Image-based Modeling and Rendering

1. Introduction

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Outline
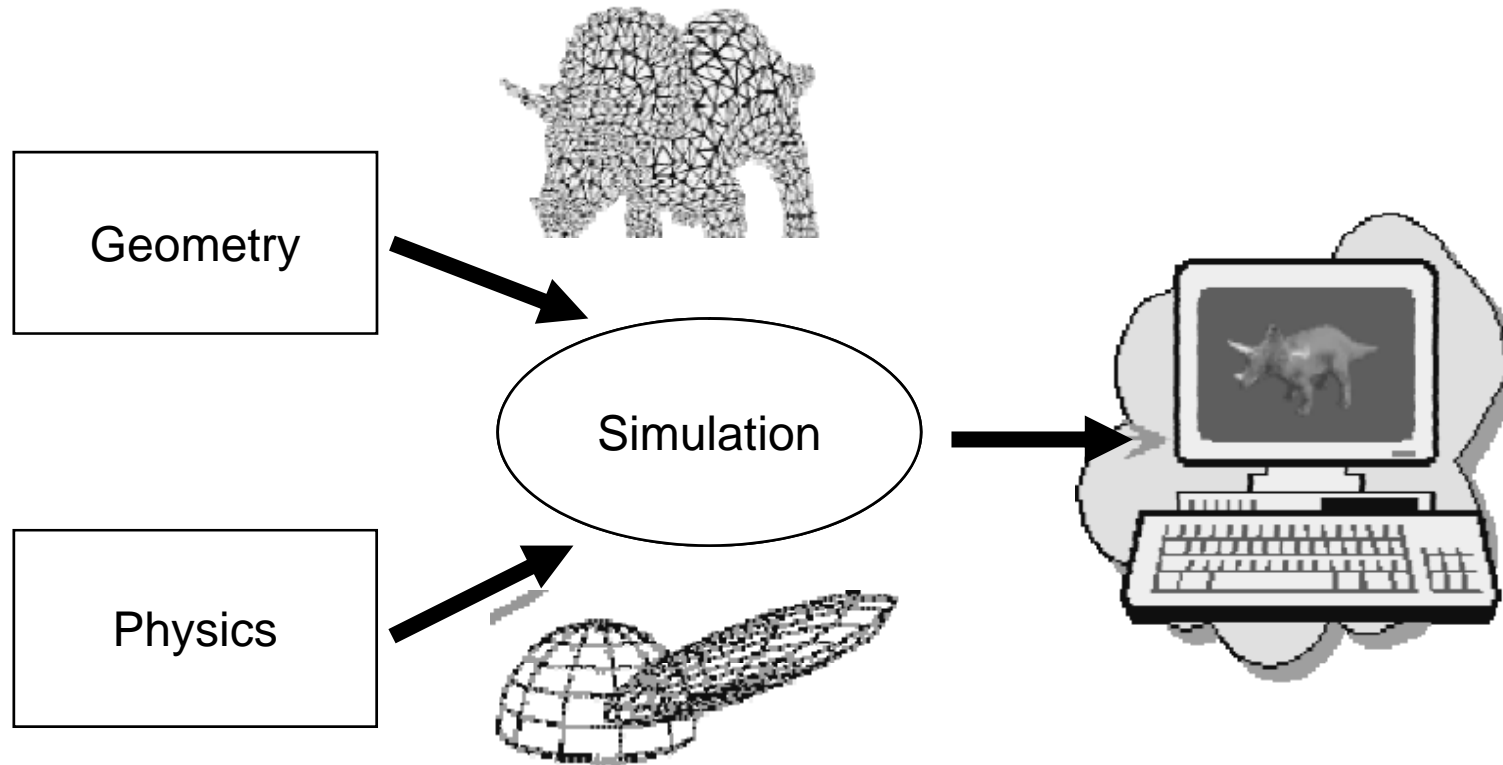
- What're Image-based approaches?

- When should I use IBMR techniques?

