CSE 190: Virtual Reality Technologies

LECTURE #17: LIGHTFIELD TECHNOLOGY

Announcements

Project 3 due this Sunday, May 31st at 11:59pm

Next Monday: Discussion with TA Andrew and instructor

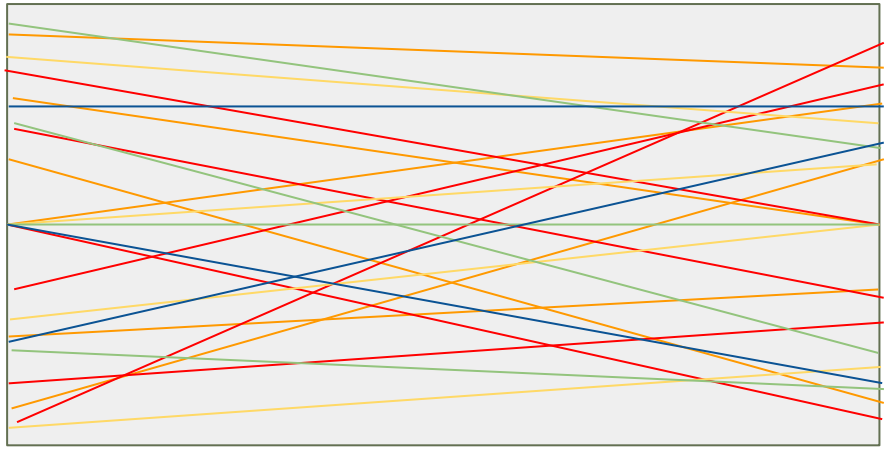
- Topic: final exam

Today's VR app presentations:

- Mitchell Zhang: VRaccoon
- Kevin Thai: Nintendo LABO VR

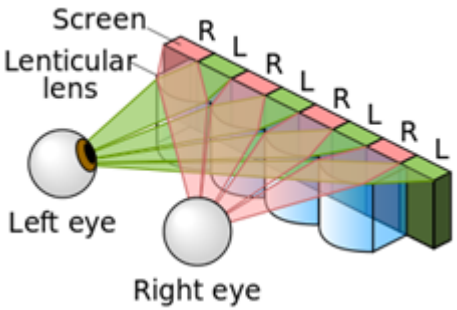
What is a Light Field?

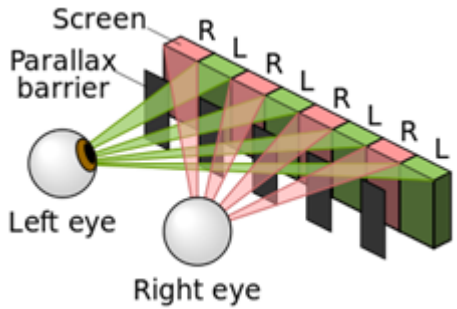
A function describing the radiance of light at every point (x, y, z) in space, in every direction (θ, ϕ)



