

CSE 190: Virtual Reality Technologies

LECTURE #6: DISPLAYING 3D IMAGES



Announcements

Homework project 1 is due this Friday at 2pm

- To be demonstrated in VR lab B210
- One member of each team:
Upload code to TritonEd by Friday 2pm

Stereo Imaging: Concept

General concept: each eye sees a slightly different image

Example: Viewmaster:

left eye is shown one image on the disc, right eye sees a different image

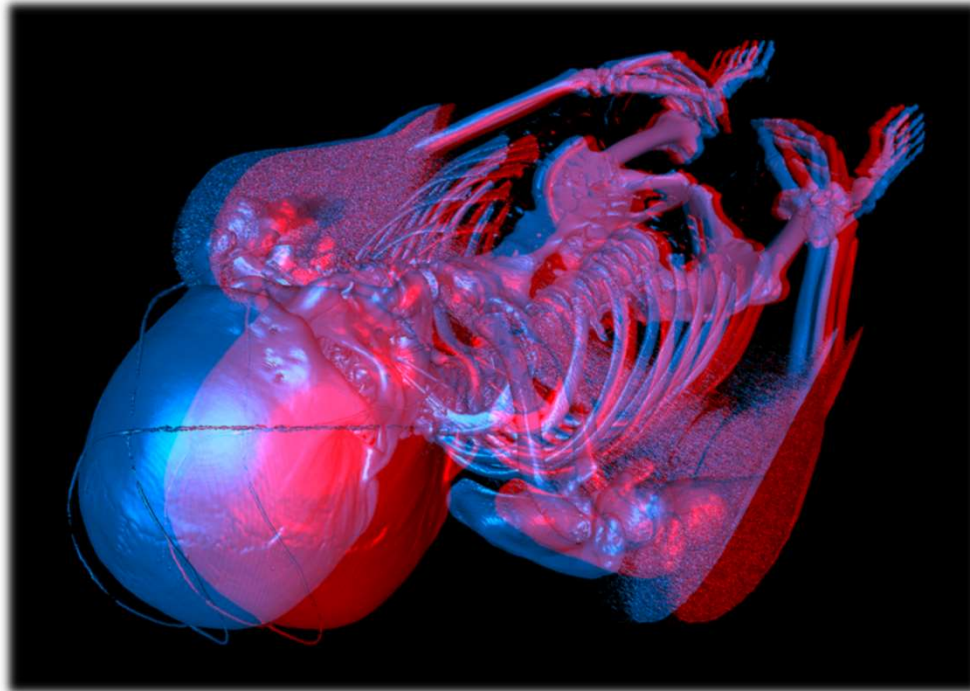


Stereo Imaging: Anaglyphic

Requires red/blue, red/green glasses

Color is diminished (but not entirely lost)

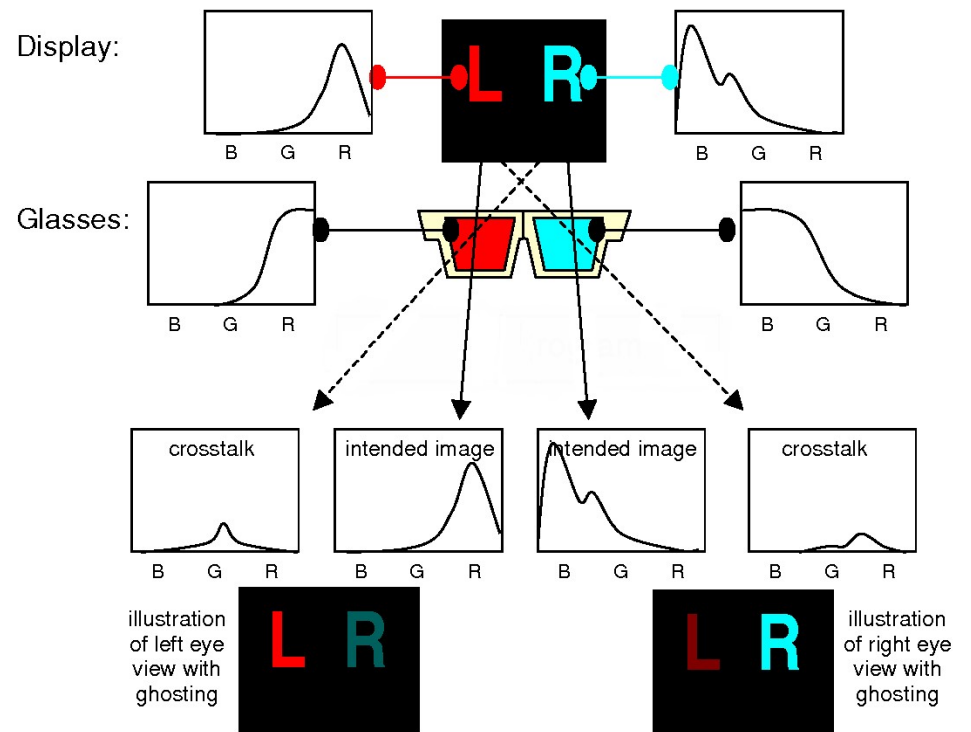
Example below: left eye: red, right eye: blue



