 - more distinct colours can be used to draw the pixel
 - If the image is in RGB, more distinct shades of Red, Green, Blue can be displayed



Colour Information

- For example in greyscale
- If we use only 1 bit. We can only display black and white (2 values)



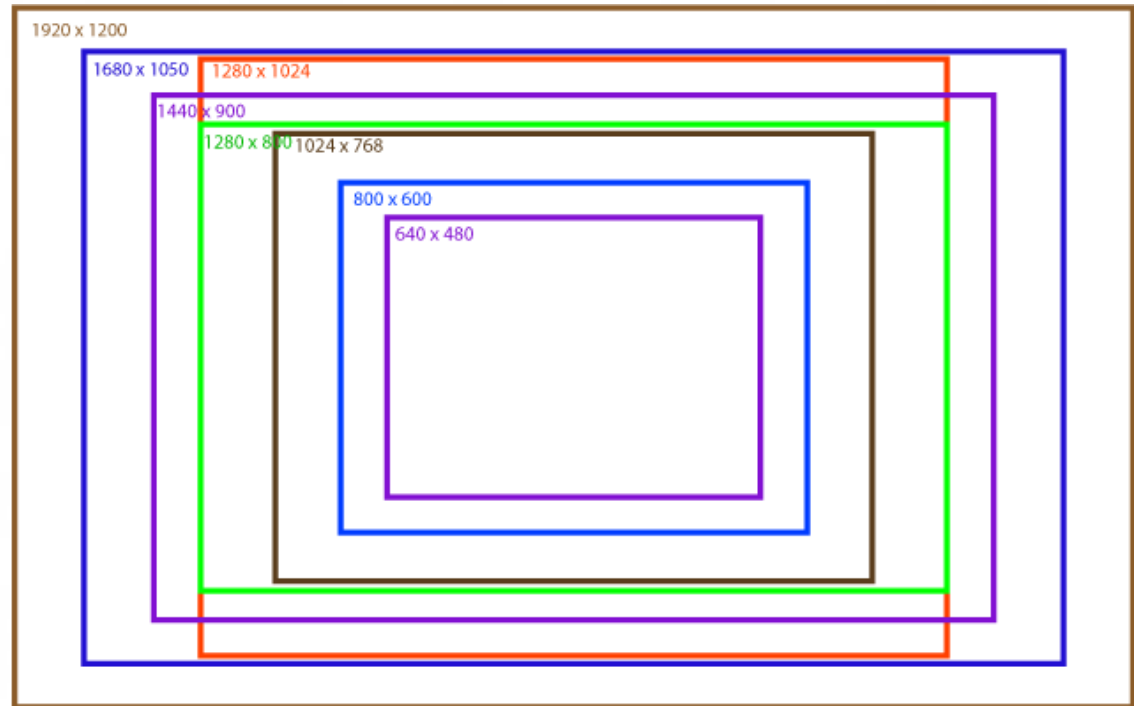
- If we use 2 bit. We can display 2 more (grey)



Colour Information

- 01 bits per pixel → 2 colours
- 02 bits per pixel → 4 colours
- 04 bits per pixel → 16 colours
- 08 bits per pixel → ?
- 16 bits per pixel → ?
- 24 bits per pixel → 16,777,216 colours
- 36 bits per pixel → ?





Lecture 10

Computer Displays II

SCREEN SIZE & RESOLUTION



Screen Sizes

- 14 inch
 - 640 x 480 or 800 x 600
- 15 inch
 - 800 x 600 or 1027 x 768
- 17 inch
 - 1024 x 768 or 1152 x 864
- 19 inch
 - 1152 x 864 or 1280 x 1024



Popular video screen size settings

- Regular TV sets intentionally show oversized images
 - Overscanning
 - Varies with TV sets
 - Not to put important information at the edges
- Image is 10% larger than physical screen will show
 - Cant show a full 640 pixel image width



