

# Light Field Transfer: Global Illumination Between Real and Synthetic Objects

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presented by Yi Hua & Eric Huang

# Overview

How to place a synthetic object in a real scene convincingly?

- consistent direct lighting in both scene
- model light interaction between real and synthetic scene



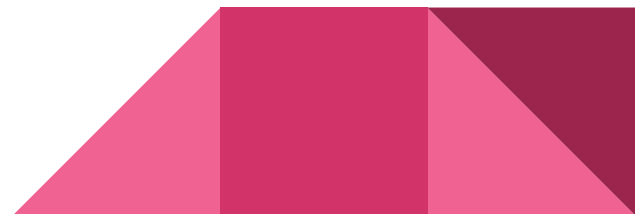
# Features

Light field interface, only 4D dataset

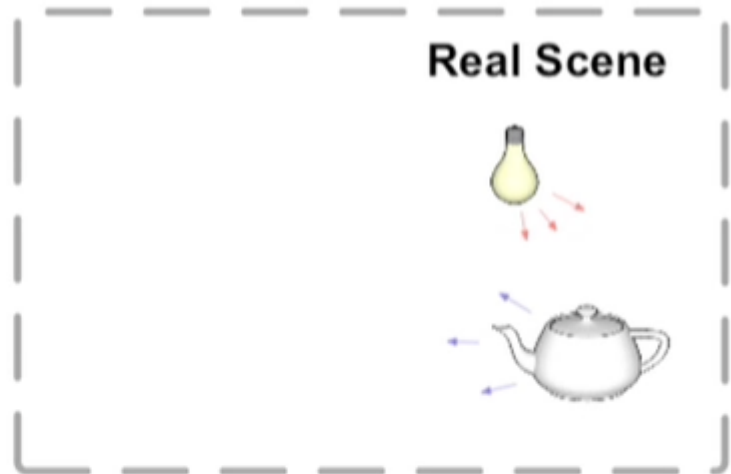
Rendering properties for real scene not necessary

Multiple bounces of global illumination

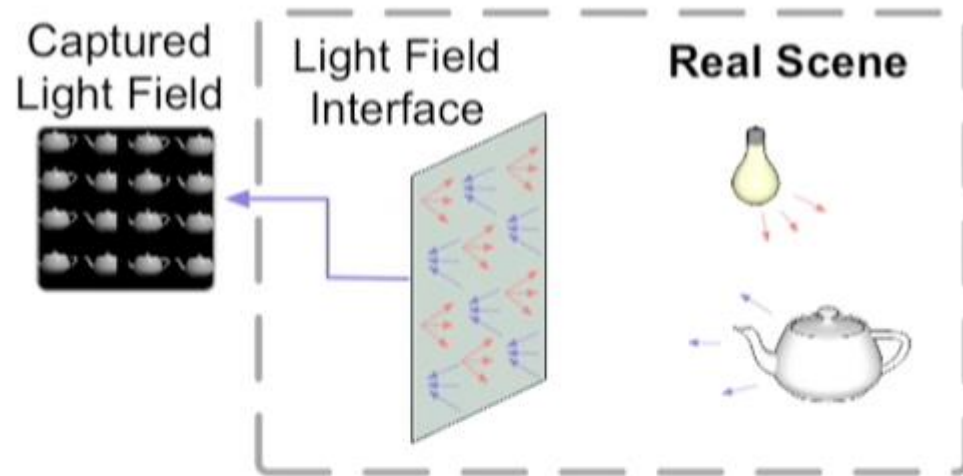
Near real-time (dynamic scenes)