Reminder: Autostereo Displays

Lenticular screen





Parallax barrier

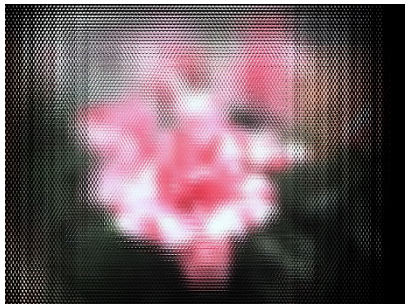
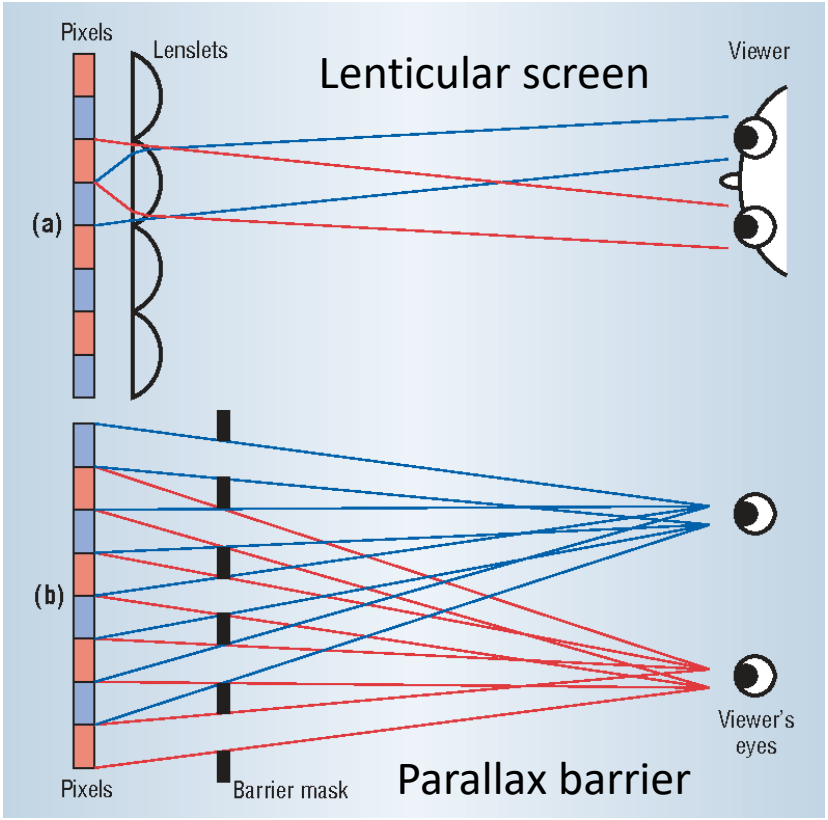
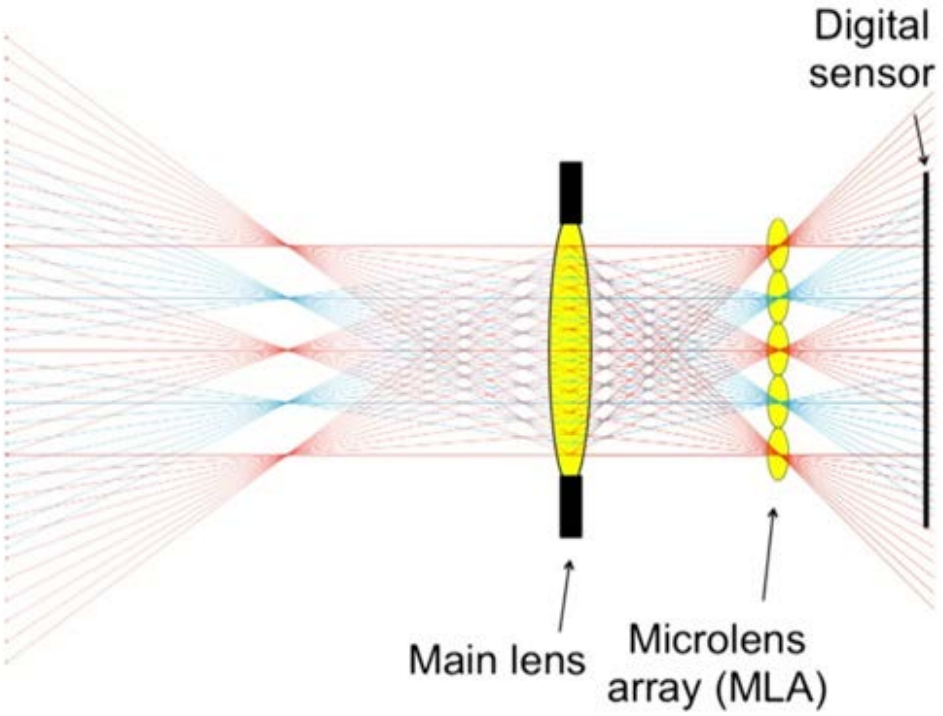


