ACKNOWLEDGEMENTS

By design this course and the associated course materials are tied closely to an existing text. This close tie provides you with an interactive exposure to the course contents in the classroom and a passive exposure to substantially equivalent material when you are alone with the text.

After careful consideration, ***Computer Graphics*** by Donald Hearn and M. Pauline Baker (Prentice Hall, 1986) has been selected as a text which provides the best combination of both comtemporary content and appropriate readability. Material from the text, the Instructor's Guide and the Transparency Masters supplement to the text has been reproduce/adapted in part by permission of Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

The figure on 2.15 and the two figures on 19.3 are taken from *Principles of Interactive Computer Graphics*, Second Edition, by William M. Newman and Robert F. Sproull (McGraw-Hill, 1979) by permission of McGraw-Hill Book Company, New York, New York.

The figure on 5.18 and the figure on 7.28 are taken from ***Fundamentals of Interactive Computer Graphics***, by James D. Foley and Andries van Dam (Addison-Wesley, 1982), reprinted with permission.

Course notes have been formatted by Lorraine Mullen, Wendy Miller, Dan Gleason and David Lewis at the Department of Instructional Graphics, Brigham Young University.

HISTORY OF COMPUTER GRAPHICS

1950	simple pictures - Whirlwind I
1963	"Sketchpad" - Ivan E. Sutherland
mid '60s	heady research - MIT General Motors Bell Laboratories Lockheed Aircraft
late '60s	heady research - University of Utah
1974	economic threshold crossed
late '70s	economic raster graphics
early '80s	microprocessor graphics
late'80s	photorealism

DISPLAY DEVICES
(Section 2-1 in *Computer Graphics*)

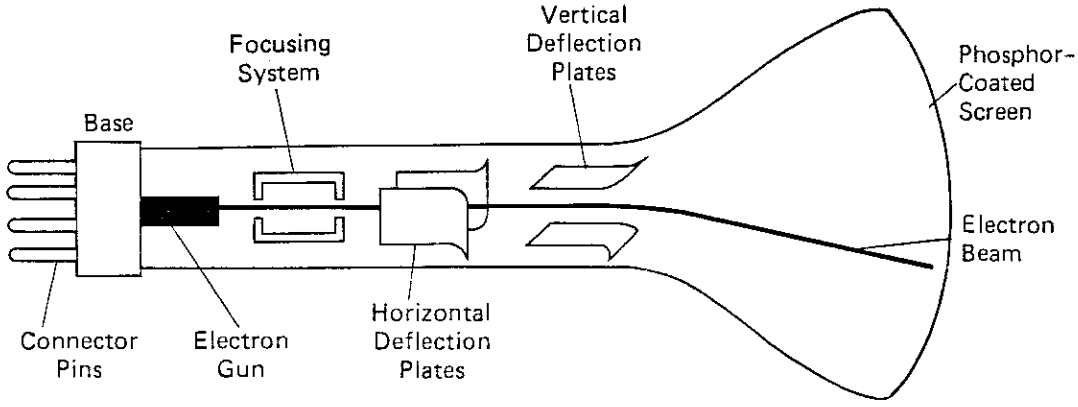
HARD COPY DEVICES
(Section 2-2 in *Computer Graphics*)

DISPLAY DEVICES

- Refresh Cathode-ray Tubes
- Random-scan and Raster-scan Monitors
- Color CRT Monitors
- Direct-view Storage Tubes
- Plasma-panel Displays
- LED and LCD Monitors
- Laser Devices
- Three-dimensional Monitors

Refresh Cathode-ray Tubes

- see figure 2-3 on page 29
- architecture



  - beam of electrons (cathode rays)
  - control grid
  - focusing structure
  - deflection structure
  - phosphor-coated screen
- Image maintenance
  - fluorescence
  - phosphorescence
  - refresh