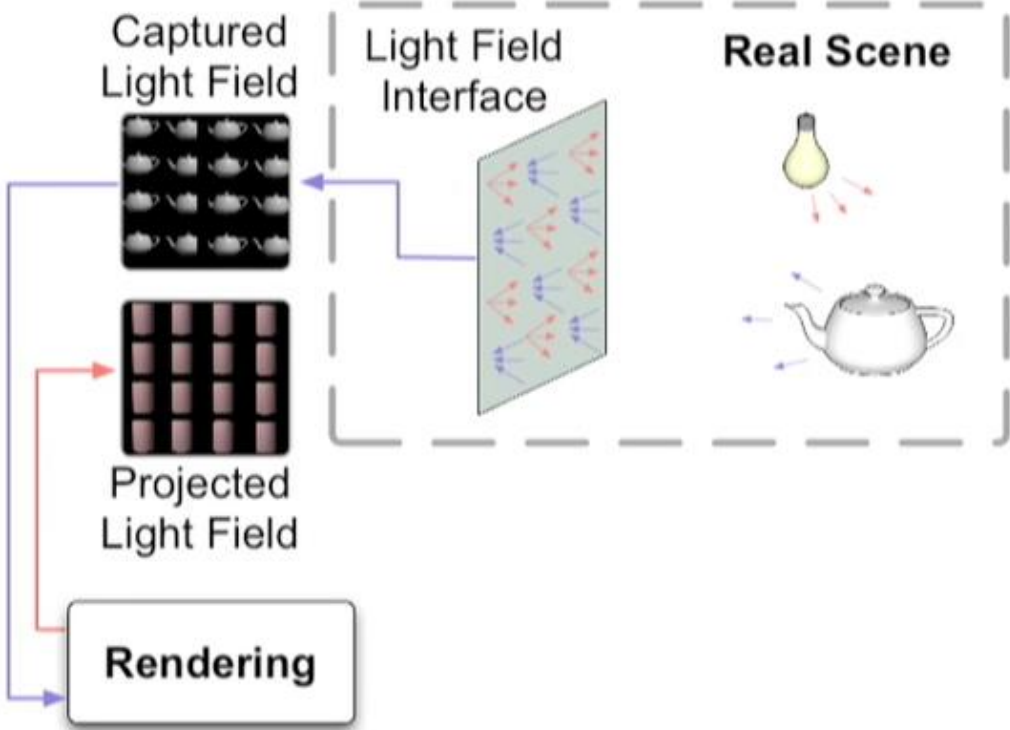
# Method



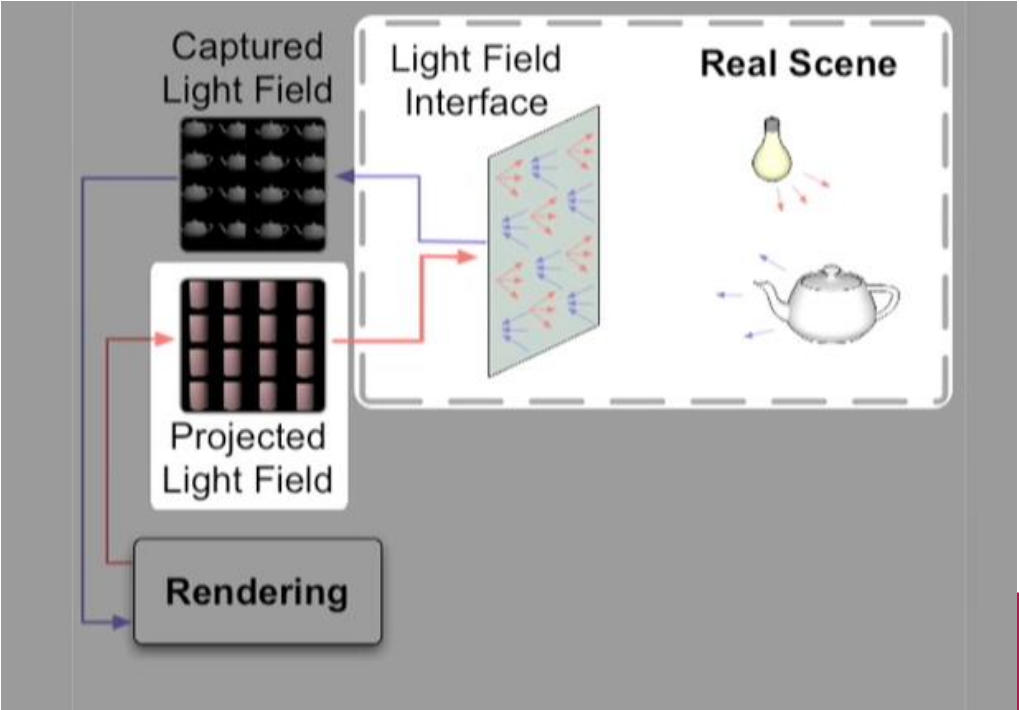
# Method



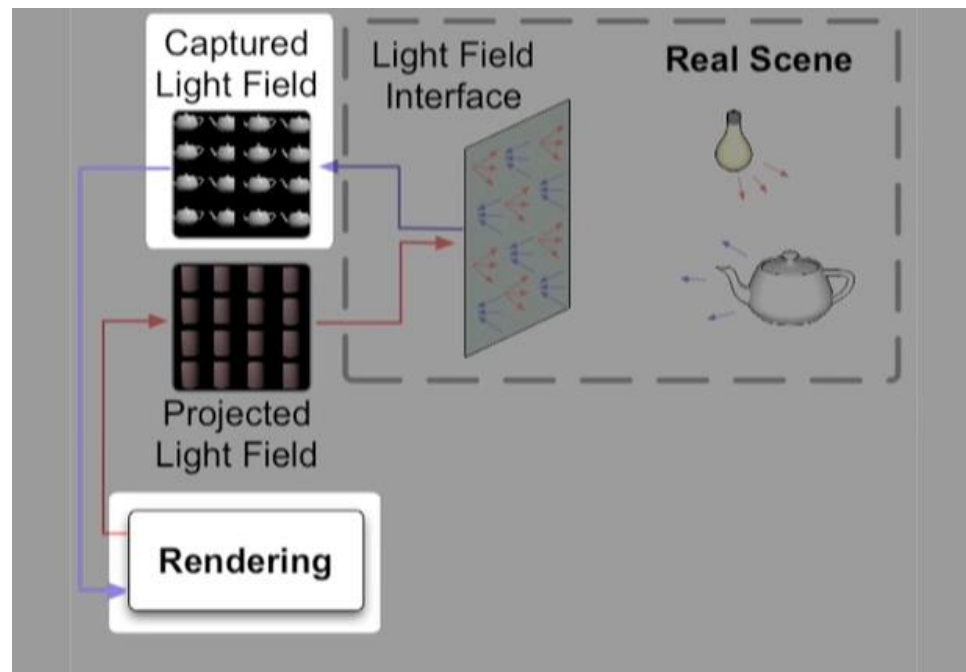
# Method



# Method



# Method





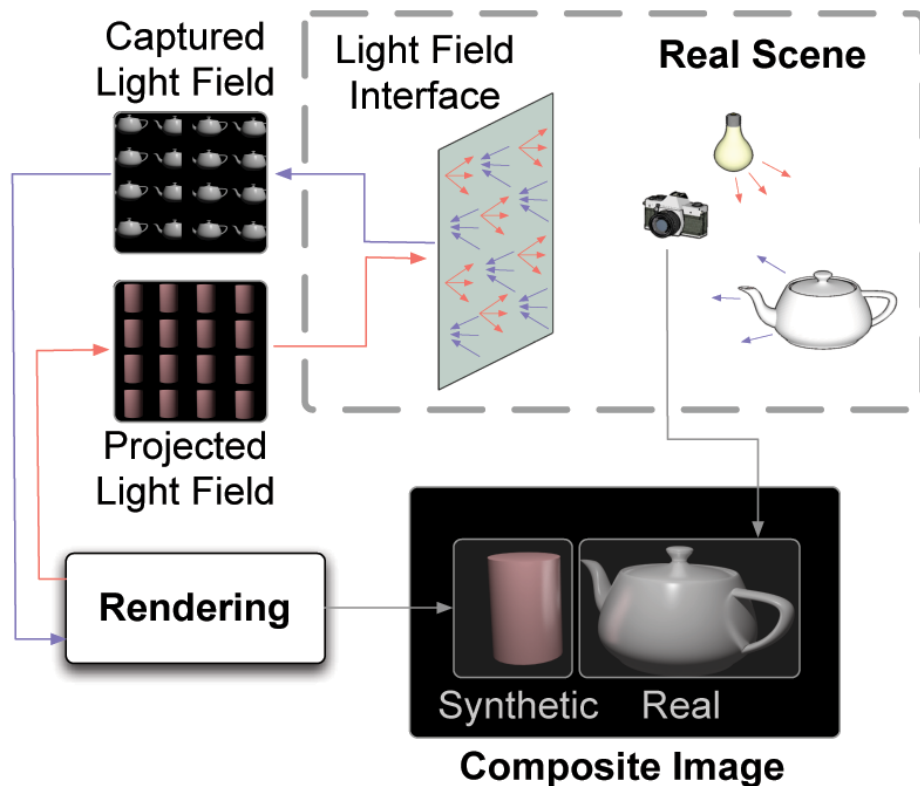