Ghosting

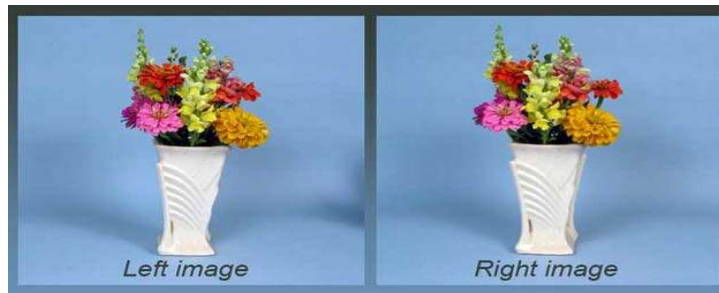
Ghosting is when a **secondary** “ghost” image can be seen along with the primary image

On stereo displays, the ghost image is the image displayed for the other eye, visible because of **insufficient filtering** by the stereo glasses

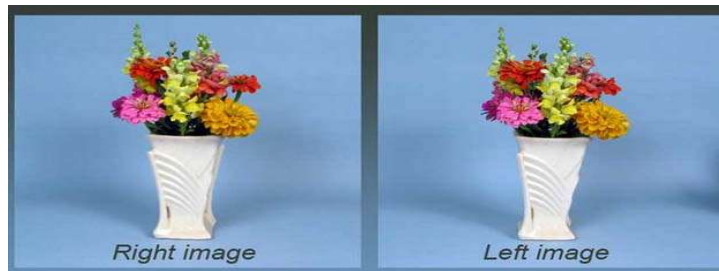


Stereo Imaging: Side-by-Side

Stereo can be seen by fusing images: converge eyes in front or behind the actual image plane



Eyes converge
behind image
plane



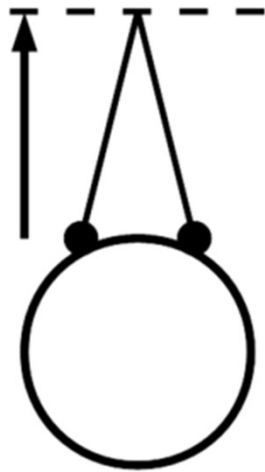
Eyes converge in
front of image
plane

Single Image Stereograms

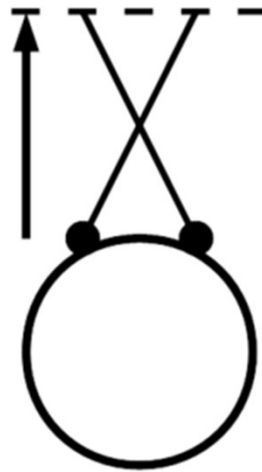
SIS: Single Image Stereogram

SIRDS: Single Image Random Dot Stereogram

No glasses required

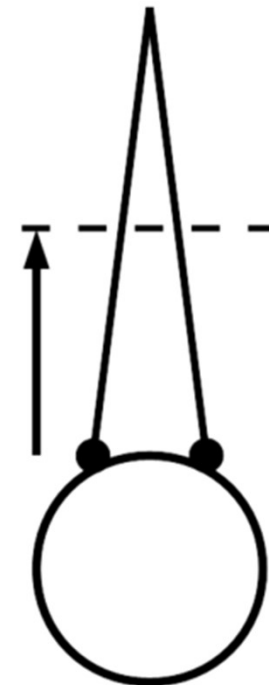


Aligned vergence and
accommodation
(normal viewing)



Cross-eyed
vergence.