Refresh Cathode-ray Tubes, continued

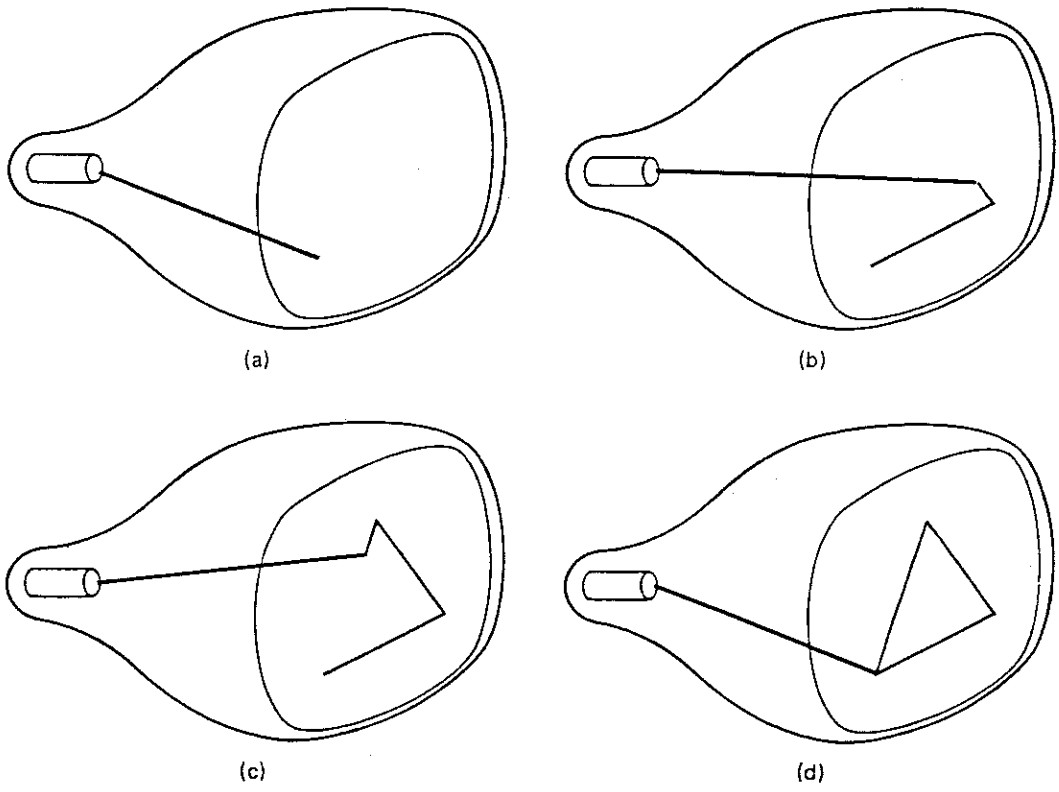
- deflection
  - electrostatic
  - magnetic
- focusing
  - electrostatic
  - magnetic

Refresh Cathode-ray Tubes, continued

- display characteristics
  - resolution
  - aspect ratio
  - phosphor
    - color
    - persistence
    - graininess
    - efficiency
    - burn resistance

Random-scan and Raster-scan Monitors

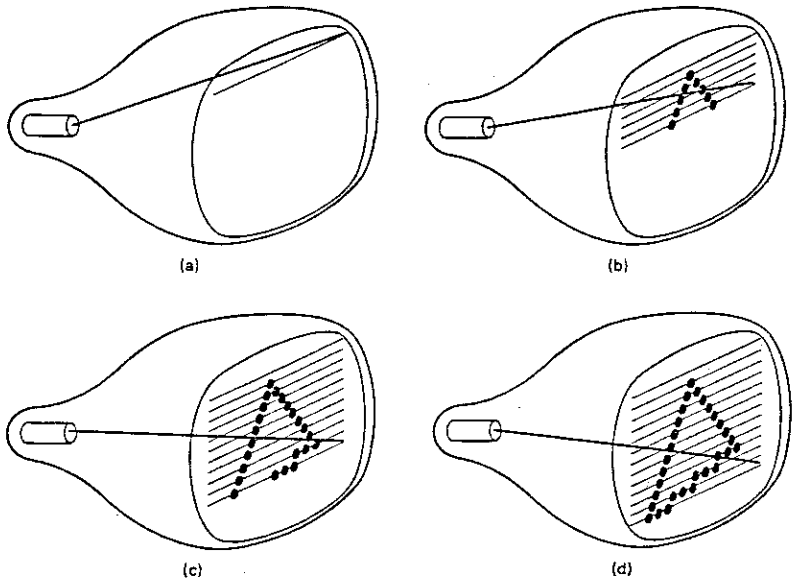
- **random scan (vector, stroke, calligraphic) displays**



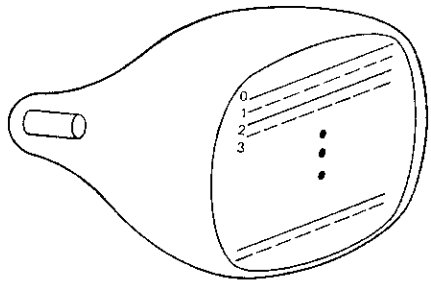
- beam directed only to parts of the screen where a picture is to be drawn
- picture drawn in any order
- line drawings only
- refresh 30 to 60 times/second

