Computer Fundamentals

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Lecture 3

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Input and Output Devices

- Input devices
  - Enable user to enter commands and data
- Output devices
  - Enable computer to communicate information to user

Display and Sound

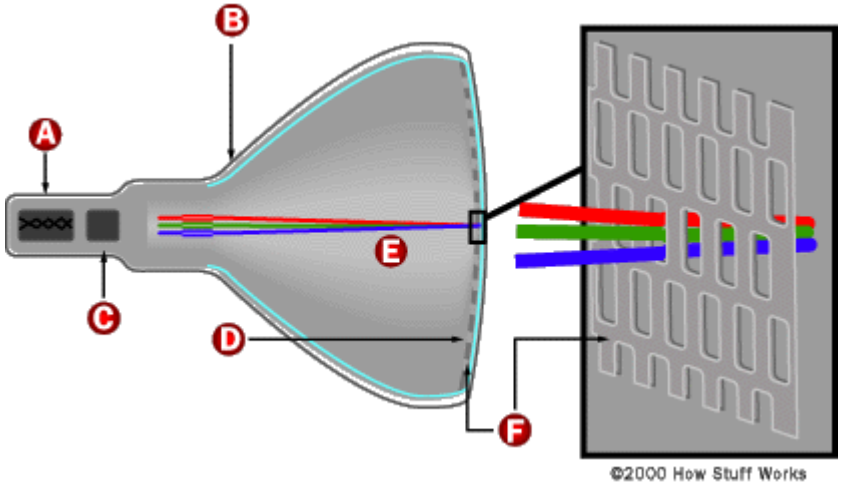
- Monitors
- Video Cards
- Projectors
- Sound Systems

Monitors

- Most common output device
- Connected to video card
- Categorized by color output
  - Monochrome
    - One color with black background
  - Grayscale
    - Varying degrees of gray
  - Color
    - Display 16 to 16 million colors

Monitors (cont.)

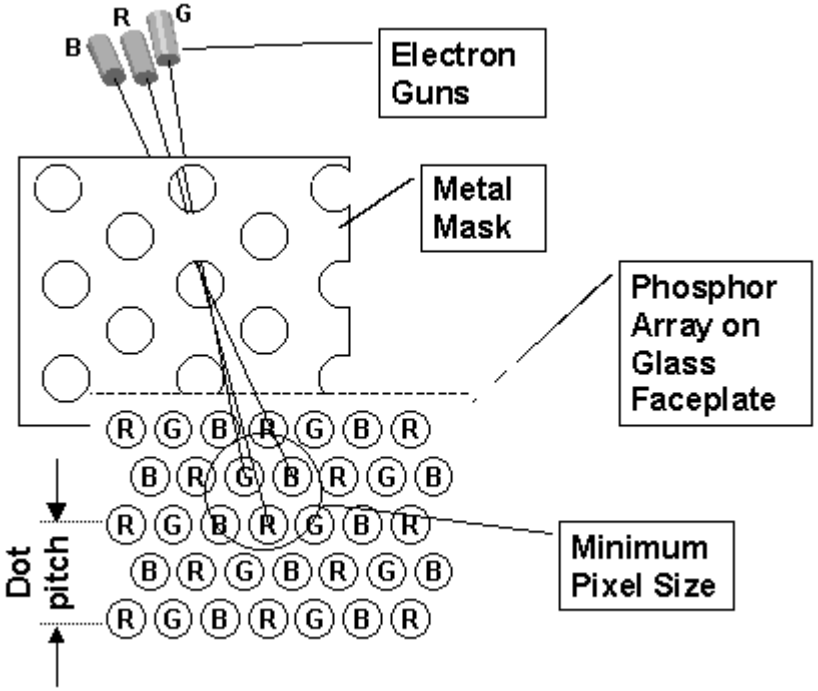
- Cathode Ray Tube (CRT)
  - Once used to be a common type of monitor
  - Electrons fired from the back
  - Electrons excite phosphor to glow
  - Phosphor is arranged in dots called pixels (picture elements)
    - Unique address of each pixel
  - Dot mask ensures proper pixel is lit
    - Dot mask - sheet of metal perforated with holes



Source: *http://computer.howstuffworks.com*

Monitors (cont.)

- CRT color
  - Phosphor dots arranged in triads
  - Red, green, and blue dots
  - Three colors blend to make colors
  - Varying the intensity creates new colors



Sources: *http://www.oclc.org*
http://www.tech-faq.com

Monitors (cont.)