Image without autostereo filter

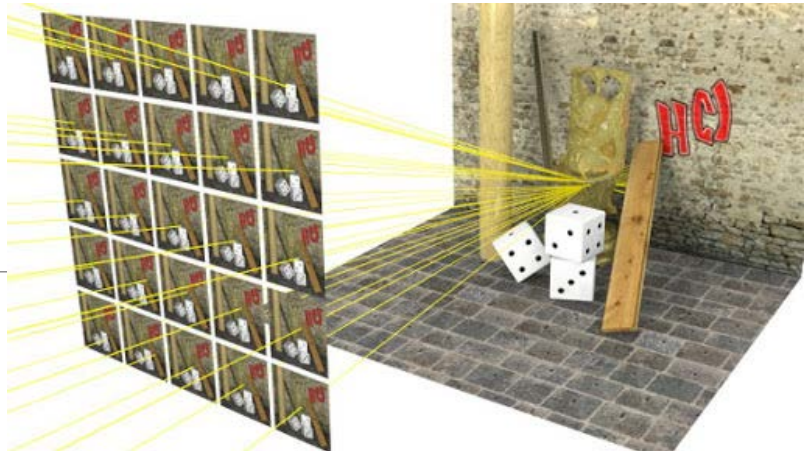


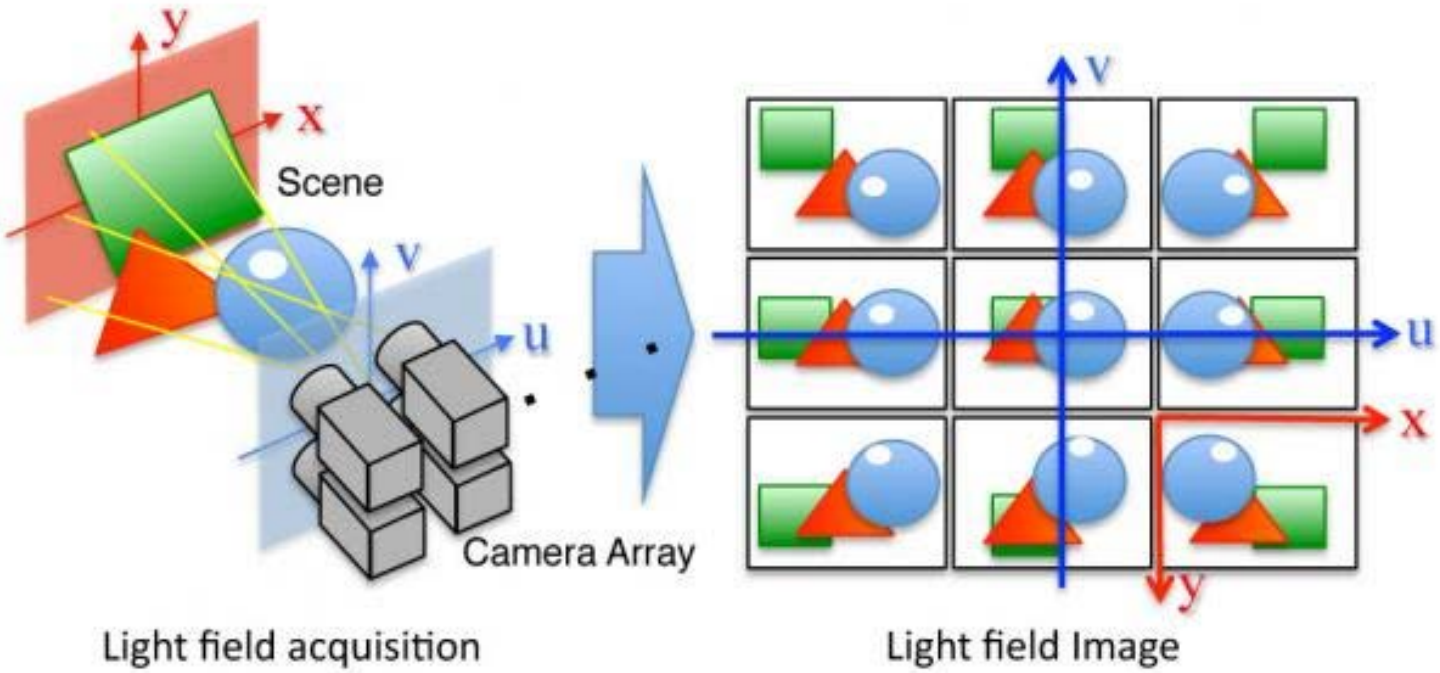
Lightfield Cameras

Micro-lens array captures light from different directions



Lightfield for 3D Image Capture





Lightfield Display

Nvidia presentation at Siggraph 2013

https://www.youtube.com/watch?time_continue=4&v=f_CkJCZ3Uxw

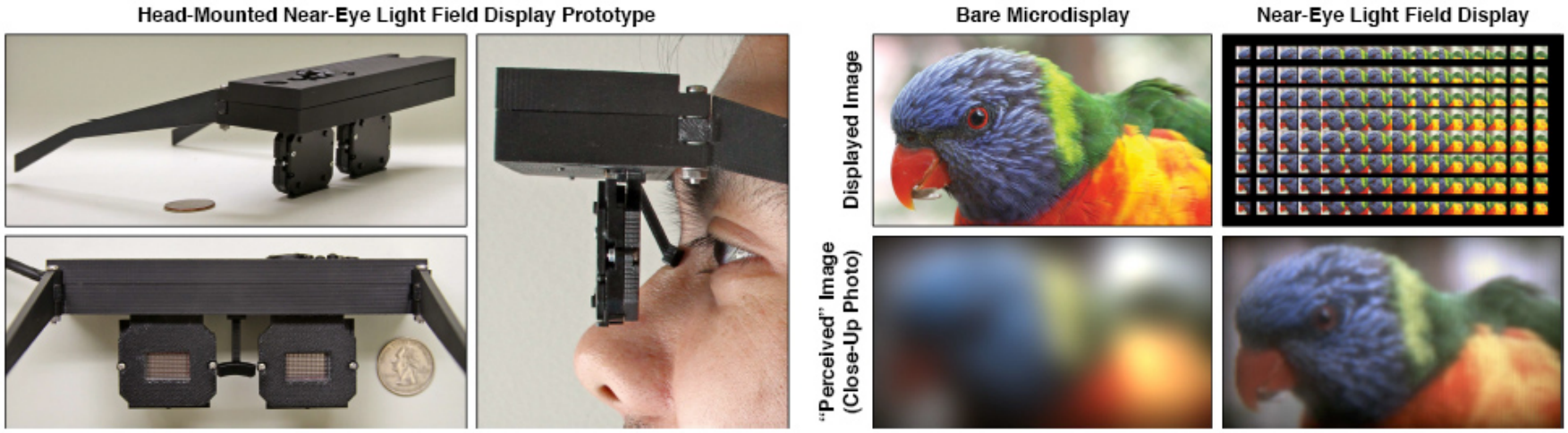


Figure 1: *Enabling thin, lightweight near-eye displays using light field displays. (Left) Our binocular near-eye display prototype comprises a pair of OLED panels covered with microlens arrays. This design enables a thin head-mounted display, since the black box containing driver electronics could be waist-mounted with longer OLED ribbon cables. (Right) Due to the limited range of human accommodation, a severely defocused image is