Random-scan and Raster-scan Monitors, --continued

- raster scan



- beam directed over the entire screen
- picture drawn top-to-bottom, left-to-right
- colored and shaded areas
- refresh 30 to 60 times/second
- sometimes interlaced



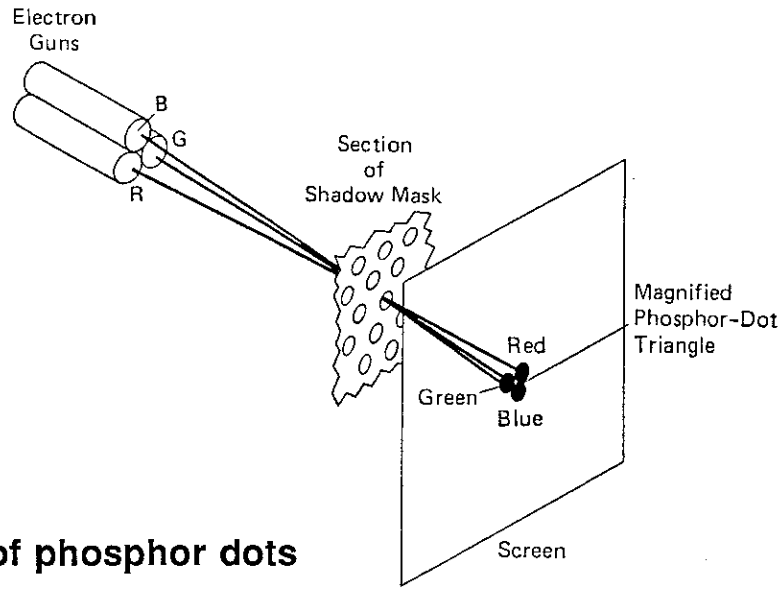
Color CRT Monitors

- beam-penetration CRTs
- shadow-mask CRTs
- TV sets
- composite monitors
- RGB monitors

beam-penetration CRT

- two layers of phosphor (red and green)
  - slow electrons strike the first layer
  - fast electrons strike the second layer
  - intermediate electrons strike both
- red, orange, yellow and green only

shadow-mask CRT

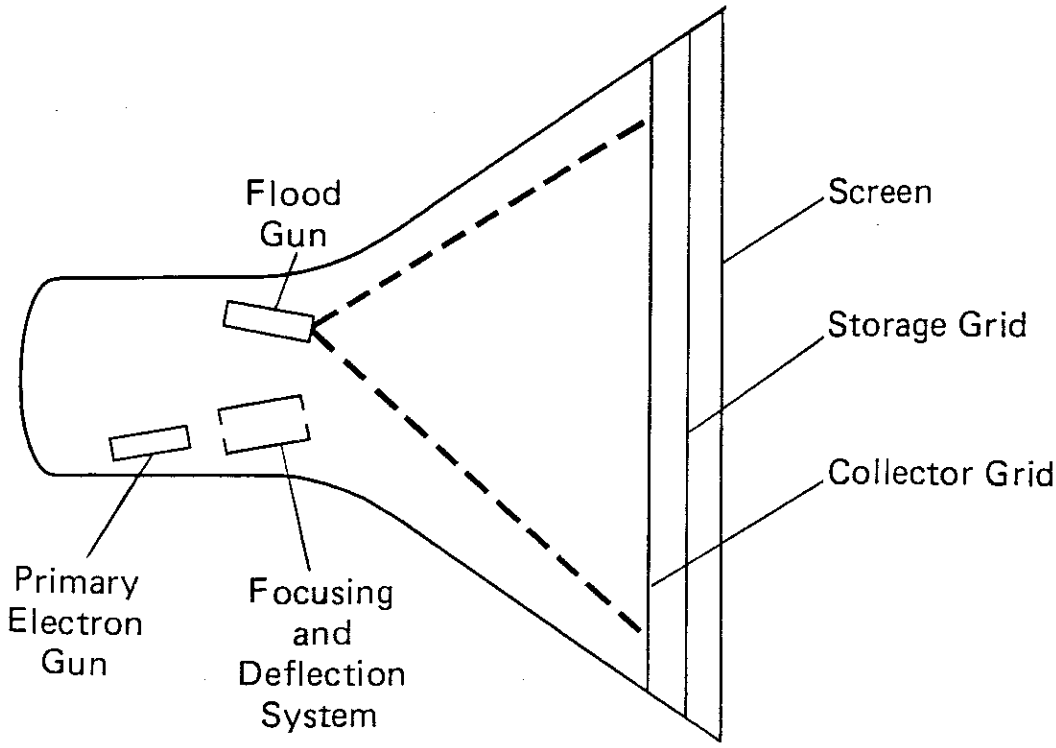


- tiny triads of phosphor dots
  - red
  - green
  - blue
- three electron guns
- one deflection system
- one focusing system
- the shadow mask controls which rays strike which phosphor dots
- color variations by combining colors