- Liquid-crystal display (LCD)
  - Special liquid-crystal used for image display
  - Liquid-crystal is transparent normally
  - Becomes opaque when charged with electricity
  - May not be clearly visible in bright light
  - Have limited viewing-angle
- Types
  - Passive matrix LCD
  - Active matrix LCD

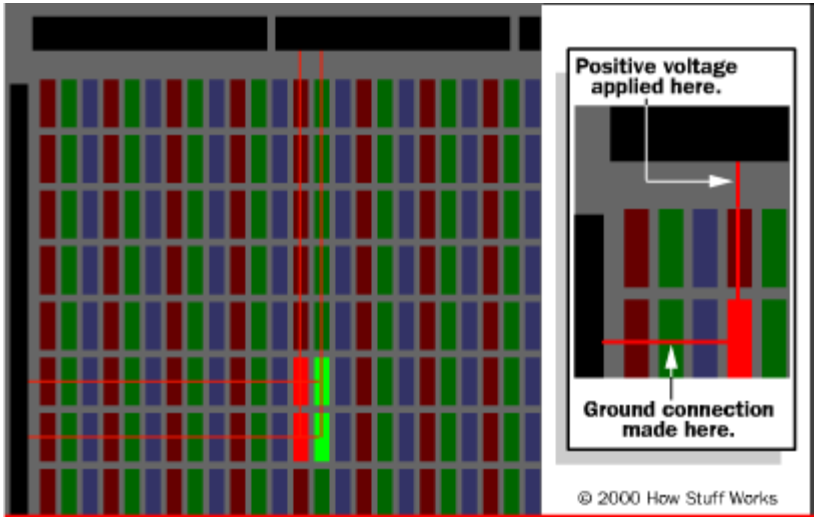
Monitors (cont.)

- CRT vs. LCD (liquid-crystal display)
  - Very large
    - Appr. 16 inch deep vs. a few inches deep
  - Very heavy
    - Over 30 kg vs. below 5 kg
  - Use a lot of electricity

Source: *http://vgcollect.com*

Monitors (cont.)

- Passive matrix LCD
  - Pixels arranged in a grid
  - Pixels are activated indirectly
    - Activation through ICs (transistors)
    - Row and column are activated
  - Animation can be blurry
    - E.g. mouse pointer moved quickly would leave trail



Source: *http://electronics.howstuffworks.com*

Monitors (cont.)

- Active matrix LCD
  - Each pixel is activated directly
  - Pixels have 4 thin film transistors (TFTs)
    - One each for red, green, blue
    - One for opaqueness
  - Transistors arranged in a thin film
  - Animation is crisp and clean

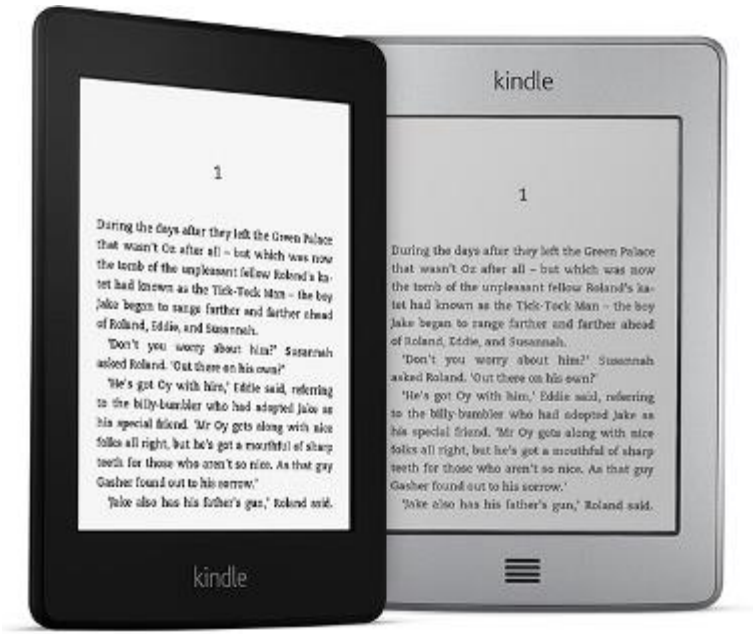
Monitors (cont.)