Ref: SIGGRAPH'99 Course Notes "IBMR"

Conventional 3-D Graphics

Simulation

Geometry

Physics

Simulation

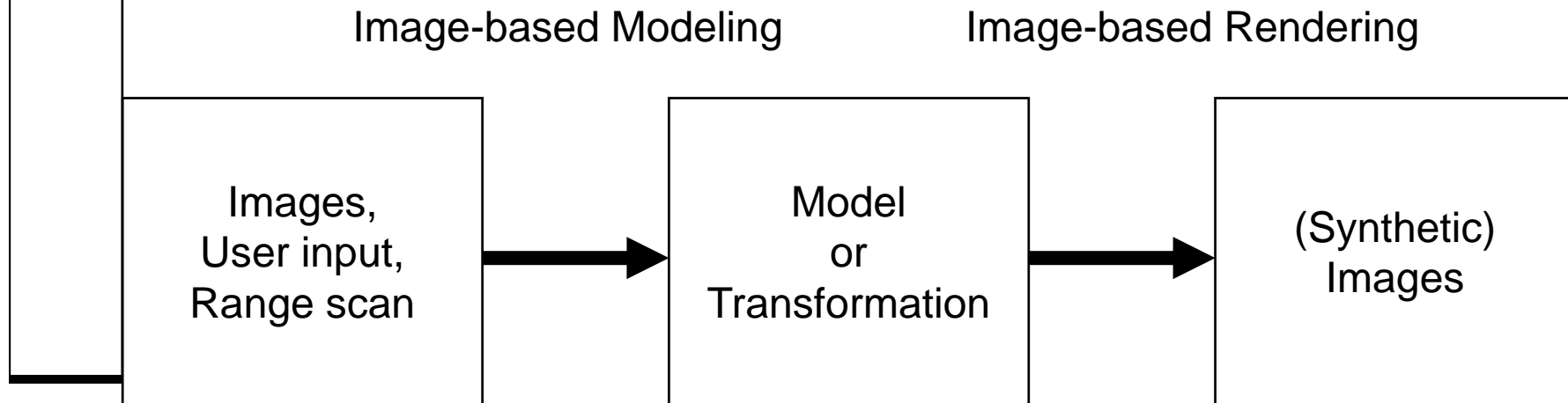# Computer Vision

Analysis

What's IBMR?

Image-based Modeling   Image-based Rendering

Images, User input, Range scan	→	Model or Transformation	→	(Synthetic) Images

The Image-Based Approach

Images → Analysis & Re-project → Images

Images → Analysis → Geometry → Simulation → Images
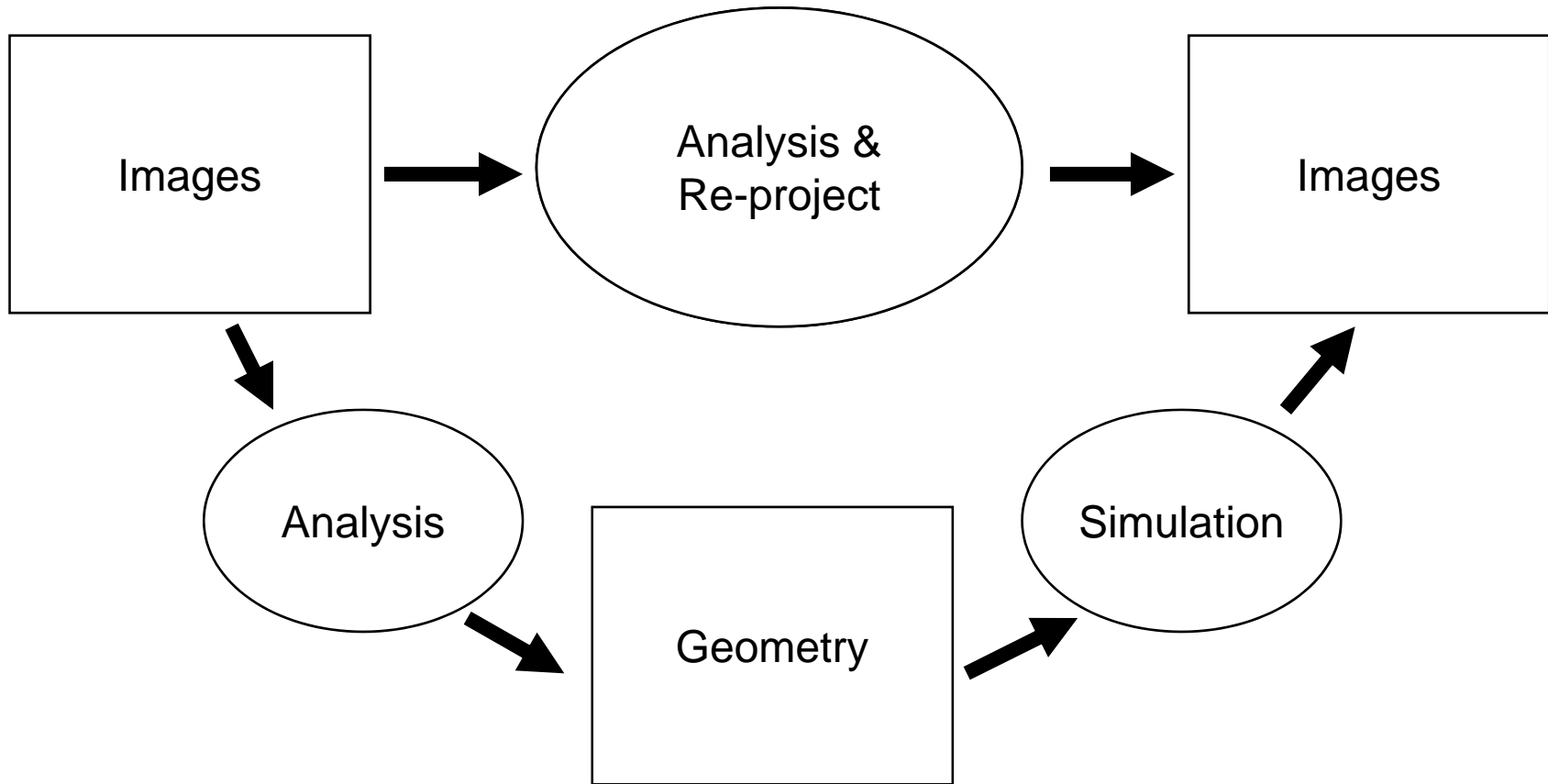
Image-Based Modeling

