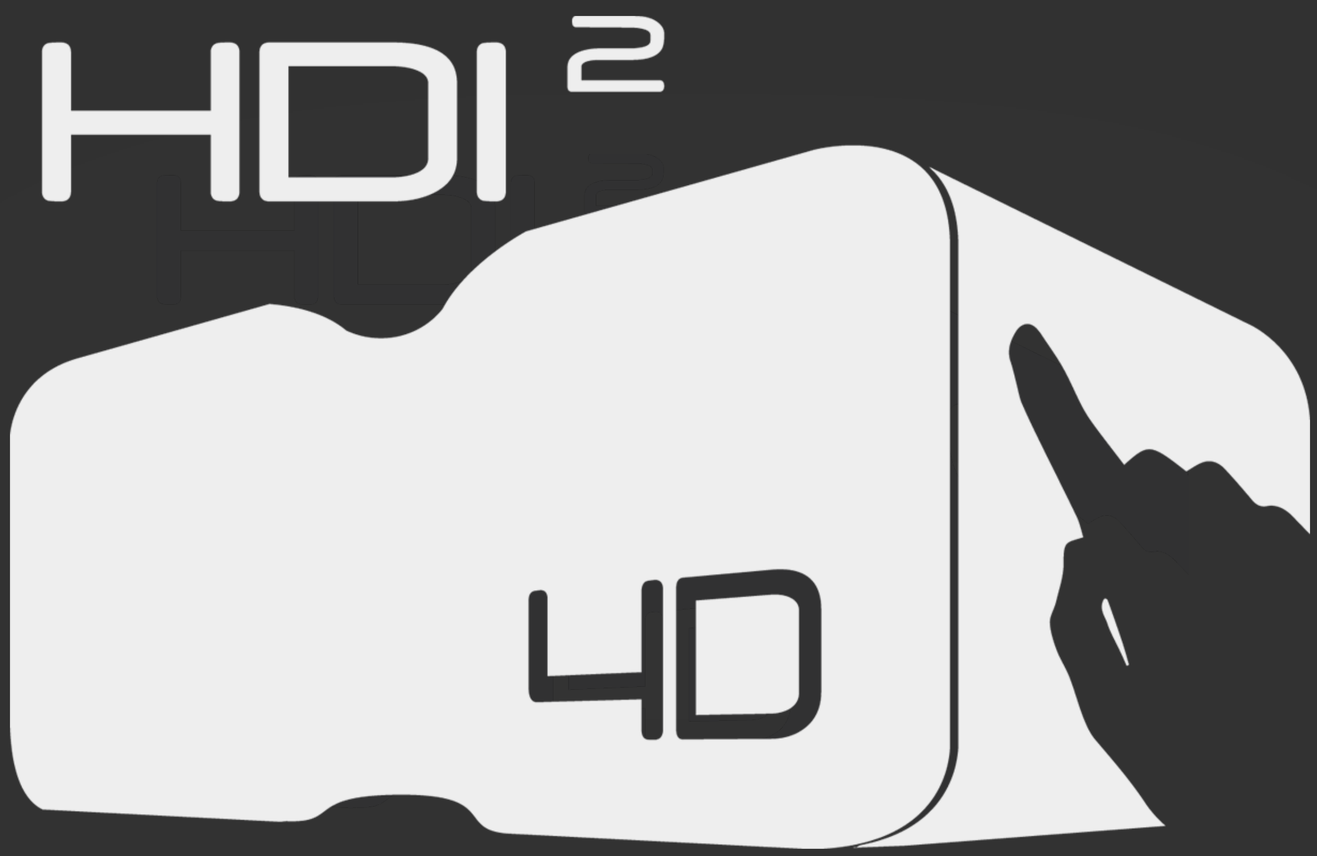