- Drawbacks of LCD
  - More expensive than CRT
  - Must sit directly in front of screen
  - Can be more fragile than CRT

Source: *http://www.safetysignsandnotices.co.uk*

Monitors (cont.)

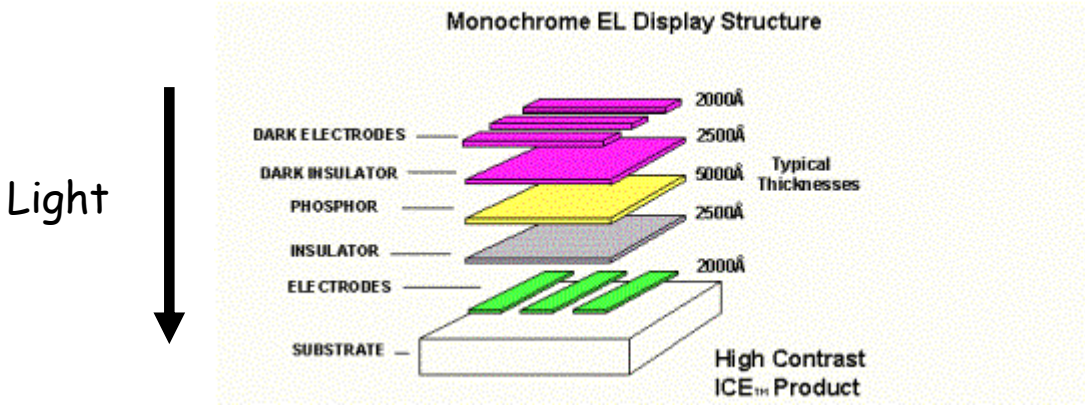
- Paper-white displays
  - High contrast between fore and background
  - Document designing
    - E.g. newspaper and magazine composing



Source: *http://blog.mytrendyphone.co.uk/amazon-launches-kindle-paperwhite-lending-library-in-uk*

Monitors (cont.)

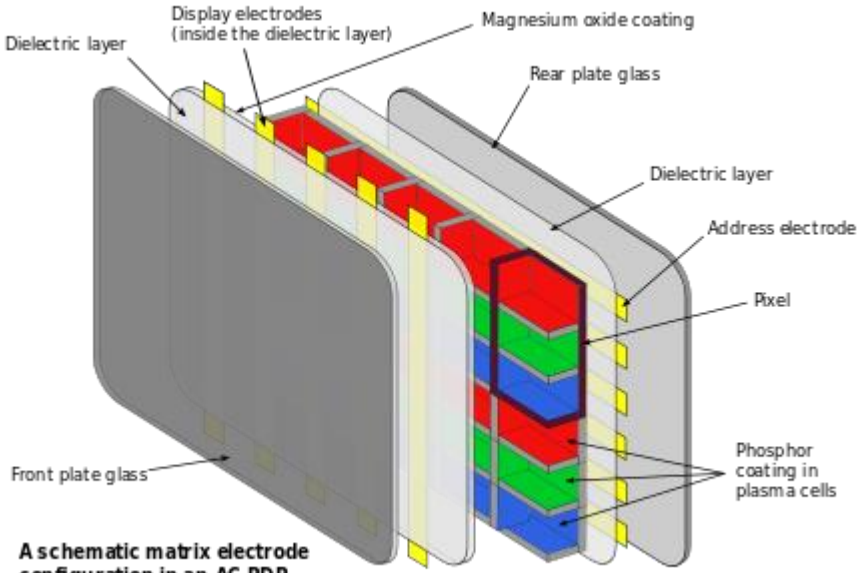
- Electro-luminescent displays (ELD)
  - Similar to LCD
  - Uses phosphor held between 2 insulator films to produce light
  - Grid of wires outside insulators
    - Cathodes and transparent anodes with glass
    - Send current through film
  - Light emitted from glass for viewer



Source: *http://www.indiana.edu/~hightech/fpd/papers/ELDs.html*

Monitors (cont.)

- Plasma monitor
  - Gas is excited to produce light
  - Intensity controlled by voltage applied at various points
  - Lost all market share now



A schematic matrix electrode configuration in an AC PDP

Source: *https://en.wikipedia.org/wiki/Plasma_display*

Monitors (cont.)

