Bristol Computer Graphics

Comparing real and virtual HDR-scenes

Timo Kunkel, Alan Chalmers
University of Bristol

kunkel@cs.bris.ac.uk

Radiance Workshop 2006

Outline

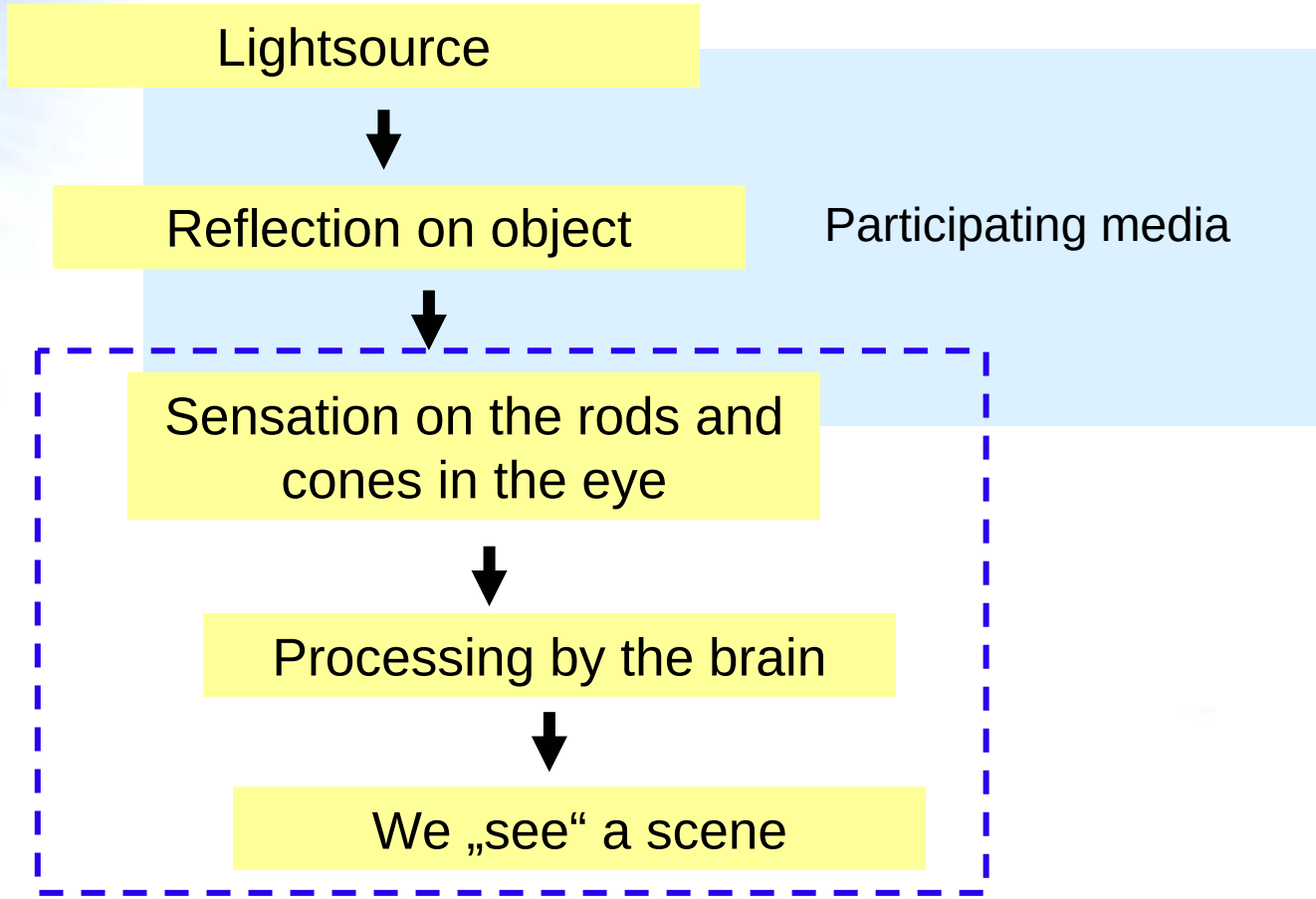
1. Introduction
2. Goal: „There Reality“
3. First experiment
4. Future tasks