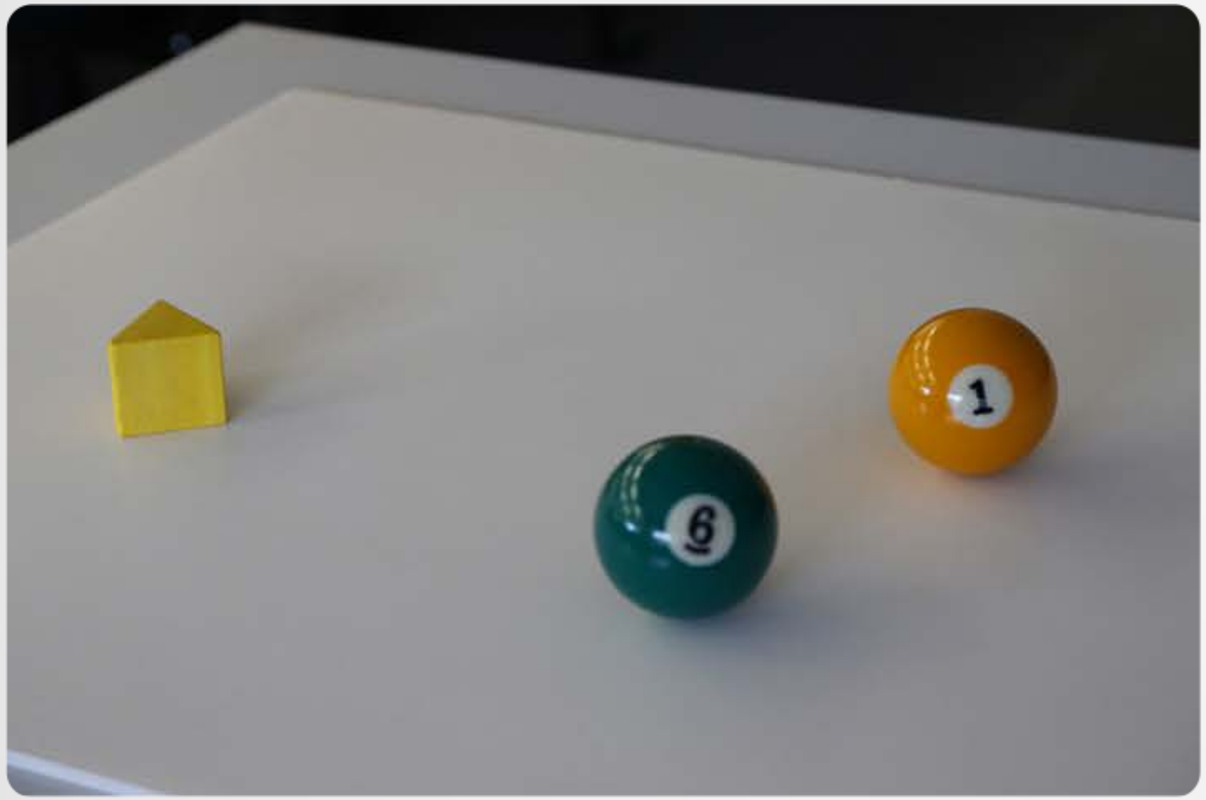