- Images (photographs, renderings) are used to determine
    - Scene Appearance
    - Scene Geometry
    - Lighting
    - Reflectance Characteristics
    - Kinematic Properties
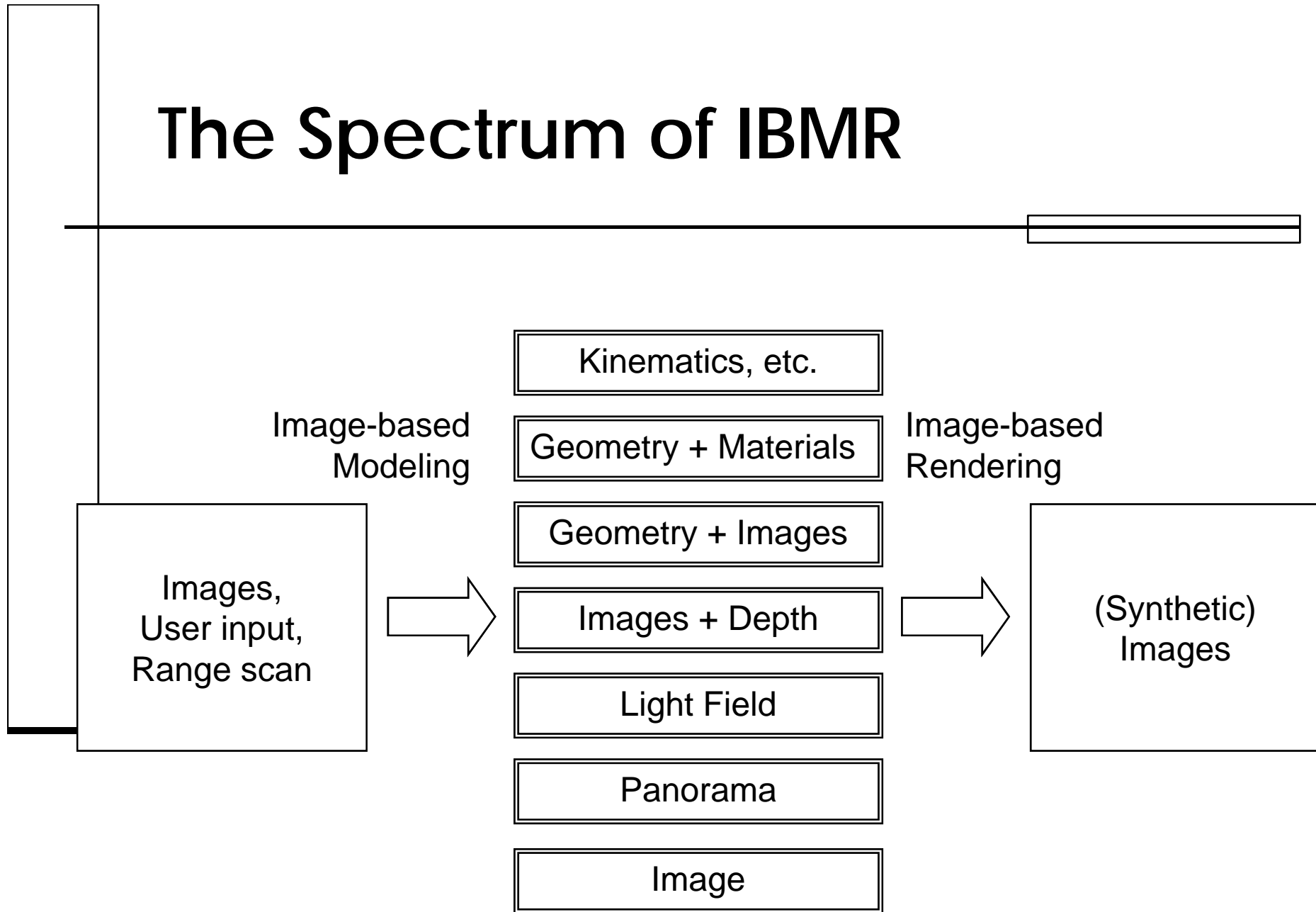
- Modeling scenes photo-realistically is easier
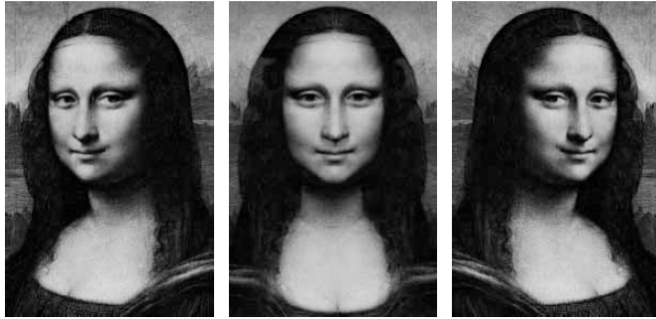
Image-Based Rendering