perceived when a bare microdisplay is held close to the eye (here simulated as a close-up photograph of an OLED). Conventional near-eye displays require bulky magnifying optics to facilitate accommodation. We propose near-eye light field displays as thin, lightweight alternatives, achieving comfortable viewing by synthesizing a light field corresponding to a virtual scene located within the accommodation range (here implemented by viewing a microdisplay, depicting interlaced perspectives, through a microlens array).*

Some of the following slides are from:

The Eye and Near-Field Optics in Hololens and Magic Leap

ANDREW JONES, NUMAIR KHAN,
AND ELEANOR TURSMAN
BROWN UNIVERSITY

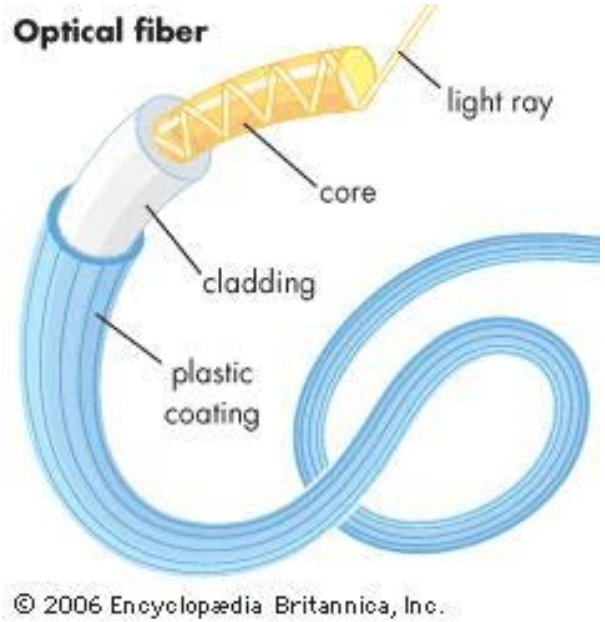
Waveguides

What: tool that controls movement of EM or sound waves while restricting power loss over travel time