other monitors

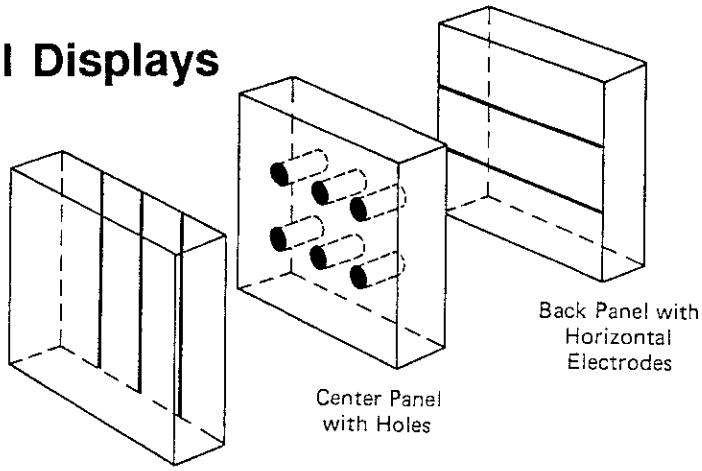
- TV sets
  - color TV and RF modulator to simulate the broadcast signal
- composite monitors
  - adaptations of TV sets that bypass the broadcast circuitry
- RGB monitors
  - intensity level for each electron gun taken directly from the computer
  - high quality images

Direct-view Storage Tubes (DVSTs)



- image stored as a charge distribution on a storage grid
- architecture
  - primary gun
  - focusing and deflection system
  - flood gun
  - storage grid
- advantage: no refresh required
- disadvantages
  - no color
  - no selective erasure

Plasma-panel Displays

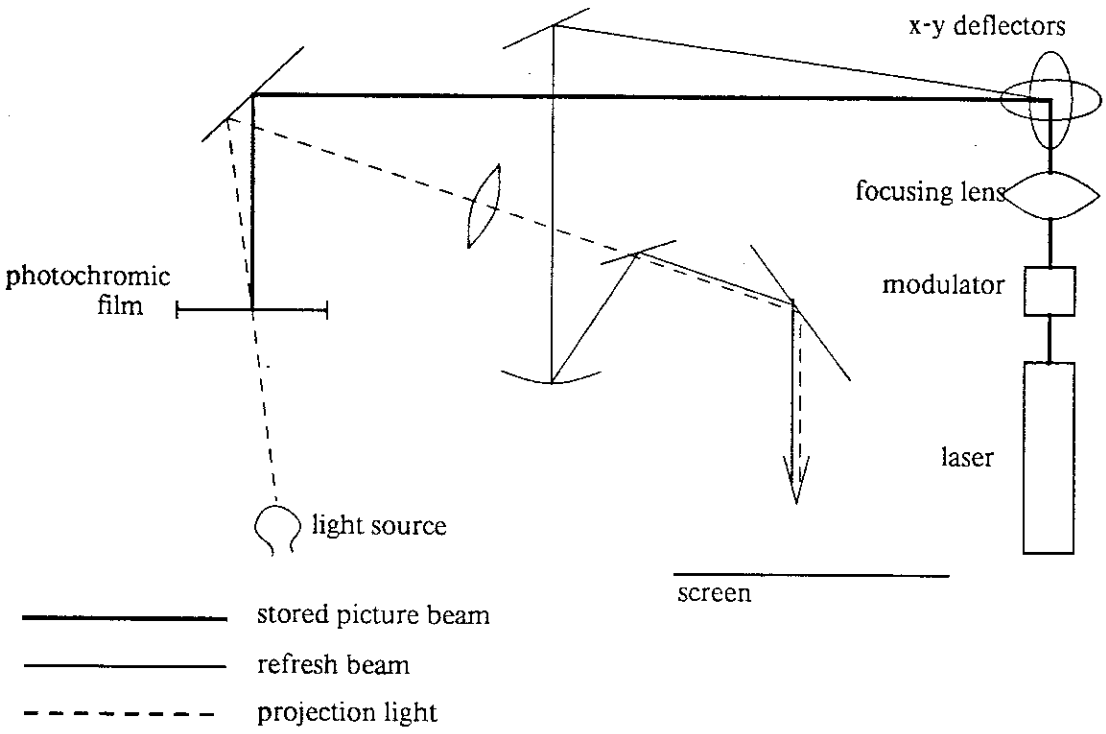


- architecture
  - neon gas between two glass plates
  - vertical and horizontal electrodes
  - cells of gas
  - see figure 2-13 on page 37
- behavior
  - firing voltage
  - sustaining voltage
  - erasing voltage
- advantages
  - no refresh required
  - flat
  - transparent
- disadvantages
  - one color
  - 64 points/inch
  - 20 microsecond write and erase