- Appearance in available views is used to determine appearance in novel views

- Not necessary to perform full illumination computations
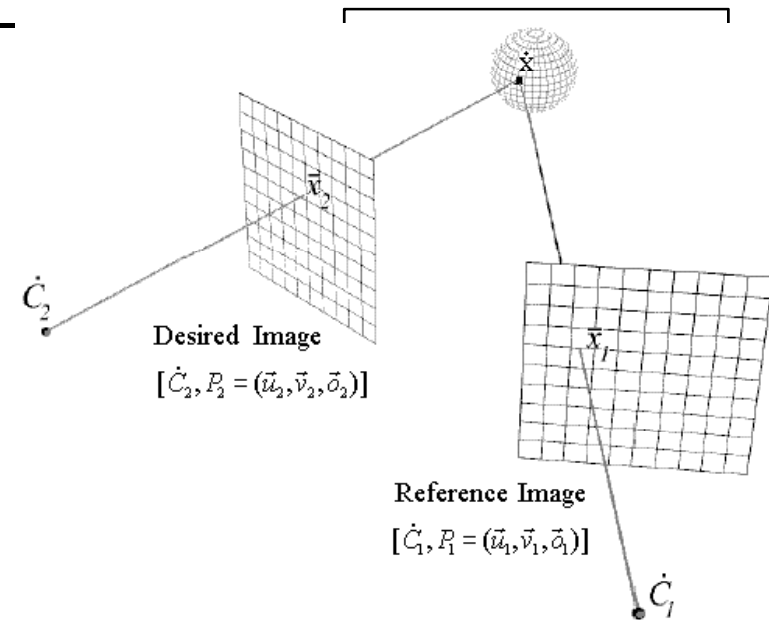
- Rendering could be faster

The Spectrum of IBMR

Image-based
Modeling

Kinematics, etc.