# Method

Light field interface, only 4D dataset

No rendering properties for real scene

Multiple bounces of global illumination

Near real-time (dynamic scenes)

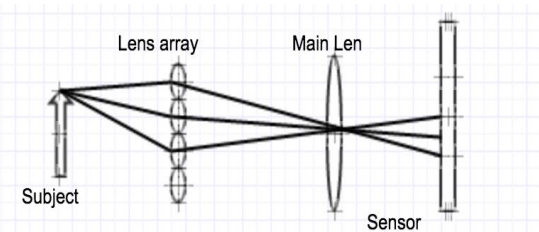
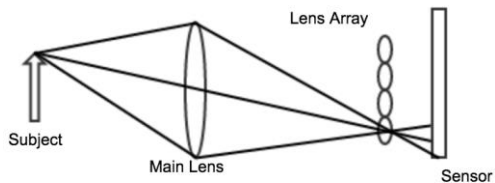


# Setup

Multiplexing with lens array

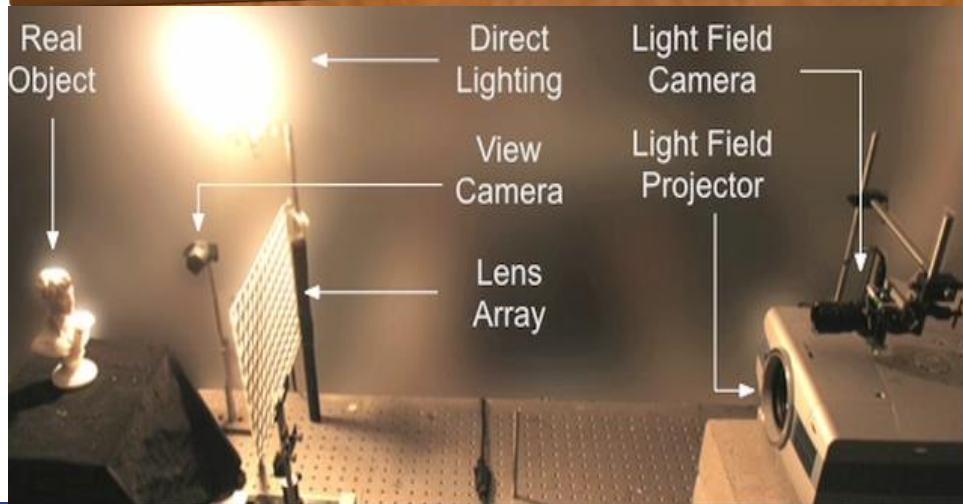
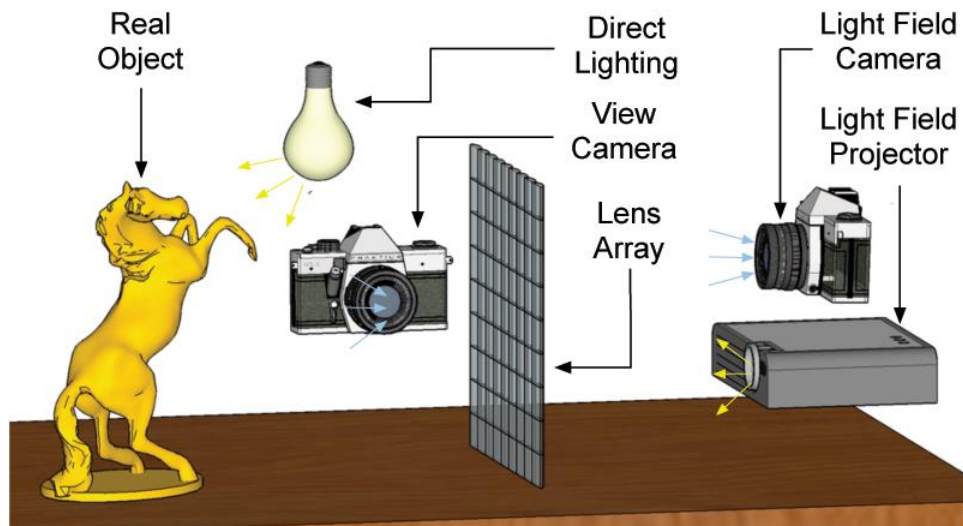
\*refer: *Hand-held Plenoptic Camera*

