CSE 190: Virtual Reality Technologies

LECTURE #14: RENDERING TO HMDS

Upcoming Deadlines

Sunday, May 16: Project 3 due

Monday, May 17: Discussion Project 4

Sunday, May 23: Project 3 late deadline

Monday, May 24: Discussion Project 4

Sunday, May 30: Project 4 due

App Presentations

Matthew Engurasoff

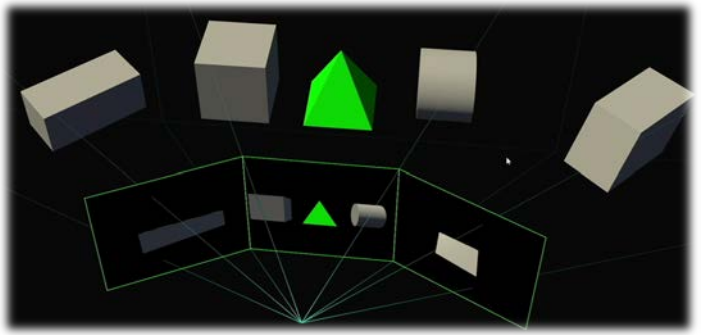
- Rhythm Dungeon

Shane Li

- Gorn

SMP

NVIDIA SMP (Simultaneous Multi-Projection)



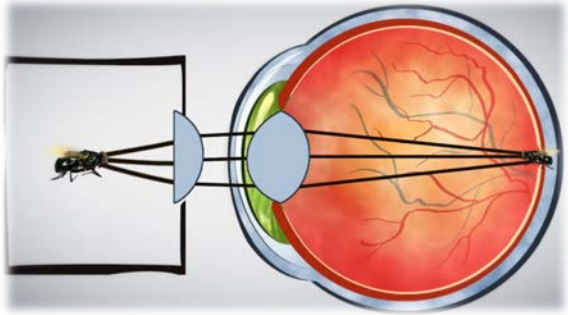
Up to 16 independent viewports can be projected simultaneously in one rendering pass

- Includes stereo (=2 viewports)

Video (1’50+): https://www.youtube.com/watch?v=p6NbyEmPalA

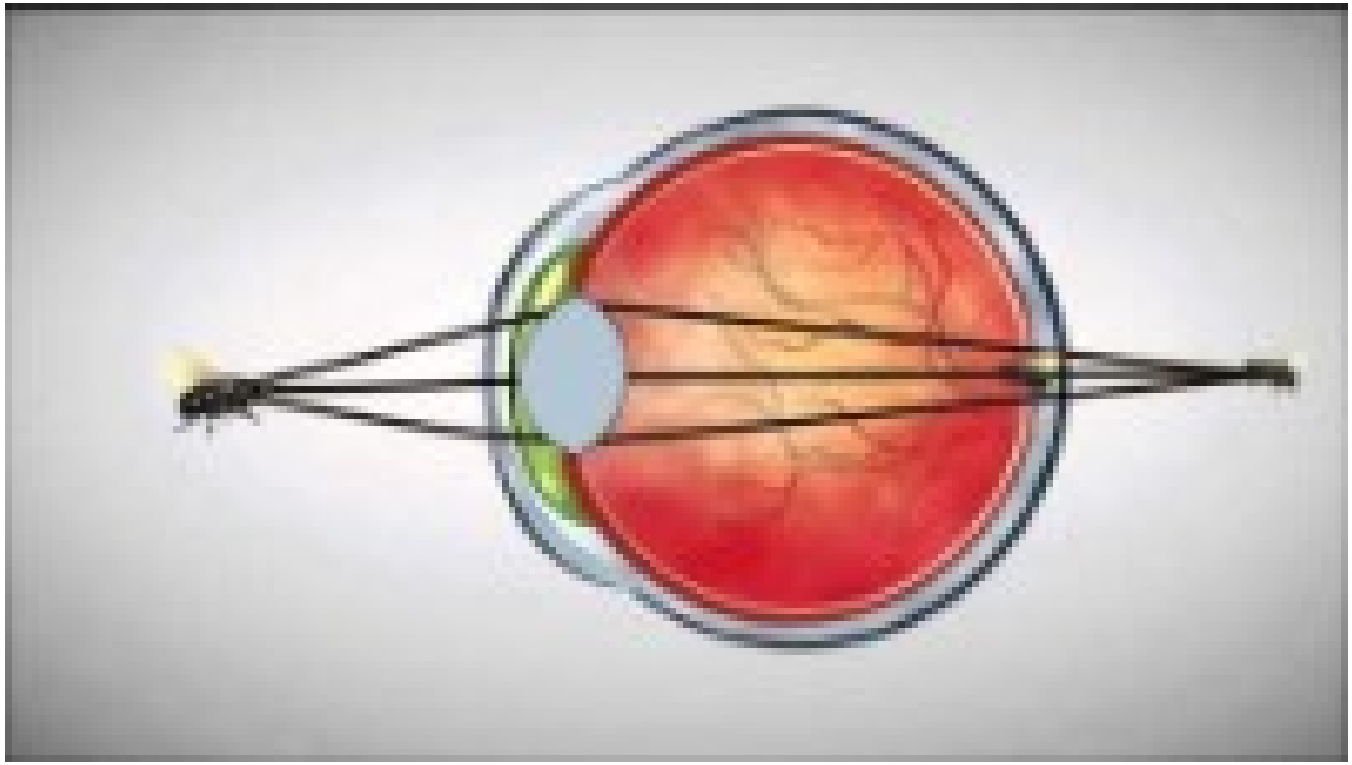
Display Limitations

Lenses for VR HMDs



How lenses for VR HMDs work:

- https://www.youtube.com/watch?v=NCBEYaC876A



Focal Distance

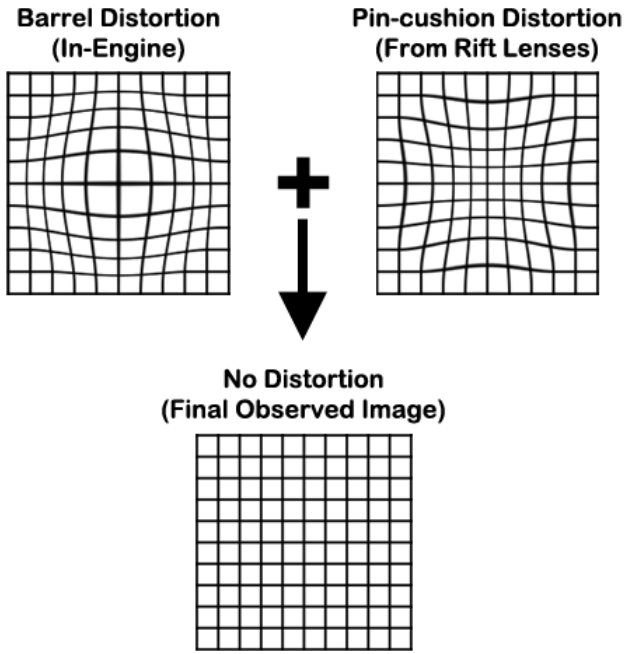
Apparent distance from eye to where the pixels are in focus.

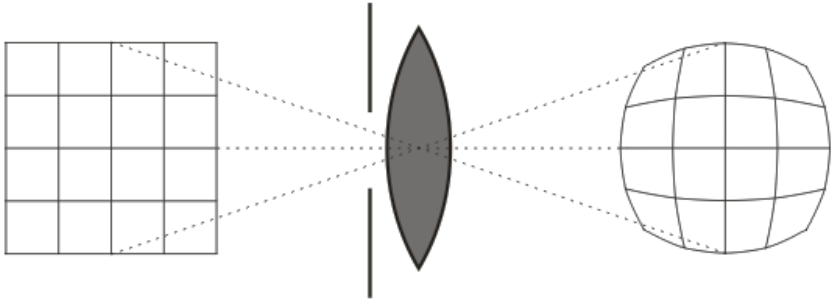
HMD	Focal Distance
Oculus DK1	Infinity
Oculus DK2	1.4 meters
Oculus CV1	2 meters
Oculus Quest 1 and 2	2 meters
HTC Vive, Vive Pro	~1 meter
Valve Index	Infinity

Lens Distortion

All VR HMDs have lenses which distort the image.

VR engine has to render a pre-distorted image so that the user will see a correct, undistorted image. A simple pixel shader can do this.

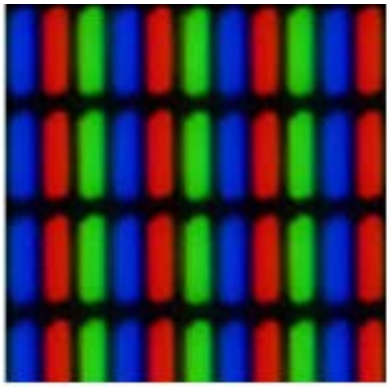




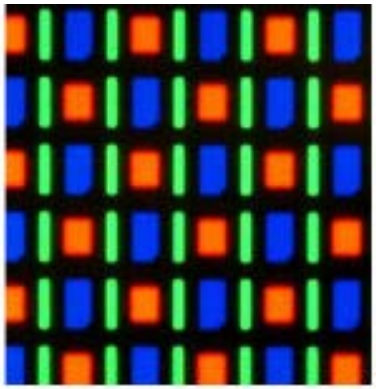
Lens Distortion

Screen Door Effect

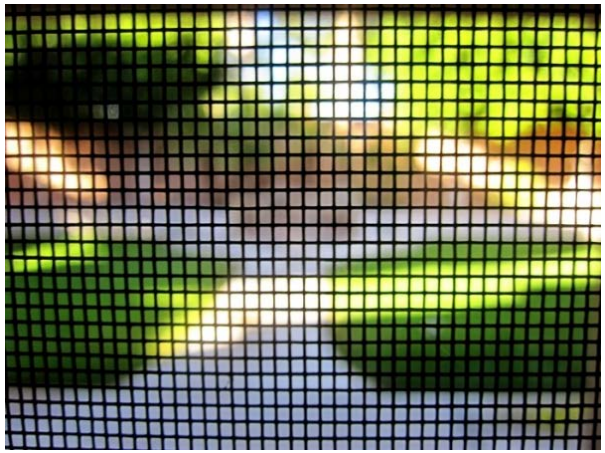
Because pixels on LCD and OLED displays have dead space in-between them image looks like looking through a screen door when looking at it through magnifying lenses.



LCD
DK1



OLED
DK2



Screen Door

Chromatic Aberration

Arises from the inability of a lens to focus all colors in the same place.

FOcal length depends on refraction.

blue and red light have different indexes of refraction → their focal length is also slightly different.

Chromatic aberration is clearly visible on photographs or video as the color channels are not perfectly aligned.

Remedy: apply “Brown's model” distortion correction formula to each color channel independently.