Arrow: accommodation

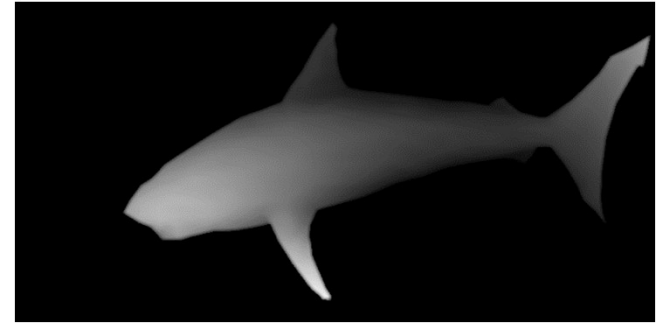


Wall-eyed
convergence

SIS Example



SIRDS Example



Stereo Imaging: Active Stereo

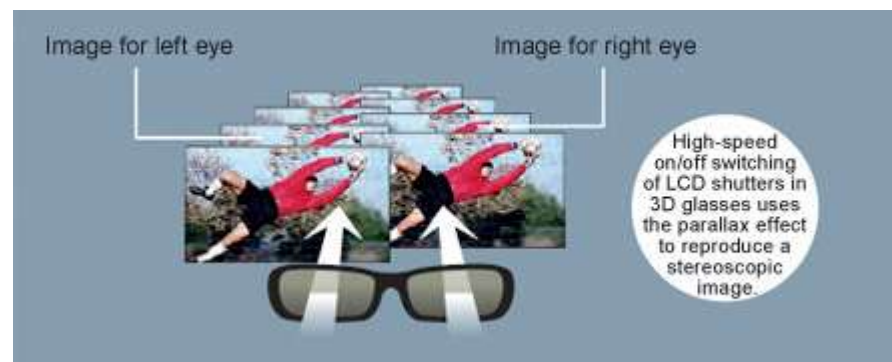
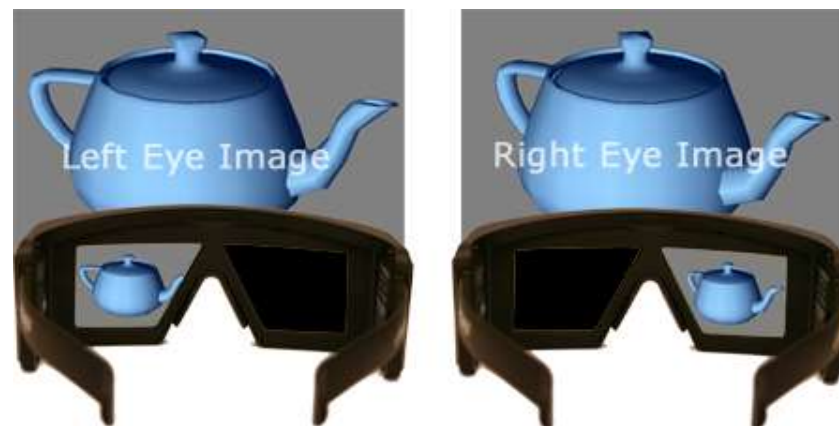
Display alternates between images for left and right eyes at 120+ Hz

Shutter glasses

- synchronized to display refresh rate
- more expensive than passive glasses (~\$30+)
- require batteries



3D shutter glasses



Stereo Imaging: Polarizing Filters

Linear polarization

Circular polarization: creates circularly polarized light by adding a quarter-wave plate after a linear polarizer

Polarizing glasses are inexpensive (~\$2-10)