- LED monitor
  - LED display uses light-emitting diodes
  - Usually a small display, or a component of a larger display
  - Brightness allows it to be used outdoors
  - Sometimes used as form of lighting
    - For illumination, task lighting, or stage lighting rather than display

Source: *www.vegasledscreens.com/faq/48-what-is-a-led-screen.html* **and** *www.duurzaamsomeren.nl/led-verlichting*

Monitors (cont.)

- LED vs. LCD
  - LED has better viewing angle
  - LED has better brightness
  - LED has better color information
  - LED has better lifespan
  - LED has greater depth (less wall mount friendly)
  - LED is expensive

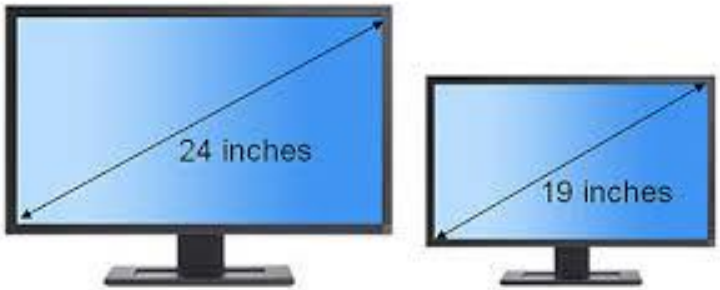
Source: *http://www.vegasledscreens.com/faq/48-what-is-a-led-screen.html*

Monitors (cont.)

- Monitors impacts user effectiveness
- Monitors should have
  - Crisp text
  - Clear graphics
  - Adjustable controls
  - Clear edges

Monitors (cont.)

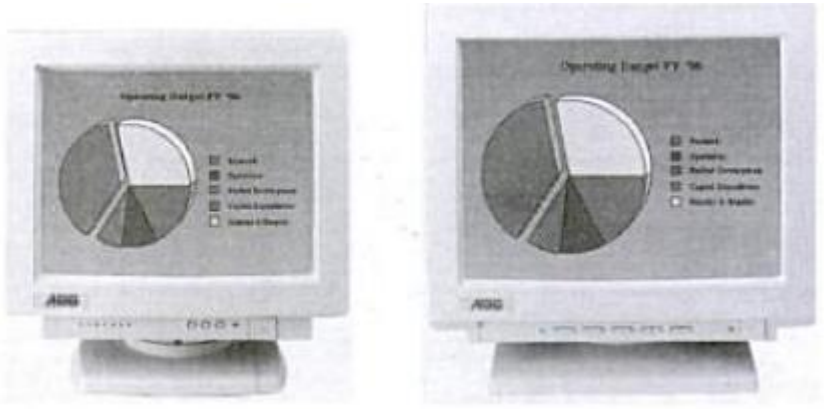
- Size of monitor
  - Measured in inches
  - Measured diagonally
  - Actual size
    - Distance from corner to corner
  - Viewable size
    - Useable portion of the screen

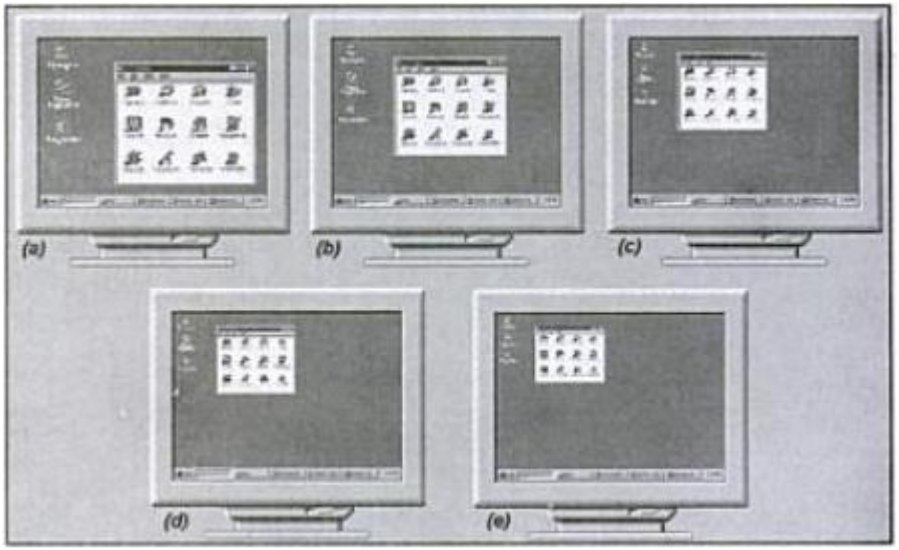


Source: *http://www.geekdashboard.com*

Monitors (cont.)