Overscanning

The raw frame



What you end up seeing



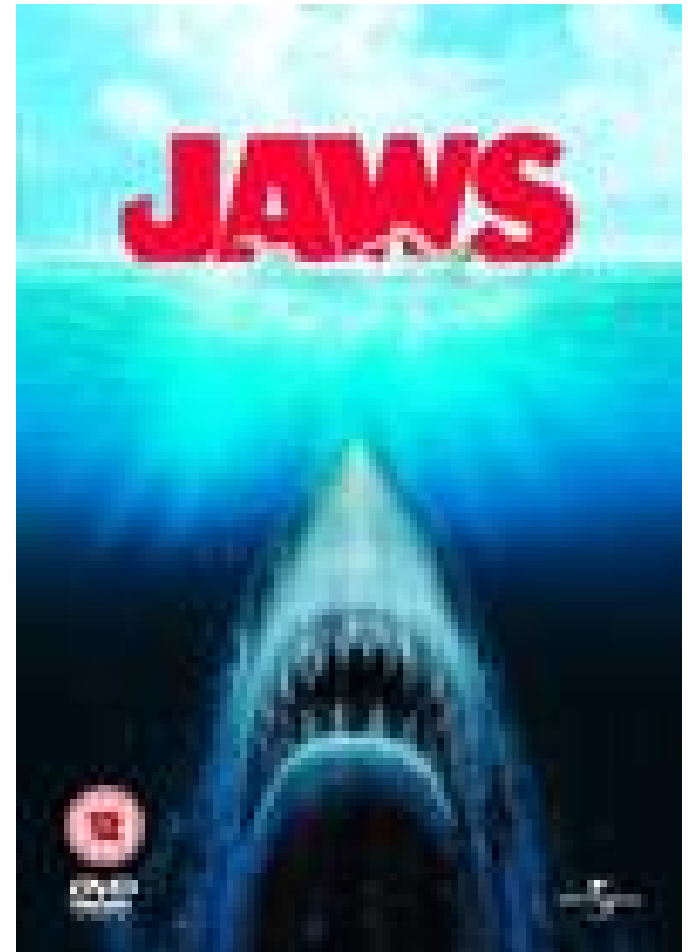
Overscanning

- When video is viewed on a computer or a special production monitor, the picture is not overscanned.
- This means that some of the image you see on a computer will not be seen on a TV.
 - A simple test is to connect your laptop to the TV



“Safe Zone”

- One of the last major Hollywood productions that did not take television screen dimensions into consideration.



Computer Display Screen Resolution

- Screen resolution is fixed
 - Larger screen leads to more pixels required
 - Macintosh OS X Resolution Independence
 - Number of pixels per inch fixed (dpi is fixed)
 - Larger screen → Display more information
- Computer screen
 - A large screen may not have enough dots to create small, complex shapes
 - Hence the larger the screen, the more pixels it must have (i.e. a larger screen must have a higher resolution)



Computer Display Resolution

- If you have a 19 inch monitor, and change the display resolution (from normal 1024x768) to 800x600, why do things appear larger, and why do some things not fit on the screen? Things also appear more blur.

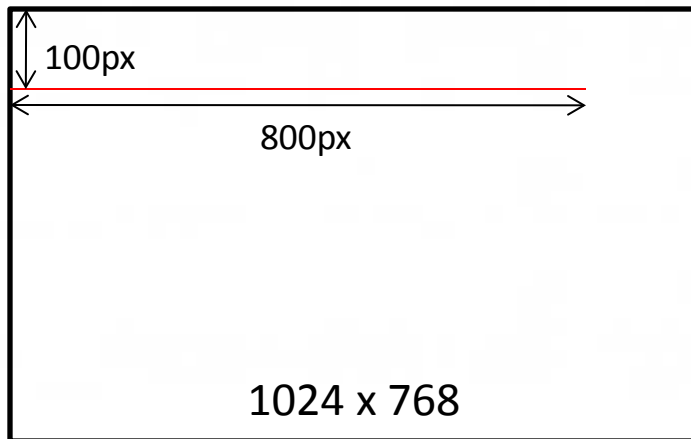


Computer Display Resolution

- Answer
 - Let's consider a line that's 800px wide. When the resolution is 1024x768, this line doesn't reach the end of the screen, but if the resolution is 800x600, then the line reaches the end of the screen.
 - Things appear more blur because since there are actually 1024x768 pixels, but the resolution is only 800x600, it means that now almost 2 pixels are used to create 1 pixel. So, in effect, each pixel at the 800x600 resolution is bigger than normal. So everything doesn't look as fine; everything looks blur



Computer Display Resolution



VS.