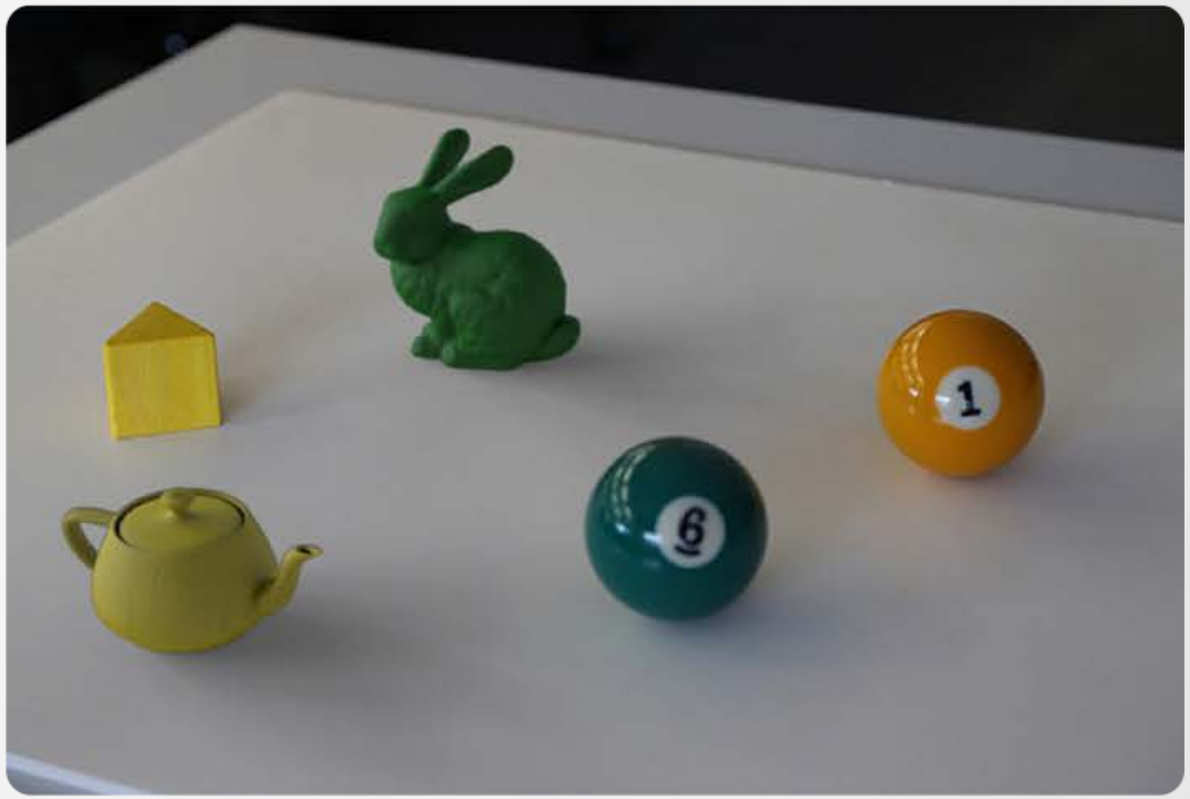
Human-Digital Content Interaction for Immersive 4D Home Entertainment
The 1st New Zealand-Korea Strategic Research Partnership Workshop