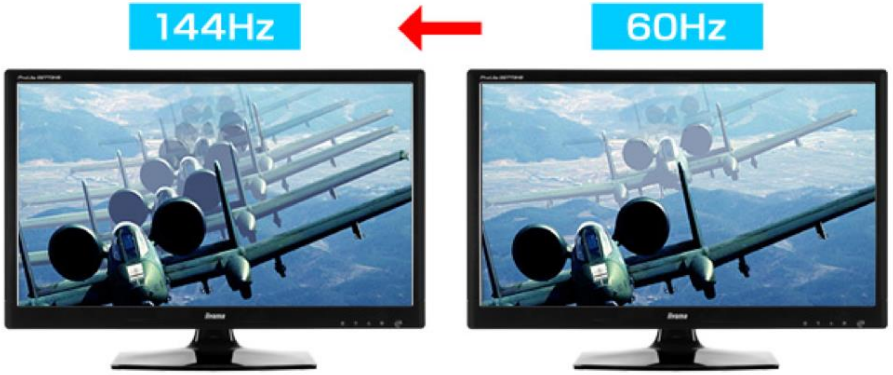
- Resolution
  - Number of pixels on the screen
  - Higher number creates sharper images
  - Higher number creates smaller images





Monitors (cont.)

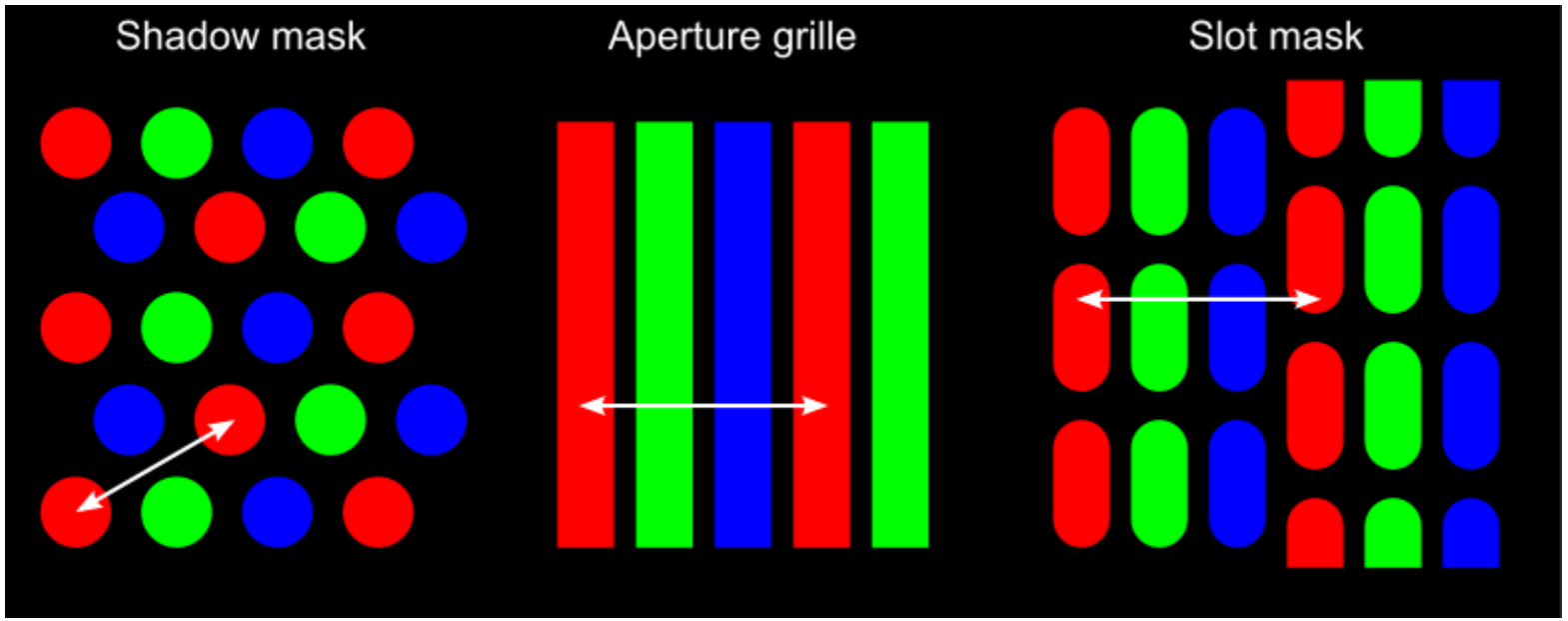
- Refresh rate
  - Number of times the screen is redrawn
  - Modern equipment sets this automatically
  - Improper settings can cause eyestrain



Source: *https://gamingbuff.com/60hz-vs-120hz-vs-240hz-refresh-rates-monitors-explained*

Monitors (cont.)