Polarizing glasses



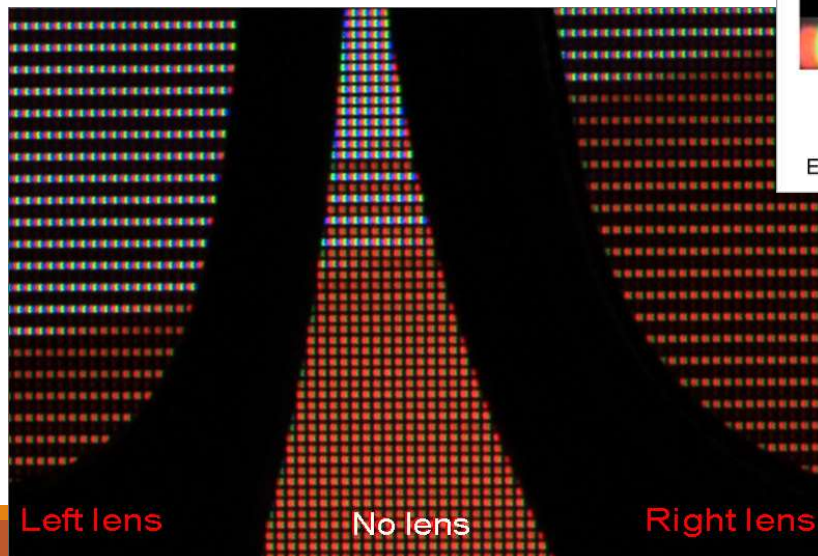
Stereo projectors

Passive Stereo Monitors

Filter on monitor polarizes
alternating pixel rows
clockwise/counter-clockwise

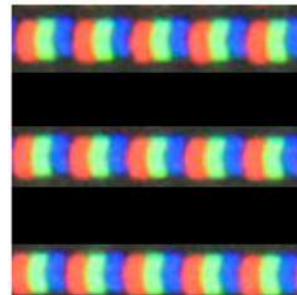
Best view point is on-axis

Off-axis viewers see ghosting



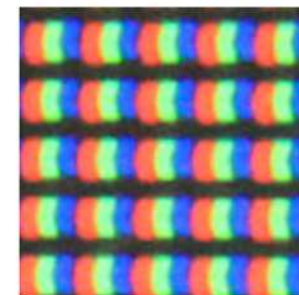
*Looking Closer at How Passive 3DTVs Work ...
Magnified views of 3DTV screen and typical monitor, at same scale*

Vizio E3D320VX 3DTV
32" diagonal
1920 x 1080



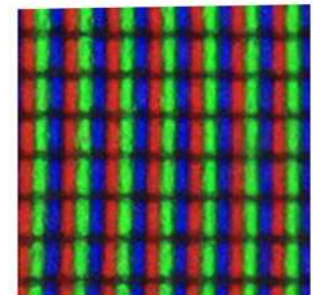
.728 mm / row
(3D mode)

Each eye sees 1/2 of the rows



.364 mm / row
(2D mode)

Acer H233H monitor
23" diagonal
1920 x 1080



.266 mm / row

Carl Pisaturo 2012

Stereo Imaging: Infitec

Clever technology, based on wavelength multiplexing

Two separate primary color triplets are filtered by glasses to generate two sets of primary colors

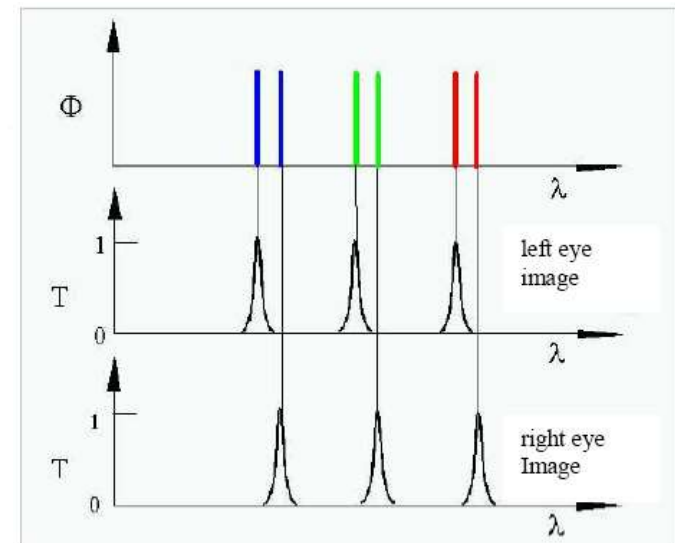
Infitec resulted from a research project at DaimlerChrysler