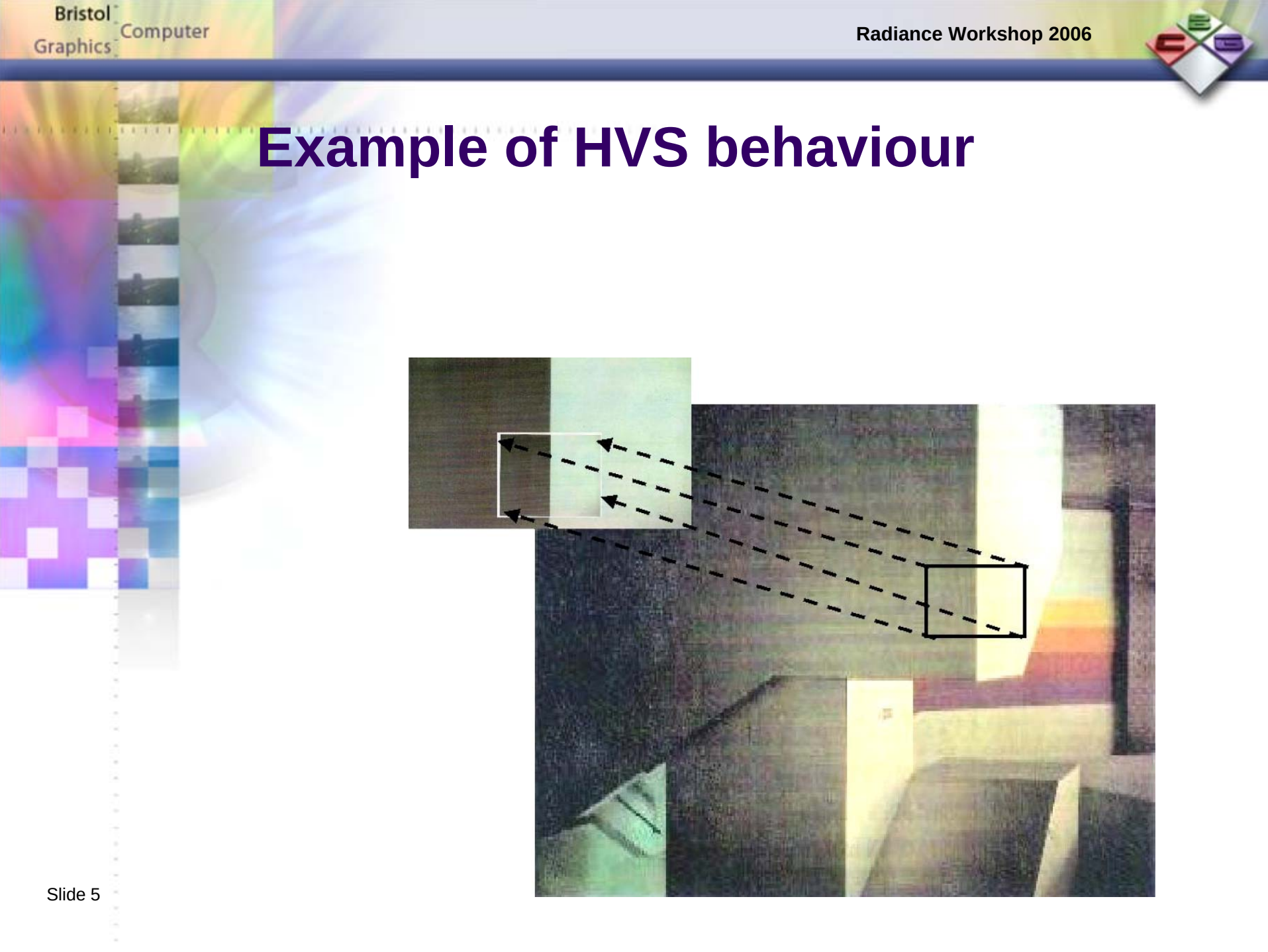
Introduction

What is reality?