Geometry + Materials

Geometry + Images

Images + Depth

Light Field

Panorama

Image

Image-based
Rendering

Images,
User input,
Range scan

(Synthetic)
Images

Image Warping/Morphing

S.Seitz et al. "View Morphing", SIGGRAPH'96

Desired Image

$[\dot{C}_2, P_2 = (\vec{u}_2, \vec{v}_2, \vec{o}_2)]$

Reference Image

$[\dot{C}_1, P_1 = (\vec{u}_1, \vec{v}_1, \vec{o}_1)]$
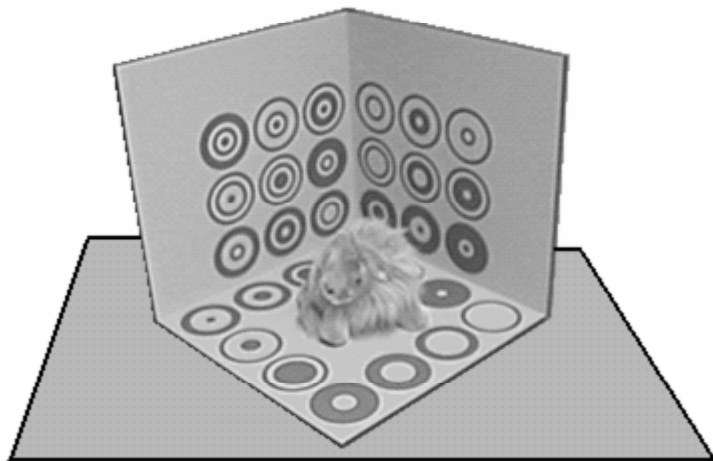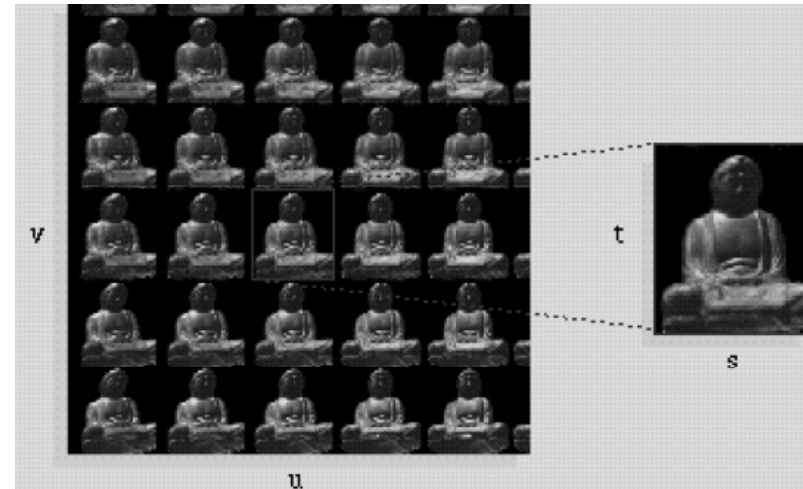
2D image morphing

With 3D perspective transformation

Panorama

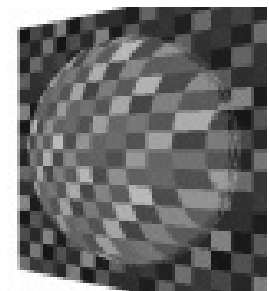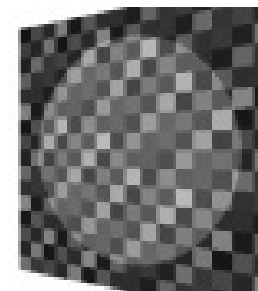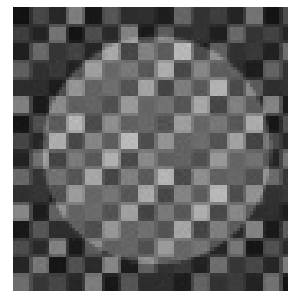E.Chen, "QuickTime VR", SIGGRAPH'95

Light Fields

S.Gortler et al. "The Lumigraph", SIGGRAPH'96

Image + Depth

J.Shade et al. "Layered Depth Images", Proc. SIGGRAPH'98.

The Spectrum of IBMR (cont.)

	Movement	Geometry	Lighting
Geometry + Materials	Continuous	Global	Dynamics
Geometry + Images	Continuous	Global	Fixed
Images + Depth	Continuous	Local	Fixed
Light Field	Continuous	None	Fixed
Panorama	Rotation	None	Fixed
Image (without view morphing)	None	None	Fixed

Applications

- http://www.virtualcamera.com/
- Array of pictures taken onto same roll of film
- Playback achieves "frozen time" effect Array
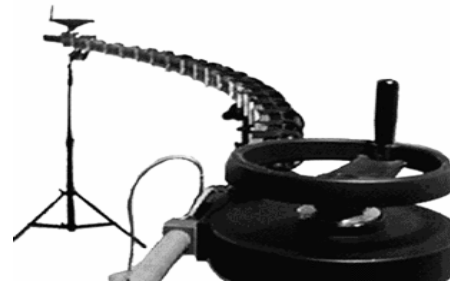
www.mvfx.com

The Matrix,
MANEX
Entertainment

Why do we develop IBMR tech.?

	Geometry	IBR
Modeling	Difficult	Easy
Complexity	#triangles	#Pixels
Fidelity	Synthetic	Acquired

Ref: Prof. Chang, NTHU, IBR lecture notes.