Different Lens arrangement



\**Hybrid Eye*

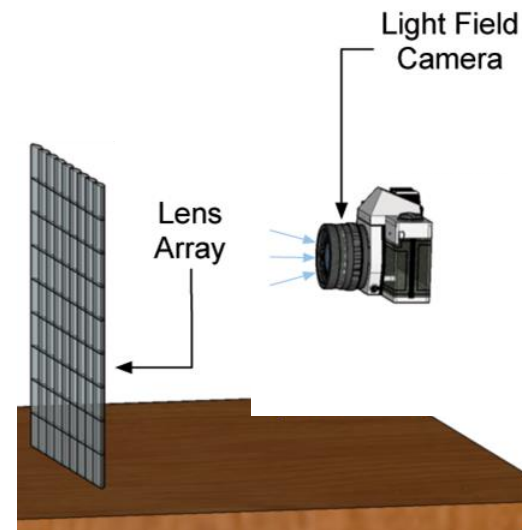
*Magic Leaps*



# Calibration

Lens array:

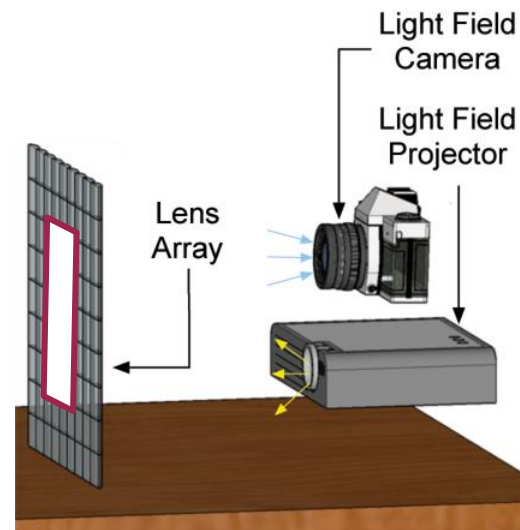
- identical intrinsics for all lens
- radial distortion
- optical center
  
- homography between lens array coord. & image coord.



# Calibration

Light field projector and camera:

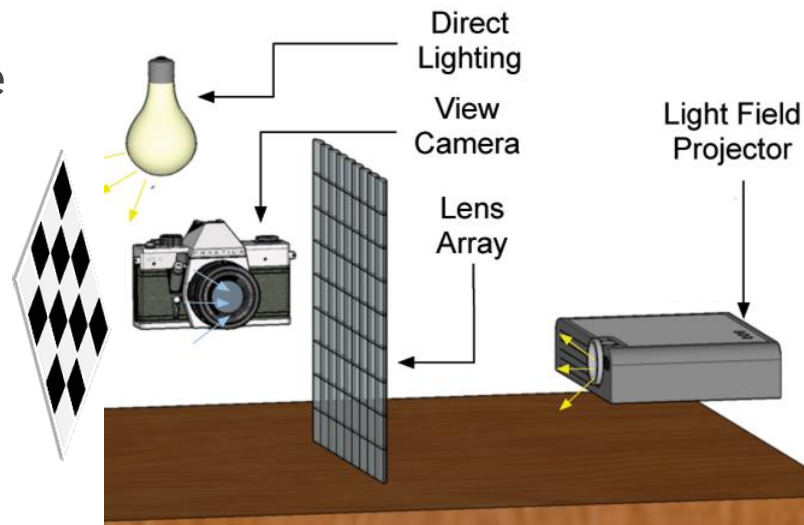
- homography between projector and camera obtained by projecting a rectangle