- A scene seen by our eyes?
- A physically correct rendering?
- A photograph?
- A painting?
- ...

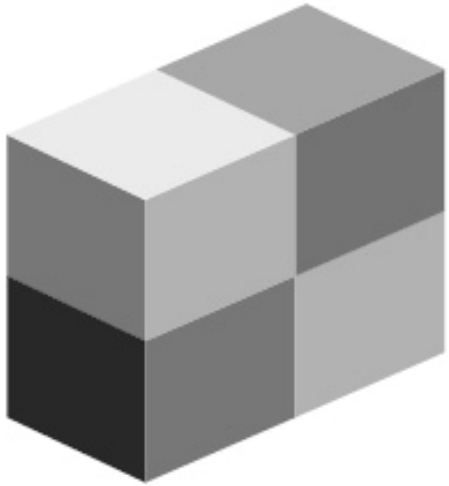
From source to sensation

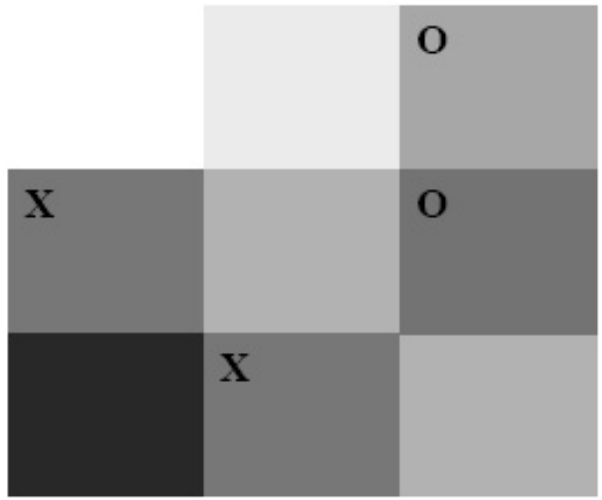




Example of HVS behaviour

Example





Interaction between reflection, illumination and 3D-shape

How to parameterize “reality”

Simulate a scene as physically correct as possible

➔ physically correct should be real?

Most attempts are not real enough.
E.g. photorealism (only LDR).

Or computational too expensive

“There Reality”

“As real as if you are there”

“There Reality”

- No need to be 100% physically correct
  (only as correct as it has to be so that humans think they are there)

Benefits:

- Saves computation cost
- „Reality in Real Time“ is possible in the near future

Image metrics

- Implement the parameters into a **Gold Standard**

- Create an image metric

Some Present Image Metrics:

- VDP
- Pdiff

“There Reality“

Objectives

- A simple psychophysical test
  - To verify the “There Reality Metric”
- a new version of an image metric like VDP
  - To test if renderer is producing “reality”
  - To compare renderers with each other

Scientific fields

- HVS
  - Phsychophysics
  - Evolutionary Biology
- Vision affected by culture
- Present image metrics
- Renderer

Experiment

Hypotheses

- The scenes displayed on the Brightside HDR-Display are more “real” than scenes presented on a normal LDR-display.
- It allows the presentation of “there-realistic” images

Experiment 1

- Test if the human judgement of lightness doesn‘t see a difference between real and HDR-monitor scene

Previous Work

- **Ann McNamarra** (2000): Comparing Real and Synthetic Scenes using Human Judgment of Lightness

- **Alan Gilchrist** et al. (1999)

  Anchoring Theory of Lightness Perception

Scenes to compare

HDR

- real scene with real objects
- HDR photograph on HDR-monitor
- HDR rendering of scene
  (rendered with Radiance-Software)
- HDR rendering of scene
  (other renderer such as CameoSim, ...)