Andrew Chalmers
Victoria University of Wellington

Perceptually Optimised Illumination for Seamless Composites



Photo



Composition

Testing Perceptual Thresholds

Statement the human eye receives images

Testing Perceptual Thresholds

Statement the human eye receives images

Focus composition

Testing Perceptual Thresholds

Statement the human eye receives images

Focus composition
Metric visual equivalence

Testing Perceptual Thresholds

Statement the human eye receives images

Focus composition
Metric visual equivalence
Goal seamless composition

Testing Perceptual Thresholds

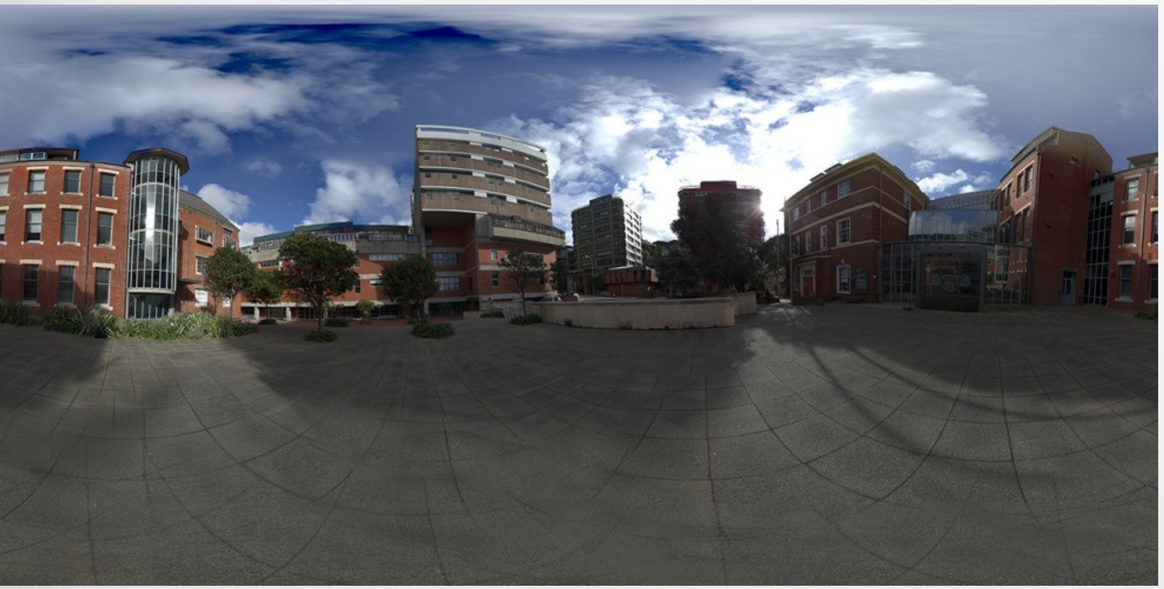
Statement the human eye receives images

Focus composition
Metric visual equivalence
Goal seamless composition
Benefit reduced resources