# Calibration

Real and virtual scene:

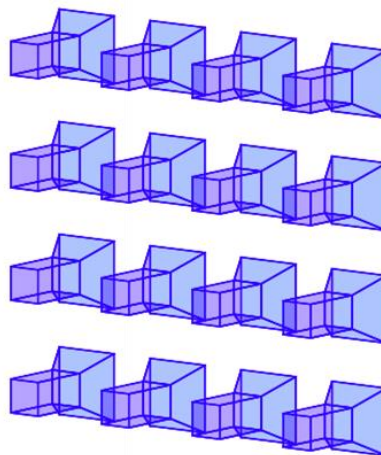
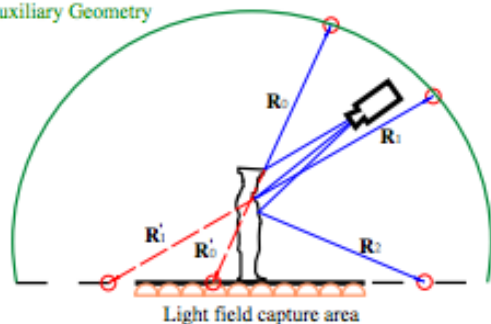
- place checkered plane in synthetic scene
- capture light field & project on diffuse surface in real scene
- locate checkered plane in real scene



# Rendering

full light field -> set of projective light sources

Auxiliary Geometry



Captured  
Light Field



Projected  
Light Field

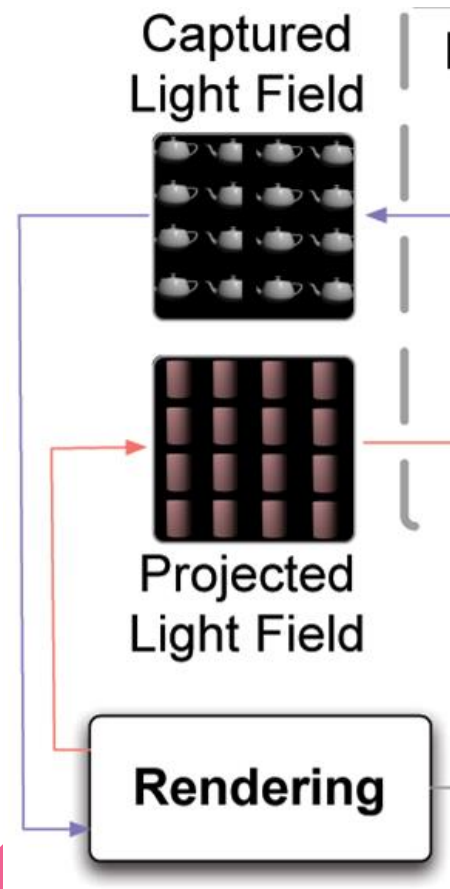
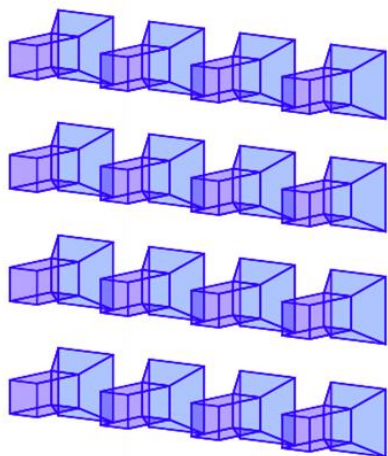


