AR Headsets

Tue, July 7 (Week 3)
Computer Display Color System

Figure 11: Optical see-through HMD conceptual diagram
Computer Display Color System
Collimated Light & Eye Box

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Figure: Eye (black) inside the eye box (green) in front of a display (blue)
Interpupillary Distance & Binocular Disparity

From collimated lights, pixels are angles, not positions.

Same angles with larger interpupillary distance (IPD) mean longer distances.
IPD & VR Headsets
The Problem with Focal Length

In most cases, an optical device with lenses can have only one focal length.
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In most cases, an optical device with lenses can have only one focal length.

Different binocular disparity, but same focal length...
Field of View

Human Field of Vision (around 150° x 120°)

Typical VR Headset today (around 90° x 90°)

MagicLeap One (40° x 40°)

Hololens (30° x 17.5°)

DAQRI Smart Glasses (34° x 18°)

AR/VR Field of View Comparison

HoloLens 30°

Magic Leap One 40°

PlayStation VR ~100°
Spatial Sound

Head-related transfer function (HRTF)
Spatial Sound

HRTF is a complicated function that depends on frequencies of sound, the positions of the source and listener, and the structure and material of the surrounding space...
## Regarding the Focal Length Problem

<table>
<thead>
<tr>
<th></th>
<th>Project North Star</th>
<th>HoloLens 1</th>
<th>Magic Leap 1</th>
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</thead>
<tbody>
<tr>
<td>1 Focal Length (≈ 0.5 m)</td>
<td>$300 (2018)</td>
<td>$3000 (2015)</td>
<td>$2300 (2018)</td>
</tr>
<tr>
<td>2 Focal Lengths (≈ 1 or 3 m)</td>
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Light Field Display

A possible improvement for displays, in terms of focal lengths, but in the future yet.