Scenes to compare

LDR

- LDR photograph of scene
  (some elements are either over- or underexposed)
- tonemapped HDR photograph to fit on LDR-display
  (different tonemappers)

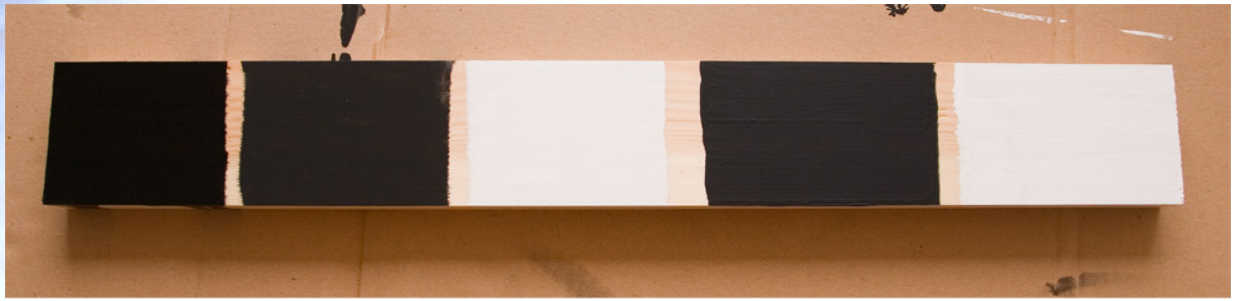
Methods

- The method follows the one of McNamara (2000)
- Changes:
  - Is extended to HDR.
  - Use of glossy or semiglossy objects
- Test will be carried out in October at Bristol University