Rendering

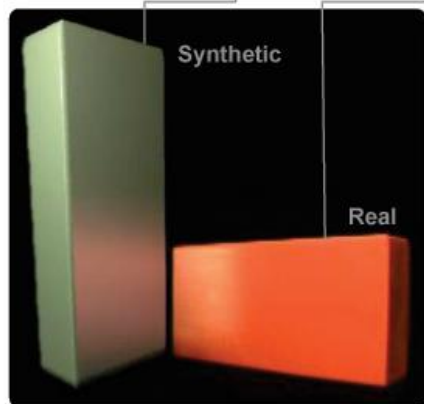
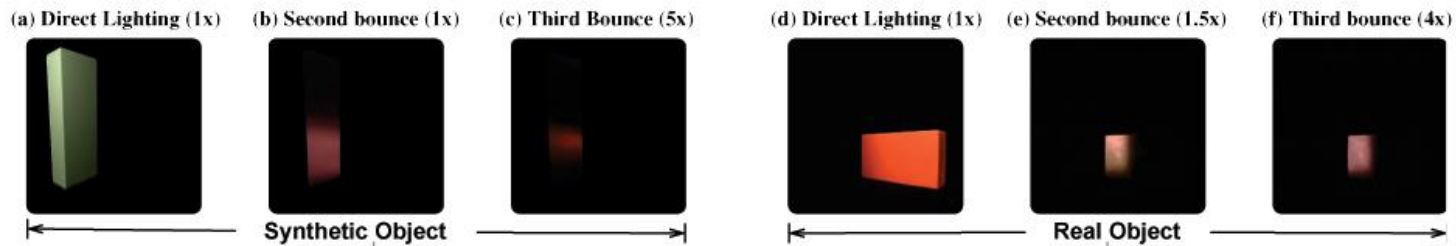


# Rendering

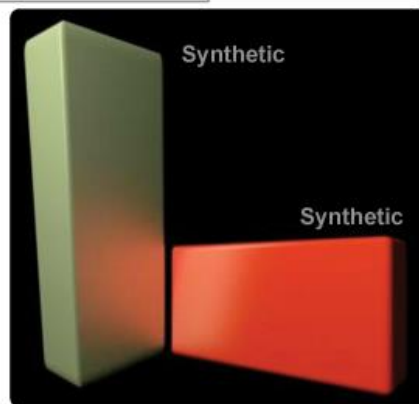
capture virtual scene light field: set of virtual cameras



# Rendering



(g) Light field transfer rendering



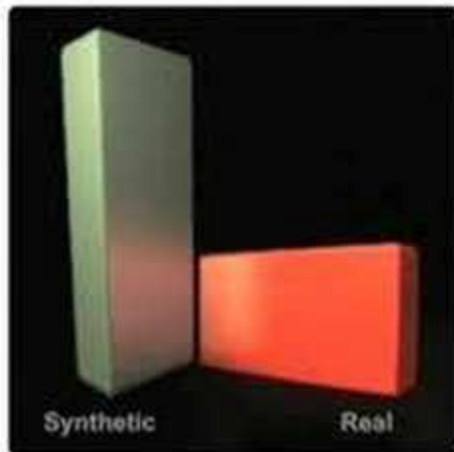
(h) Pure path-traced rendering

Iterative Light Transfer

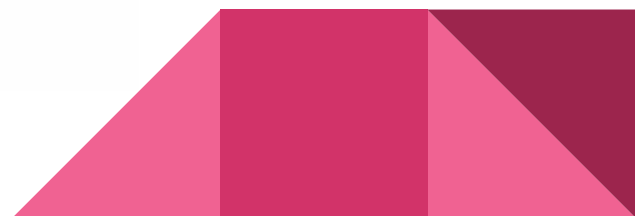
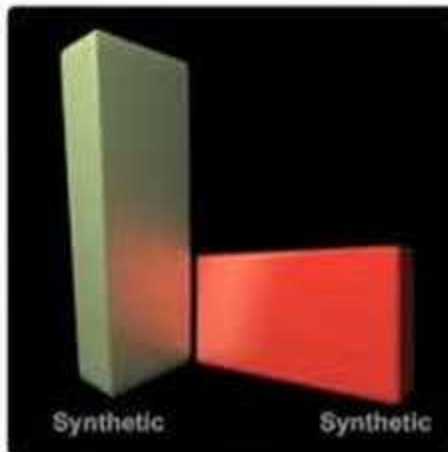