- Dot pitch
  - Distance between the same color dots
  - Ranges between .15 mm and .40 mm
  - Smaller creates a finer picture
  - Should be less than .22 for good quality



Source: *https://en.wikipedia.org/wiki/Dot_pitch#/media/File:CRT_mask_types_en-de.svg*

Video Cards

- Device between the CPU and monitor
- Better cards result in better output
- Removes burden of drawing from CPU
- Have their own processor and RAM
- Modern cards have up to 24GB RAM
  - E.g. Nvidia Quadro M6000
- Modern cards capable of rendering 3D images

Source: *https://www.digitaltrends.com/computing/nvidia-quadro-m6000-24gb*

Human Factors

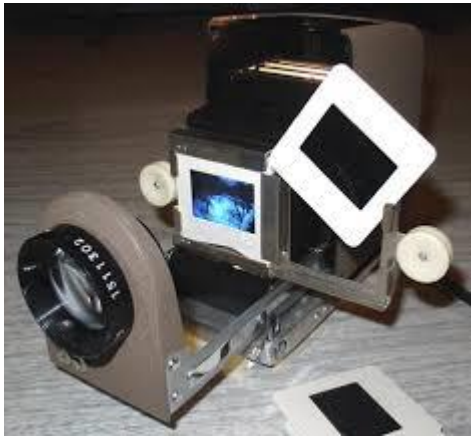
- Ergonomics related to monitors
- Eyestrain
  - Fatigue of eyes
  - Steps to avoid
    - Choose a good monitor
    - Place the monitor 2 – 3 feet away
    - Center of screen below eye level
    - Avoid reflected light

Human Factors (cont.)

- Electronic magnetic fields (EMF)
  - Generated by all electronic devices
  - EMF may be detrimental to health
  - Steps to avoid
    - Keep the computer at arms length
    - Take frequent breaks
    - Avoid CRT monitor

Data Projectors

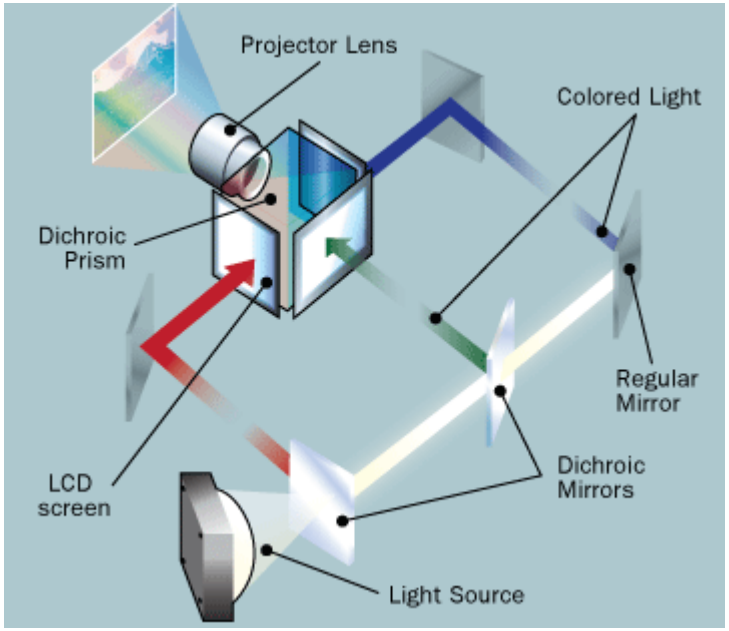
- Replaced overhead and slide projectors
- Project image onto wall or screen



Sources: *https://en.wikipedia.org/wiki/Overhead_projector*
http://www.retrothing.com/2007/07/minolta-mini-35.html **and**
http://www.scannerplace.com.au/content/epson-eb-w12-wide-screen-data-projector-price

Data Projectors (cont.)