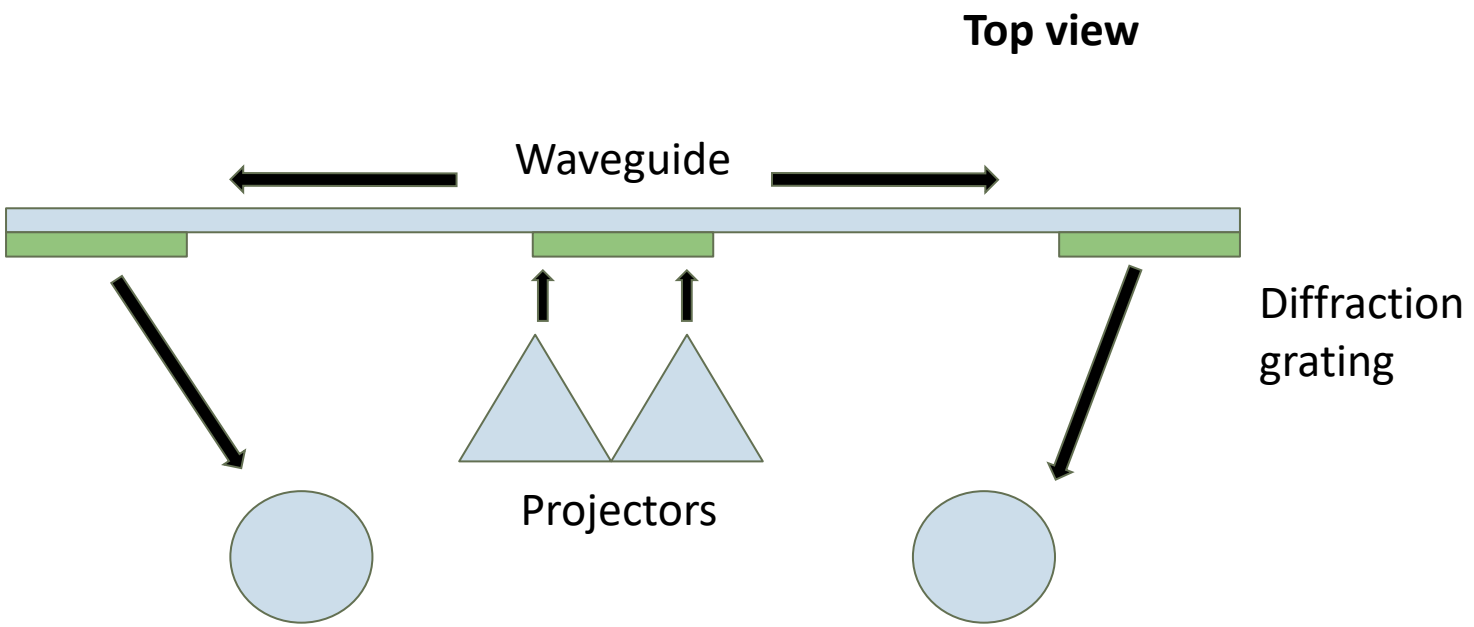
Types:

- Different shapes
- Diffractive
- Holographic
- Polarized
- Reflective, etc.