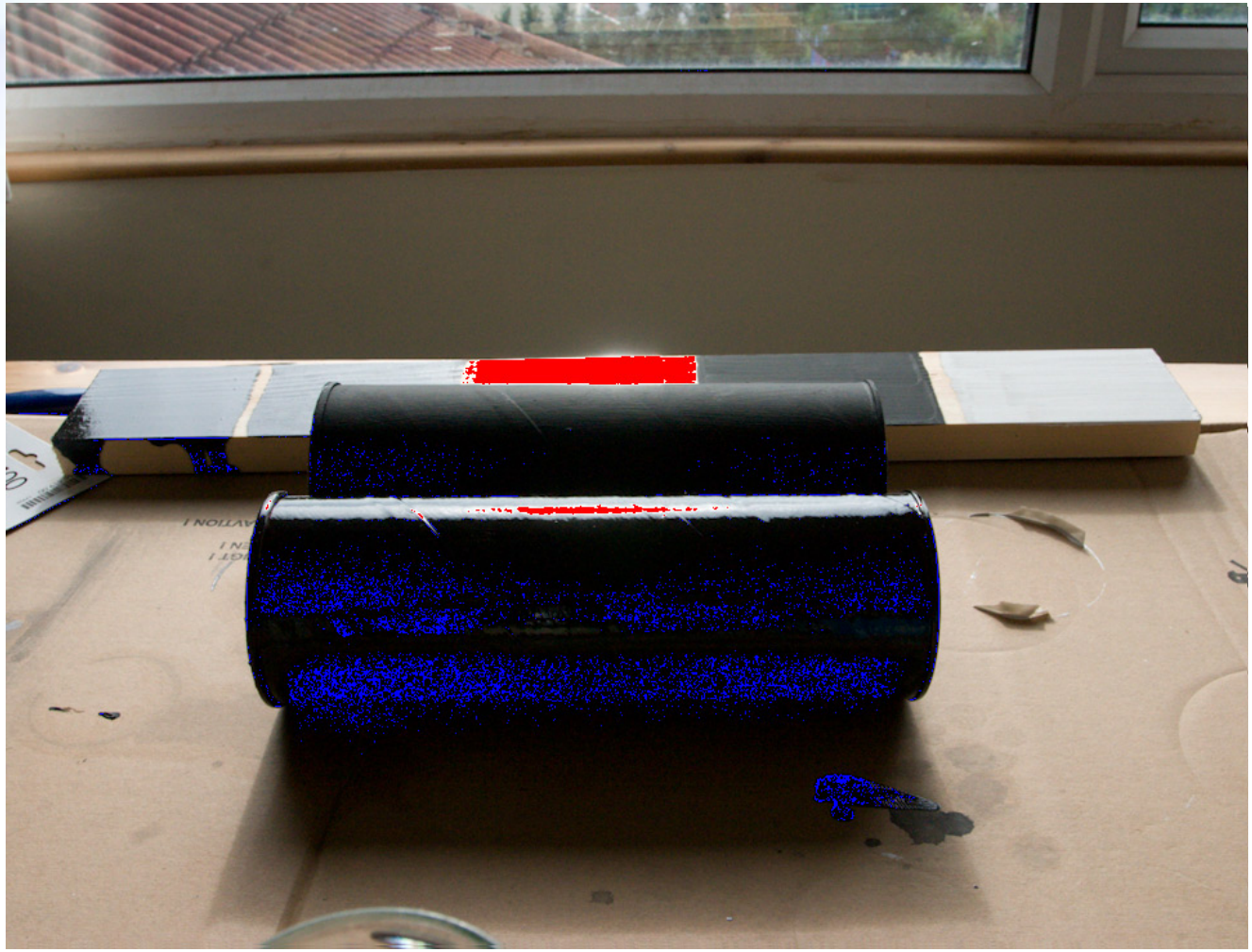
Scene

Source: McNamara, 2000

Paints



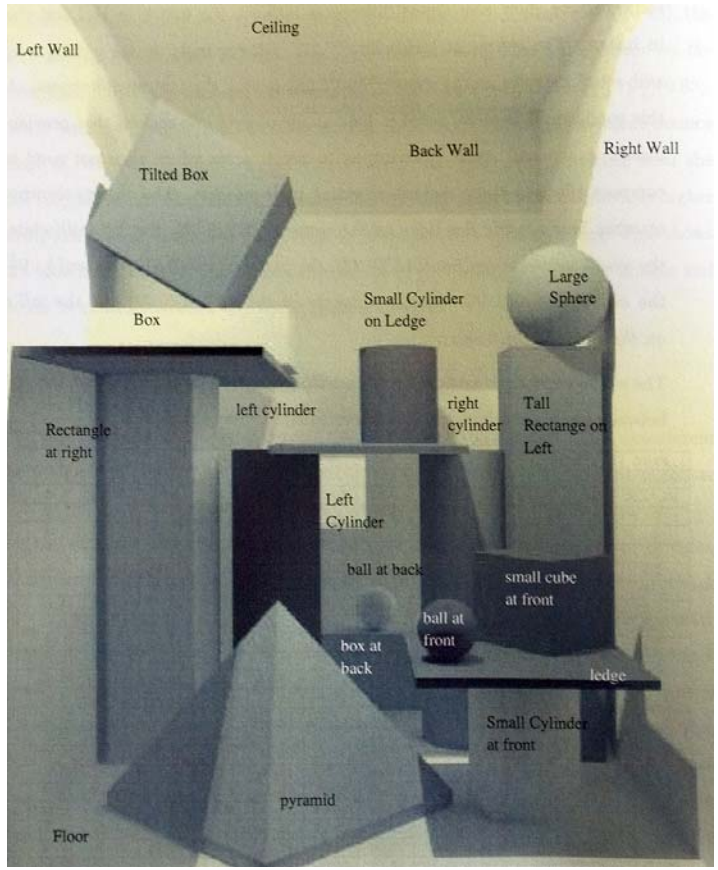
	Glossy, 0%	Glossy, 50%	Glossy, 100%	Matte, 0%	Matte, 100%
8Bit-val	13	34	232	43	226