Case Study, “Living Fantasy”

Experiment Setup

1 - Image-based lighting

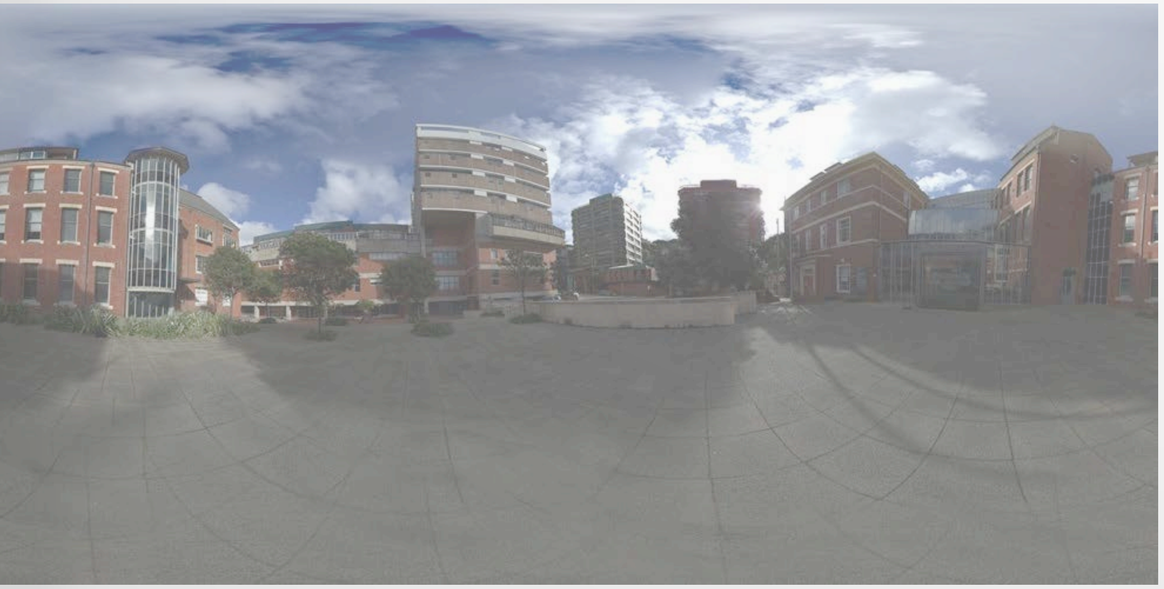


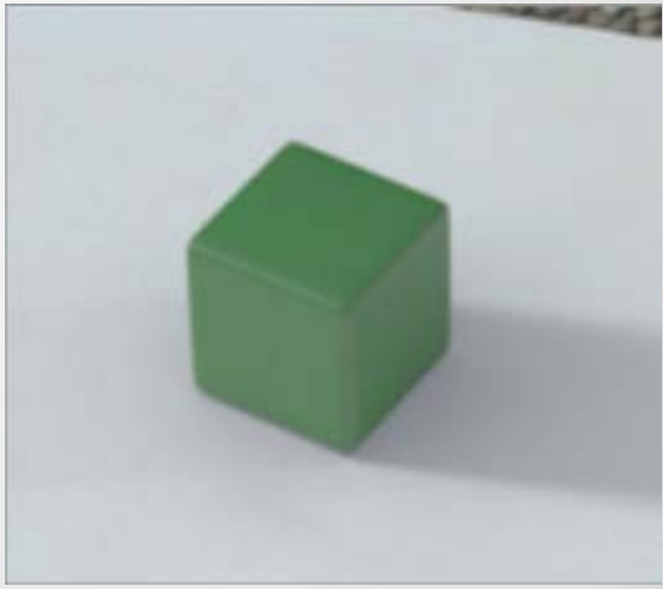