For AR applications: use diffractive or holographic techniques



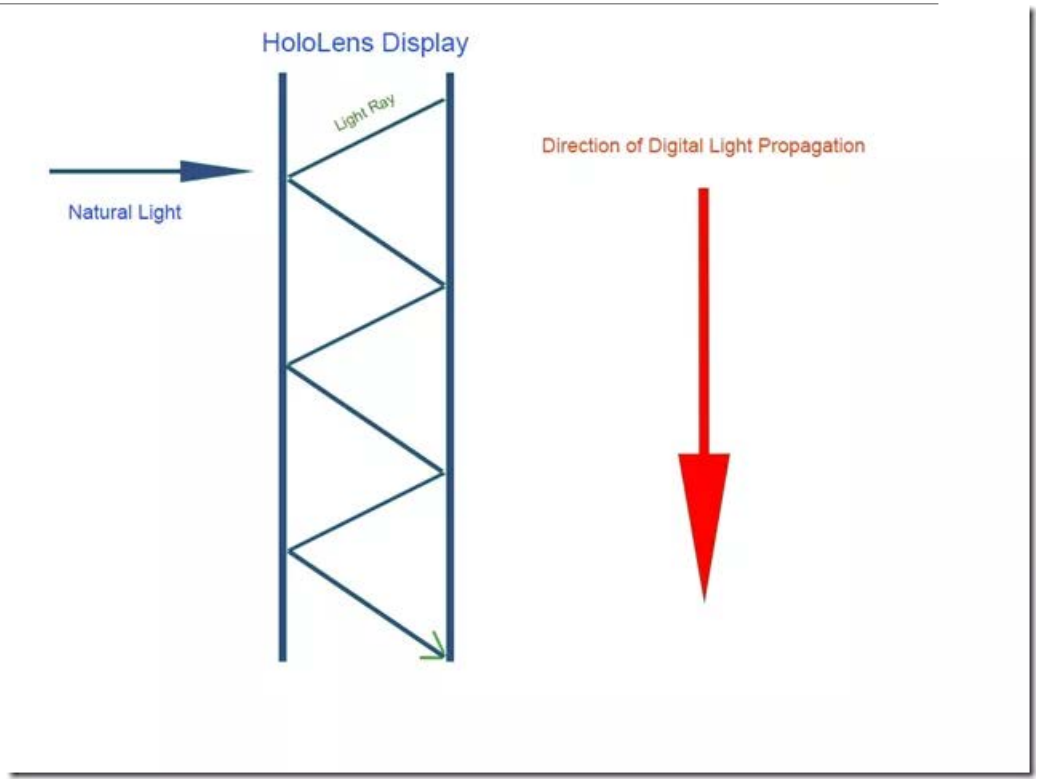
Hololens



Hololens — Waveguide

Lens = planar (holographic/diffractive) waveguide

Total internal reflection



http://www.imaginativeuniversal.com/blog/post/2015/10/17/how-hololens-displays-work.aspx

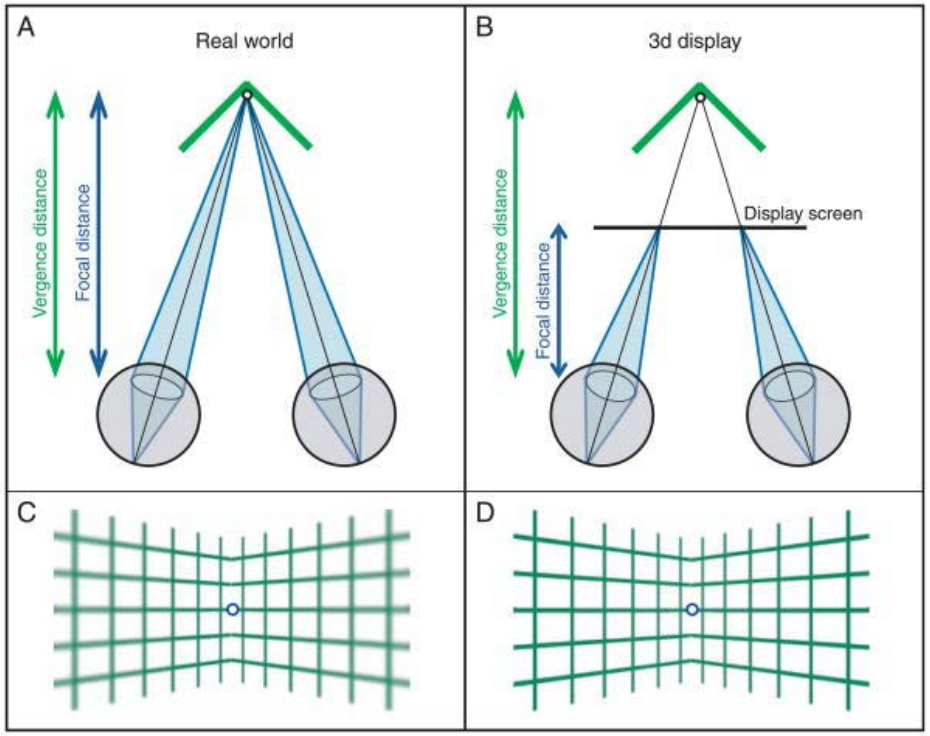
Hololens — Diffractive extraction

Three diffractive elements for RGB

https://mspoweruser.com/secrets-of-hololens-optics-revealed/

Hololens keeping every object in focus:

Vergence-Accommodation Conflict: Everything in Focus



Hoffman, D. M., Girshick, A. R., Akeley, K., & Banks, M. S. (2008). Vergence–accommodation conflicts hinder visual performance and cause visual fatigue. *Journal of Vision*, *8*(3), 33.1–3330. http://doi.org/10.1167/8.3.33


A WITHIN ORIGINAL | IN PARTNERSHIP WITH LYTRO
TRIBECA FILM FESTIVAL 2017
HALLELUJAH
MARCHÉ DU FILM
FESTIVAL DE CANNES

Hallelujah

Hallelujah: the world's first Lytro VR experience

- Presented at ACM SIGGRAPH 2017

Hallelujah trailer:

- https://www.youtube.com/watch?v=6fdH6piDl2Y

Behind the scenes (1’00 – 7’45 and 18’35-19’25):

- https://youtu.be/JSHqFToUkVc?t=59
- https://youtu.be/JSHqFToUkVc?t=1114