Test-objects

Real Scene

- Box containing basic geometric objects

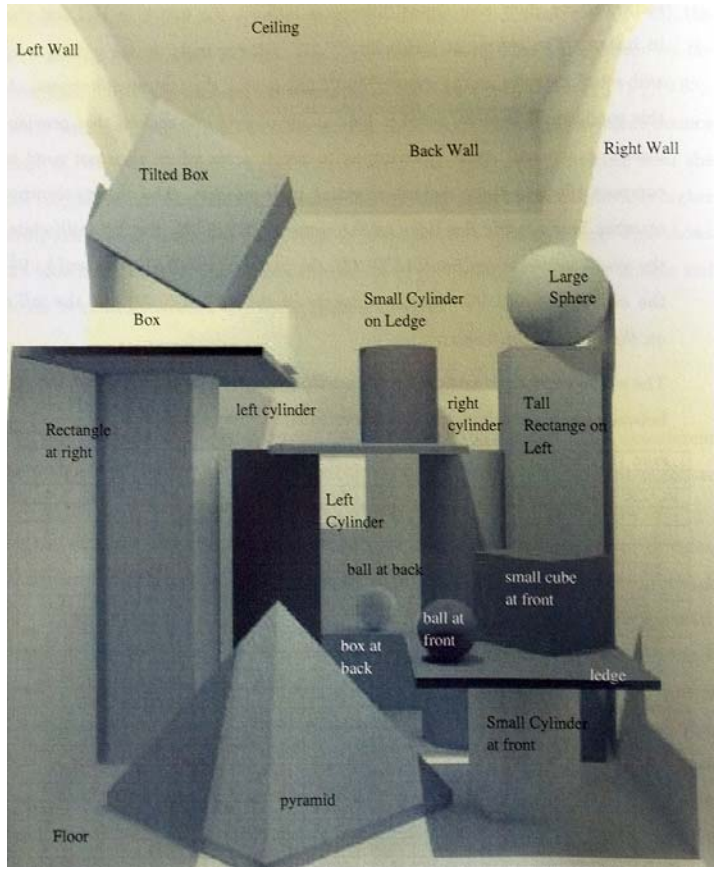


Lightsources and reflectance of objects/materials are calibrated.

Source: McNamara, 2000

Synthetic Scene

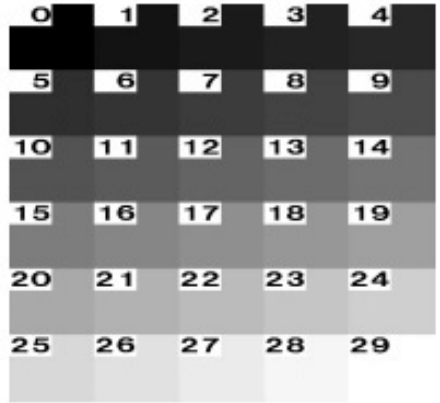
- Same like real scene
- Created using Radiance