Experiment Setup

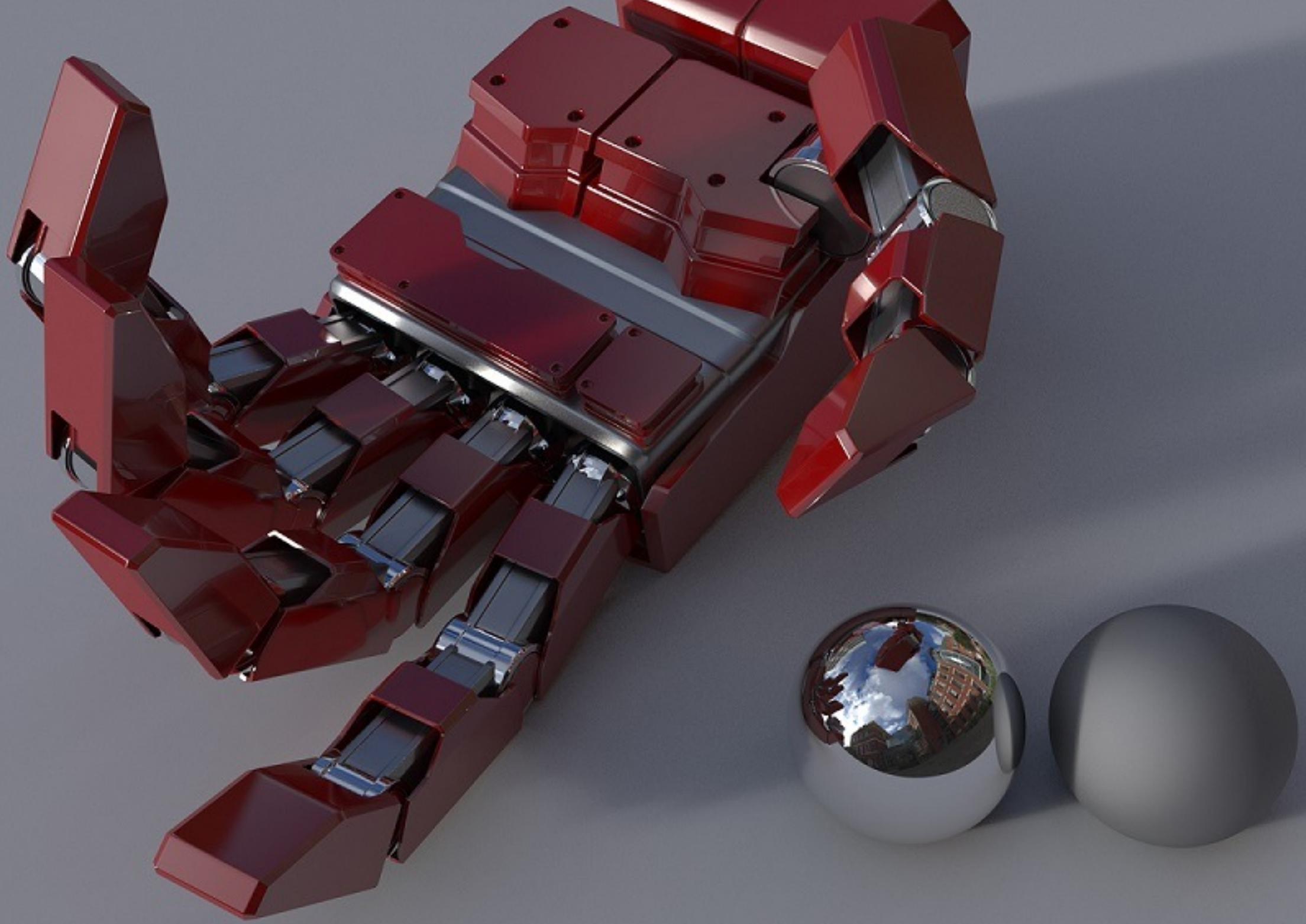
1 - Image-based lighting
2 - Glossy and diffuse materials