Projectors with Infitec filters



Infitec glasses



Primary color triplets

Autostereoscopic Displays

Light sent separately to each eye from a monitor

No headgear required

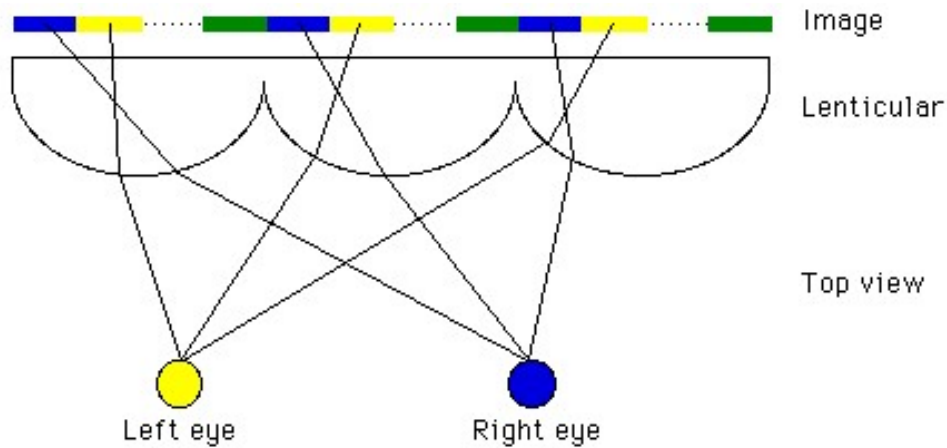
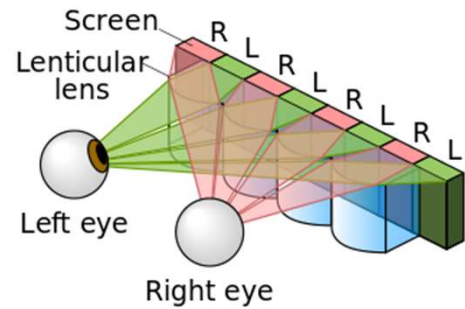
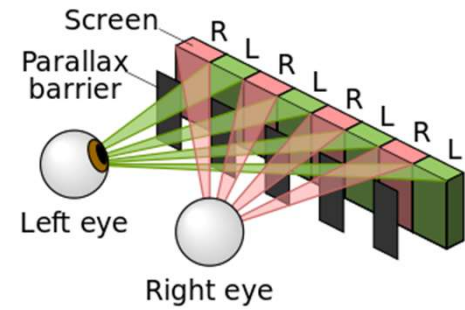
Tracked (dynamic) vs. non-tracked (static, sweet spot)

Approaches:

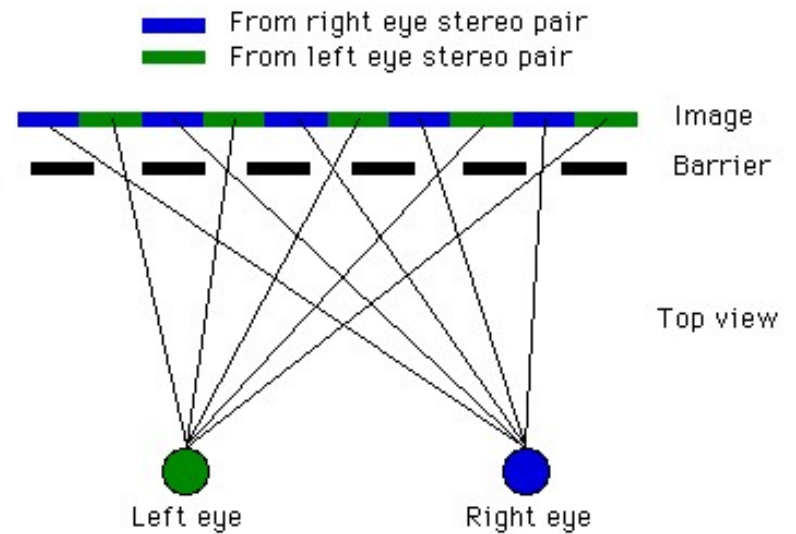
- lenticular screen
- barrier screen



Autostereo



Lenticular screen



Barrier screen