LED and LCD Monitors

- LED (light-emitting diode) monitors
  - LEDs replace phosphors or gas cells
  - requires auxiliary memory
  - useful for miniscreens
- LCD (liquid-crystal display) monitors
  - see figure 2-14 on page 38
  - crystal replaces phosphor or gas
  - requires auxiliary memory
  - useful for miniscreens

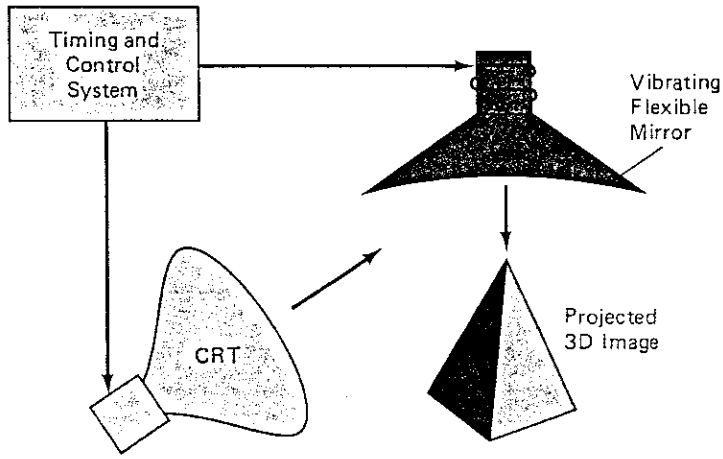
Laser Devices



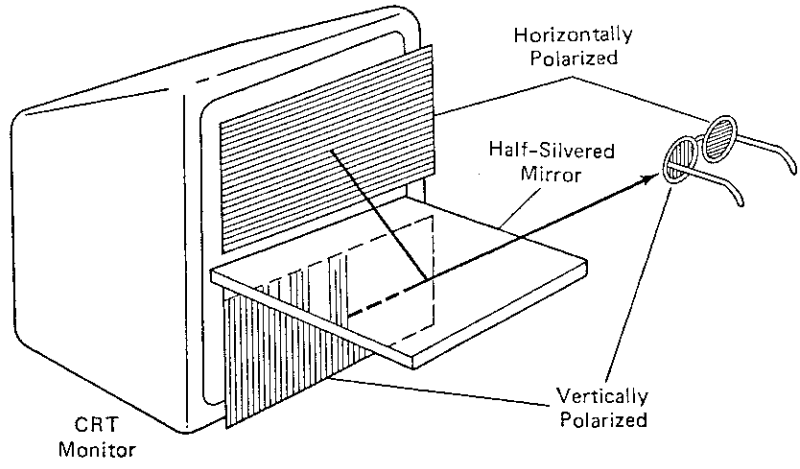
- deflect the laser beam with electromechanically controlled mirrors
- trace patterns on photochromic film
- project the image onto a screen
- change the image by advancing the film
- useful for very large screen projections

Three-dimensional Monitors

- varifocal mirrors
  - see figure 2-16 on page 39
  - synchronize mirror vibrations with the image presentation on the CRT



- stereoscopic views
  - polarized filters and half-silvered mirrors



  - bimodal projection
  - red and green images
  - shutters
  - head-mounted displays

HARD COPY DEVICES

- Film Recorders
- Printers
- Plotters

Printers

- generally available and acceptable for low quality output

impact printers

- line printers
- daisy-wheel printers
- dot matrix print heads
- see figure 2-18 on page 41

nonimpact printers

- ink-jet printers
- laser printers
- electrostatic printers
- electrothermal printers

color printers

- multicolored ribbons
- three-pass laser and xerographic printers
- three simultaneous ink jets

Plotters

- ink pen plotters
- laser beam plotters
- ink-jet plotters
- scoring plotters

ink pen plotters

- see figure 2-20 on page 43
- one or more pens mounted on a carriage or crossbar
- flatbed, drum or beltbed
  - see figure 2-21 on page 43 (a drum plotter)
  - see figure 2-22 on page 44 (a beltbed plotter)
- commands
  - raise pen
  - lower pen
  - move pen
- microprocessor for
  - lines
  - circles
  - ellipses
  - characters

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