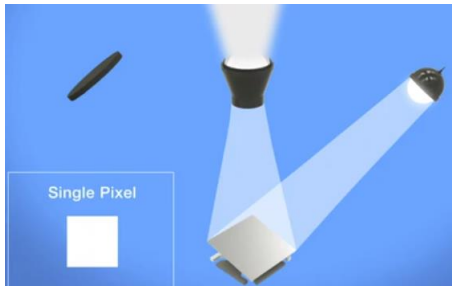
- LCD projectors
  - Most common type of projector
  - Small LCD screens for red, blue and green color
  - Working principle
    - Beam of light emitted from powerful light source
    - Group of mirrors, each reflects a specified wavelength to separate colors
    - Each colored beam passes a dedicated LCD
    - All LCDs display same image in grayscale
    - Three tinted versions of image recombined
  - Require a darkened room

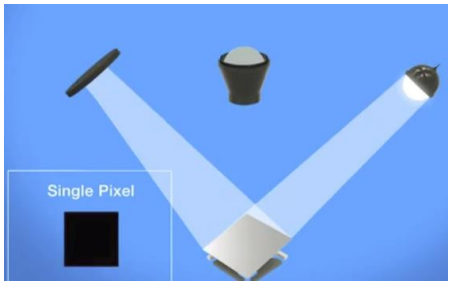


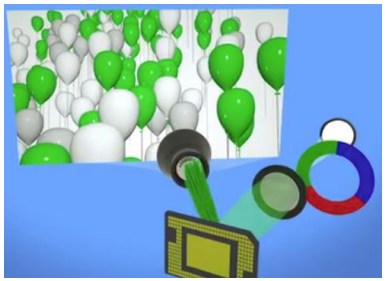
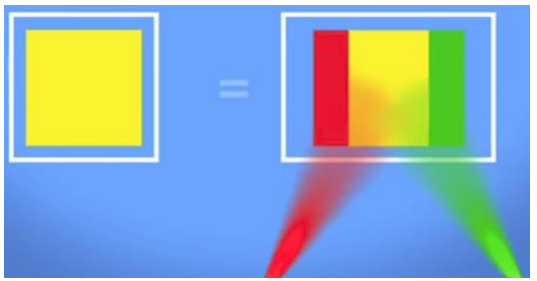
Source: *http://electronics.howstuffworks.com/lcd-projectors1.htm*

Data Projectors (cont.)

- Digital Light Projectors
  - A series of mirrors control display
    - Each mirror represents a pixel
    - Mirror size less than one-fifth the width of human hair
  - Working principle
    - Light shone onto each mirror
    - Mirror switch on and off in response to light
    - Reflected light directed either to lens or absorber (white or black pixel)
    - Color wheel between light source and mirror for colors (many colors possible)
  - May be used in lighted room





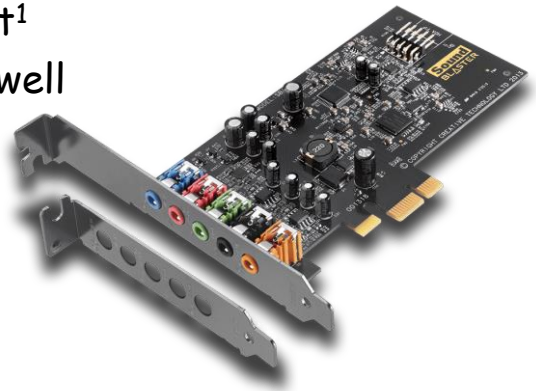



Source: *https://www.ti.com/dlp-technology/about/how-it-works.html*

Sound Systems

- Integral part of computer experience
- Capable of recording and playback

- Sound card
  - Device between the CPU and speakers
  - Converts digital sounds to analog
  - Can be connected to several devices
  - Modern cards support Dolby Surround Sound
    - Conventional stereo creates dimensional sound in front[1]
    - Dolby delivers sound from sides, behind and above as well



Source: [1]*http://www.dolby.com/us/en/technologies/surround-sound.html*
https://us.creative.com/p/sound-cards/sound-blaster-audigy-fx

Sound Systems (cont.)

- Headphones and headsets
  - Headset = headphone + mic
  - Replacement for speakers and microphones
  - Offer privacy
  - Does not annoy other people
  - Outside noise not a factor
  - Headsets have speakers and a microphone

Source: *https://www.logitech.com/en-ca/product/stereo-headset-h111*