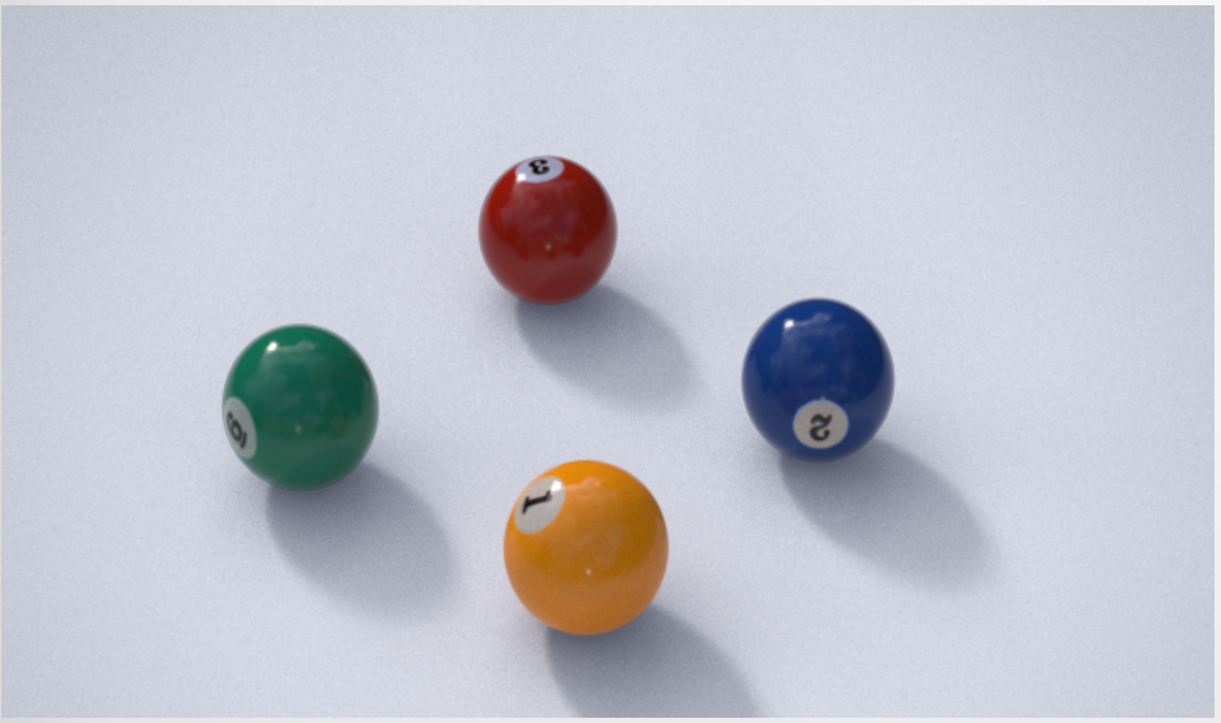
Experiment Setup

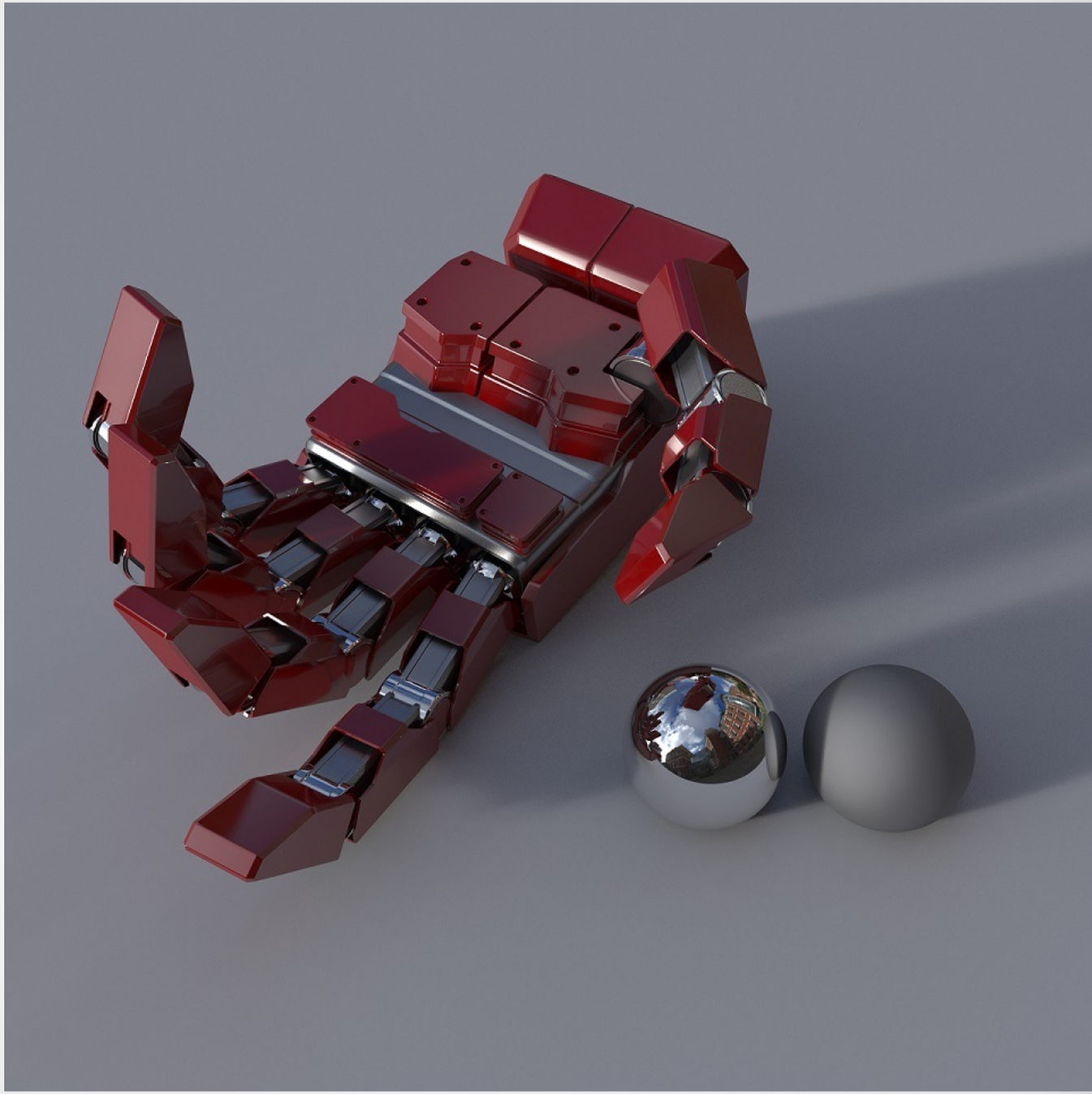
1 - Image-based lighting
2 - Glossy and diffuse materials
3 - Self-referencing test