# Results

Light Field Transfer



Path Traced



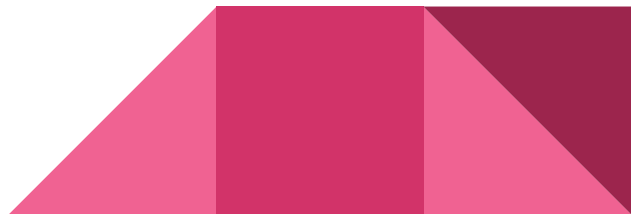
# Current Limitations

- Real objects and synthetic objects do not occlude each other
  - non-planar light field interface
- Single point light source
  - light probe
- Non-linear mapping in color between camera and projector
  - calibration



# Limitations

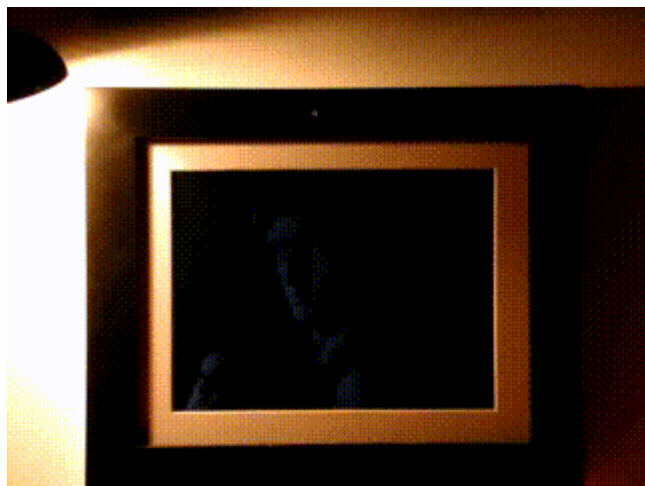
- Cannot shadow illumination of real objects
- Limited dynamic range light field transfer (24-bit color projector)
- Mirror reflections require large number of samples
- Online method requires synthetic models to be finished at the time of rendering



# Related work

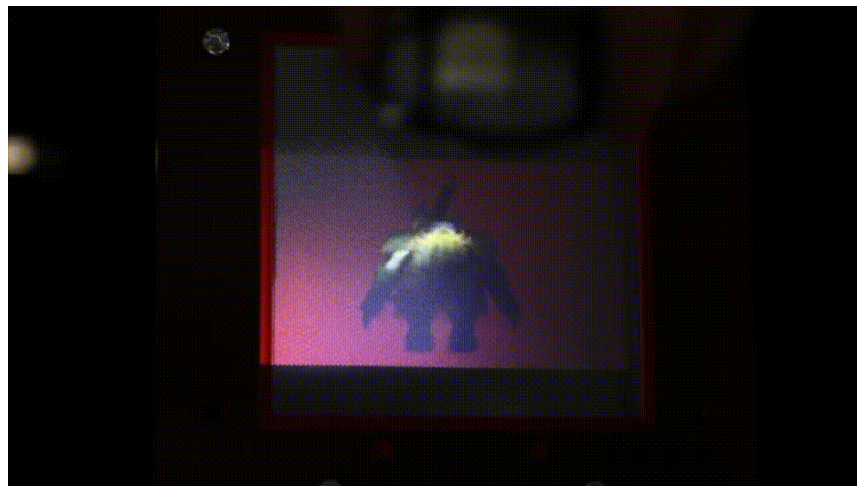
## Lighting Sensitive Display

S.K. Nayar, P.N. Belhumeur and T.E. Boult,



## 8D: Interacting with a Relightable Glass-Free 3D Display

Matthew Hirsch, Shahram Izadi, Henry Holtzman, Ramesh Raskar



# Rating: 1.5

## PROs:

- Inspiring idea
- Practical implementation
- Introduces new opportunities for visual effects and augmented reality applications

## CONs:

- Method is still restrained in lab setting
- Results are only evaluated qualitatively

## PRO or CON?

- Didn't get into the details of implementation



Questions?