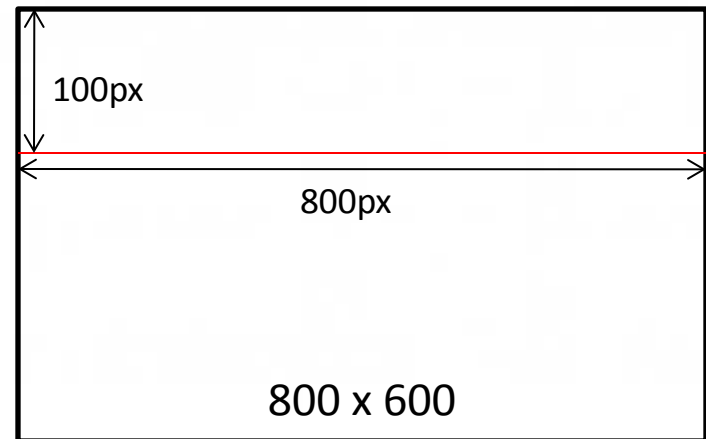


Image Size

- Refers to physical dimensions of an image.
- Number of pixels in an image is fixed
- When we resize an image:
 - Increase in size → Decrease in resolution
 - Decrease in size → Increase in resolution



Aliased



Anti-Aliased

Computer Displays II

ANTI-ALIASING



Pixelation / Jaggies

- Large fonts created on computer screen
 - Diagonal lines created with stair-stepped appearance

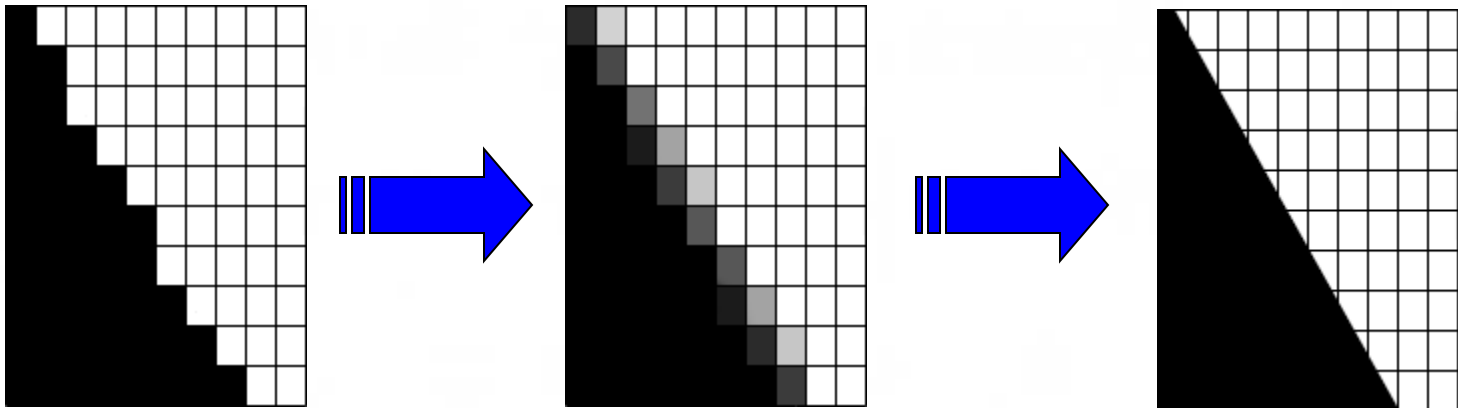
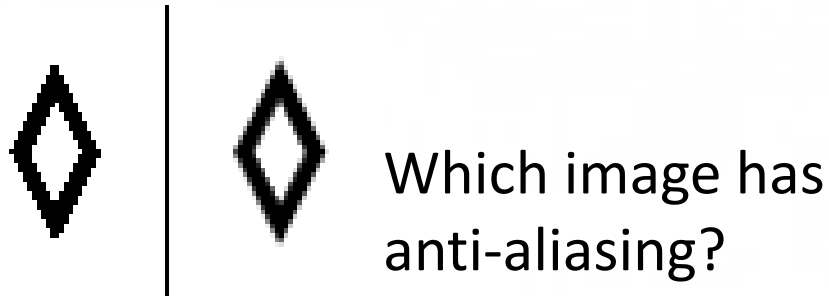
Text not anti-aliased.