Source: McNamara, 2000

Task for participants

- Match the reflectance of all object in the scene to a Munsell chart



Task for participants

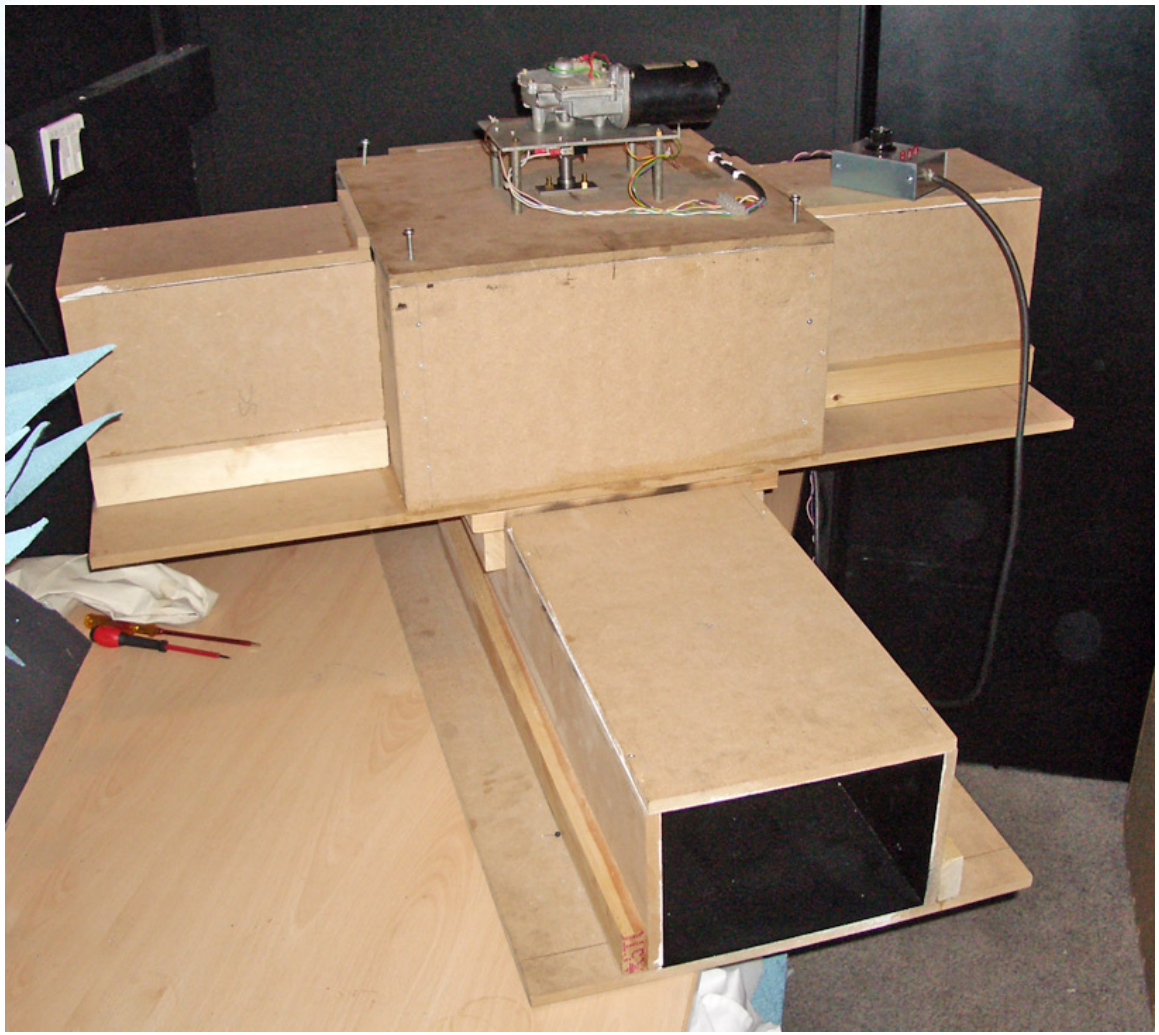
- The HVS has limitations so there will be systematic errors
- Both sets of lightness errors should be close to each other if the rendered image is perceived as “real”

- Estimate the contrast of the object seen to a reference

Periscope

- Allows to switch between three different Scenes.
  - Real scene
  - HDR-Monitor
  - LDR-Monitor
- This switch is not visible to the participant.

Periscope



Problems

- Has the HDR-Display enough dynamic range to display a “real” scene without tonemapping?
- Does the use of a “periscope” reduce the “realness” of a scene?
  (only a “window” to reality)?

Further research

Future tasks

More complex objects and elements in the scene

- use **monochromatic colour**
- use of **full colour**
- increase the complexity of the **geometry**

Future tasks

- Implemetation into software
- what is more important:
  - Colour
  - Glossiness
  - Shape
  - Etc...

Summary

- Figure out what makes a scenes believable real – **“There Reality”**
- Create a **Gold Standard**
- Create a **simple psychophysical test** to verify the Gold Standard
- Implement that into an **image metric**

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