

Light-Field 3D Videoconferencing

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GPU day

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1. Videoconferencing and light-fields
2. Light-field 3D displays
3. Capturing light-fields with cameras
4. Light-field conversion
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Videoconferencing and light-fields

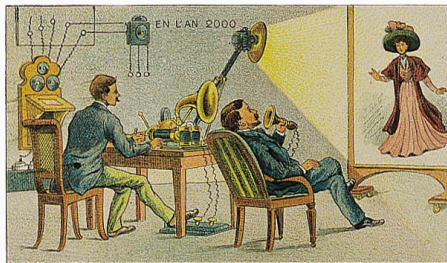
2D Videoconferencing is nothing new

2005, Skype

1959, Moon landings on TV

1936, Reich Postzentramt

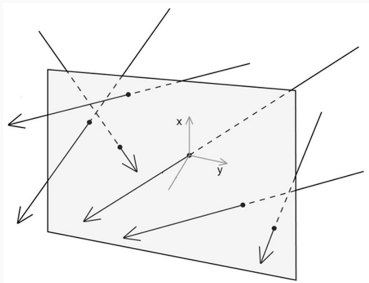
1920, Bell Labs



Concept art for 2000 (1910)

capture → *compression* → *transmission* → *decode* → *display*

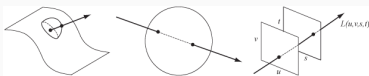
What is the Light-field (LF)



“The **light-field** is a vector function that describes the amount of light flowing in every direction through every point in space.”

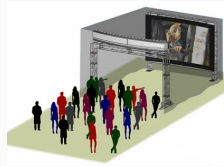
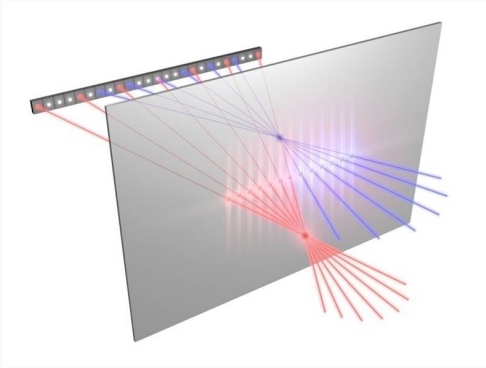
4D ray space

Basically a **window of light**.



Light-field 3D displays

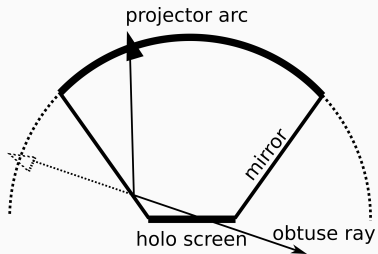
Horizontal parallax for now



Human sized display

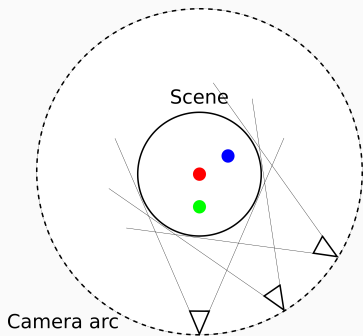
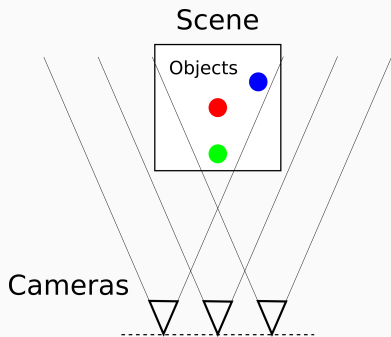


High FOV:



Capturing light-fields with cameras

Camera systems



How to capture light-field?



<http://mitchmartinez.com/bullettime/>

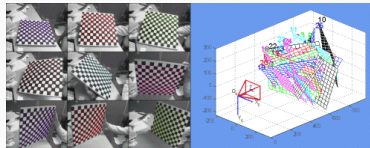
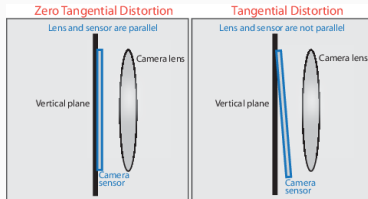
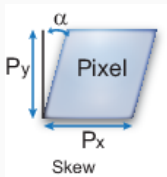
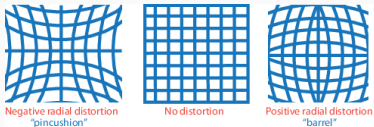
Camera arrays

- Image stream from all cameras
- Parameters as metadata
- **Bad sampling of LF**
- Calibration difficulties

Calibrated parameters

- Positions
- Directions
- Field-of-view
- Distortions
- Color

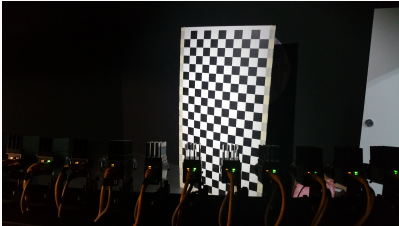
Camera distortions



Our camera arc

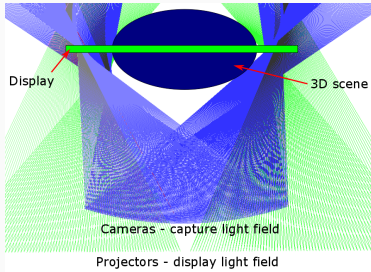
Camera selection criteria

- small size, dense :), bad quality :(
- <1000Eur, still bad quality :(
- GigE, not USB :)



Light-field conversion

Matching capture to display light-field



4D interpolation:

- Preprocessed look-up-table
- Depth aware interpolation?



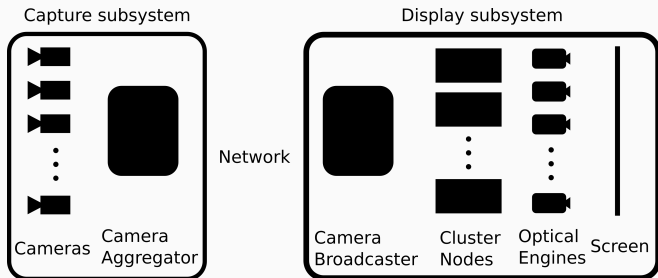
Issues:

- Depth sensor arc?
- Lower resolution
- Temporal flickering
- Edge uncertainties

Even blur is better :(

The prototype system

The schematic of the system



Cameras:

- 96 cameras, 1280 x 1080
- 2.7m distance, 120° arc
- no compression

Display:

- 100megaray display
- almost 180° FOV
- 100ms latency on LAN

Compression: bandwidth latency trade-off

Input: camera images

Output: individually or jointly
compressed streams

30-40ms latency for individual
x264

With enough GPUs on both sides!

- NVidia: NVDEC, NVENC
- Intel: Quick Sync
- AMD: VCE

Joint compression is not realtime

Demonstration I - also video



Demonstration II



Hologram Conference Room
exhibition in Seoul

Discussion

2-way telepresence camera location

- Different display technology
- Camera arc above display
- Gaze correction?
- View synthesis?
- LF interpolation

Reality check: adoption issues (wikipedia)

- Eye contact
- Appearance consciousness
- Signal latency
- Bandwidth and quality of service
- Complexity of systems
- Perceived lack of interoperability
- Expense of commercial systems

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