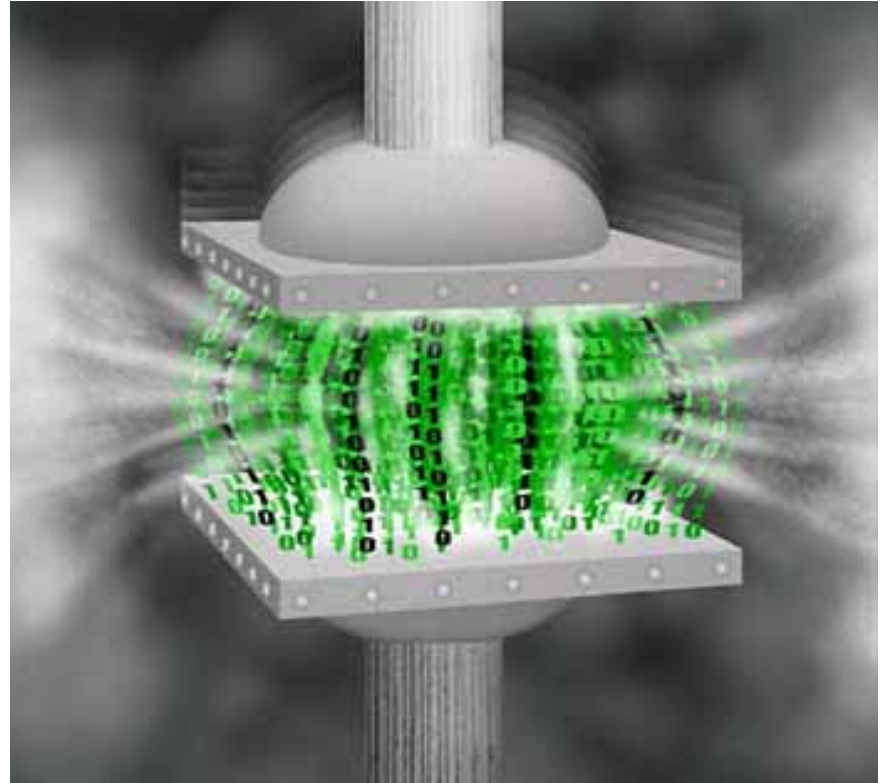
- Anti-aliasing
 - Tricking the eyes into seeing a smoother shape, especially at a distance



Anti-aliasing

- Technique of minimizing distortion artifacts





Computer Displays II

IMAGE COMPRESSION



Image Storage Requirements

- Amount of storage required depends on:
 - Number of bits representing each pixel
 - Number of bits on the image height and width in pixel
- Could be reduced with bitmap compression techniques
 - Single (Still Images)
 - GIF / JPEG / DDS
 - Moving Images
 - MPEG



Image Compression

- Lossless
 - Image can be restored in full detail
 - No difference between encoded image and decoded image
 - GIF / TIFF / BMP / PNG
- Lossy
 - Give up image quality to gain more compression possibility
 - JPEG



Graphics Interchange Format

- Cross-platform image standard for users on internet
- Limited to 256 different colors or shades of grey



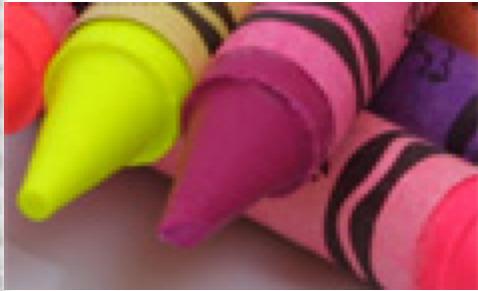
Joint Photographic Experts Group

- Most Common format of digital image
- Image information
 - Colour
 - Detail
 - Fine Details
 - Coarse Details
- Trade off between image file size and image quality



JPEG Compression

- Divides image into squares of 8 x 8 pixels



Original Image



80% Quality JPEG



60% Quality JPEG



10% Quality JPEG



Tips on Image Compression

- When editing an image in several sessions,
 - it is recommended to save the intermediate image in an uncompressed format
 - such as TIFF
 - or the editing program's native format
 - (e.g. PSD for Adobe Photoshop or PSP for Paintshop Pro).



Tips on Image Compression

- If you save an image in JPEG, and close it,
- then open it again and save it again in JPEG with the same quality setting,
- the file size will not reduce further,
 - but **quality** will have degraded further.
 - So only compress after all editing is done.



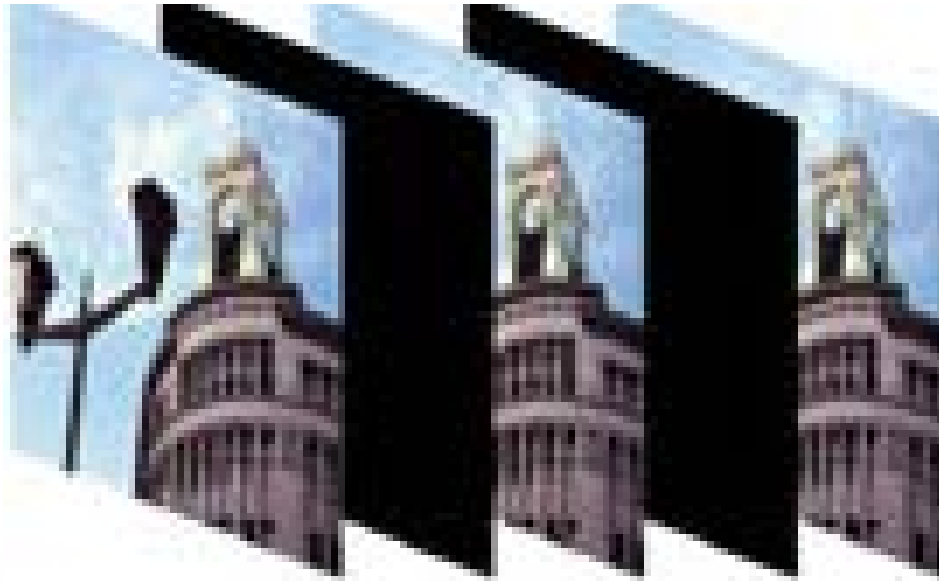
Computer Displays II

VIDEO



Video

- Time-varying image sequence
 - Sequence of still images, captured and displayed at a sufficiently high rate → Illusion of Motion



Video Scanning

- Progressive Scanning
 - Most PC's uses this, source signal is progressive by nature (no splitting of a frame into 2 halves)
 - Used in television (PAL system)
 - Will have half the frame rate of an interlaced scanning's field rate
 - Reduces motion smoothness



Progressive Scanning

- Displaying, storing or transmitting moving images
 - Lines of each frame drawn in sequence
 - Reduce Ghosting effect



Video Scanning

- Interlace Scanning
 - Splits each frame into 2 halves.
 - Also used in television (NTSC system)
 - Introduces potential problem: interline twitter
 - Shows up under certain circumstances



Interlace Scanning

- Each picture is scanned in 2 fields
 - Odd field and Even field
 - Bottom field and Top field
 - Field 1 and Field 2