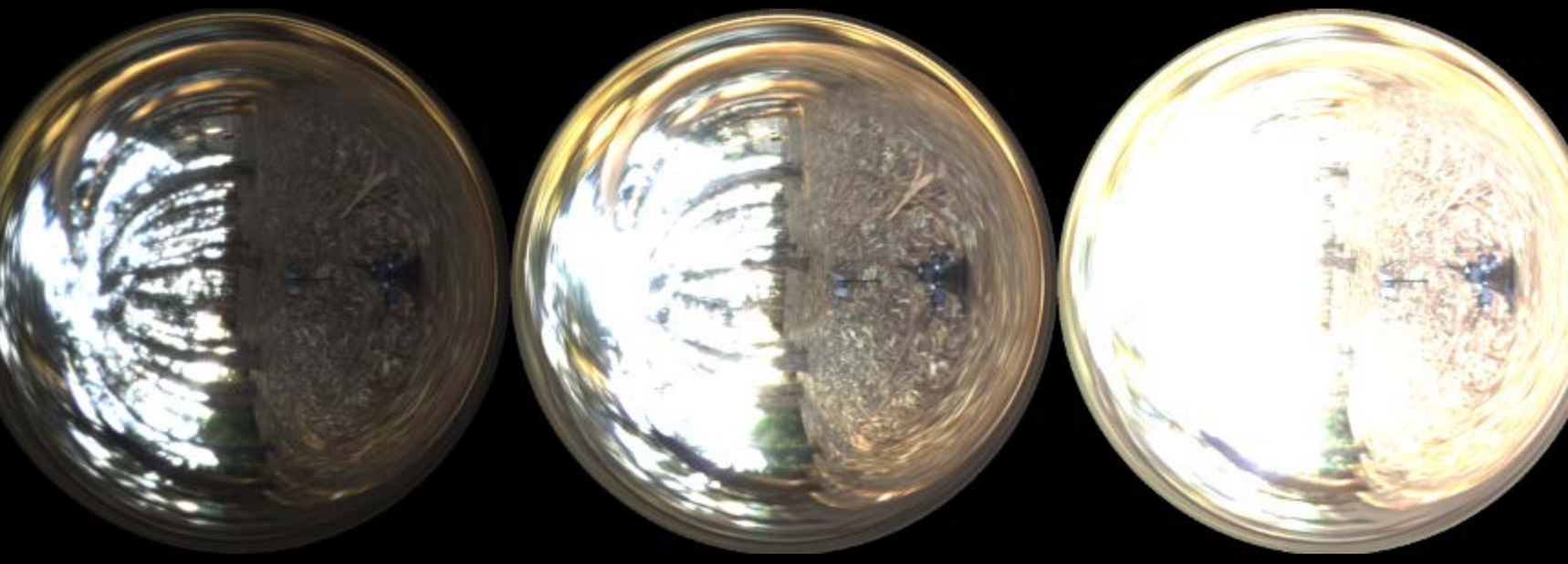

3
5
2
1



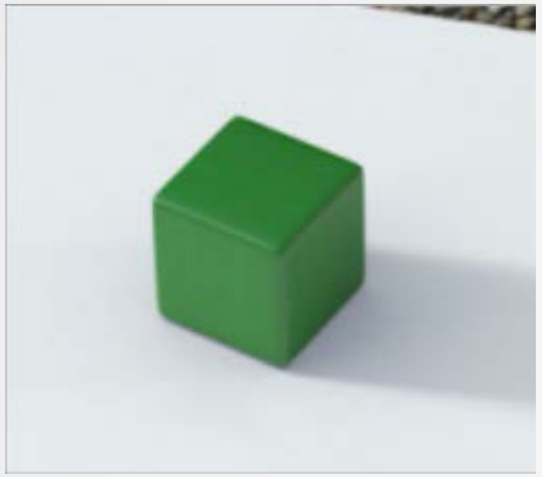
The “Fisheye” Lens

The “Nodal Ninja”

Creation

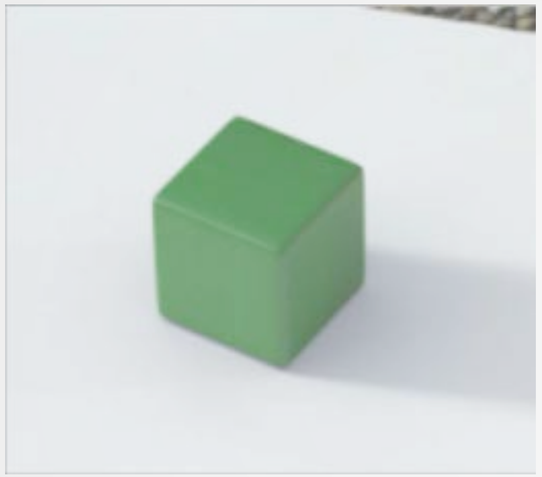


Objects & Materials



Wooden Blocks
mostly diffuse
angular shadows

Objects & Materials



Wooden Blocks
mostly diffuse
angular shadows

Billiard Balls
more gloss/specular
rounded shadows

(least discriminating shape)

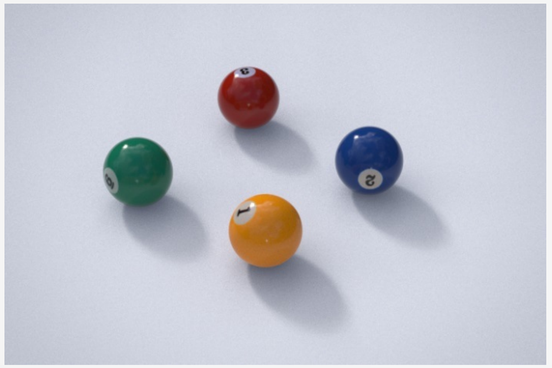
Self Referencing Test

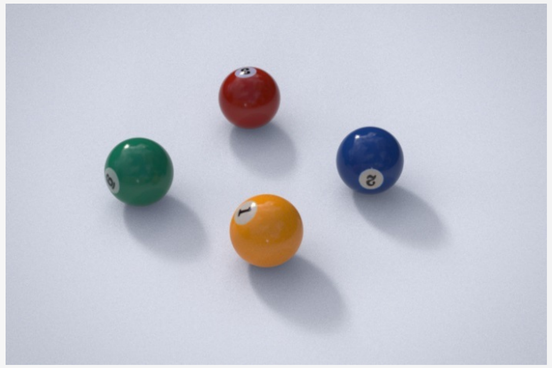
New perceptual test framework, for composition

Self Referencing Test

New perceptual test framework, for composition

Previous work compared two images side-by-side





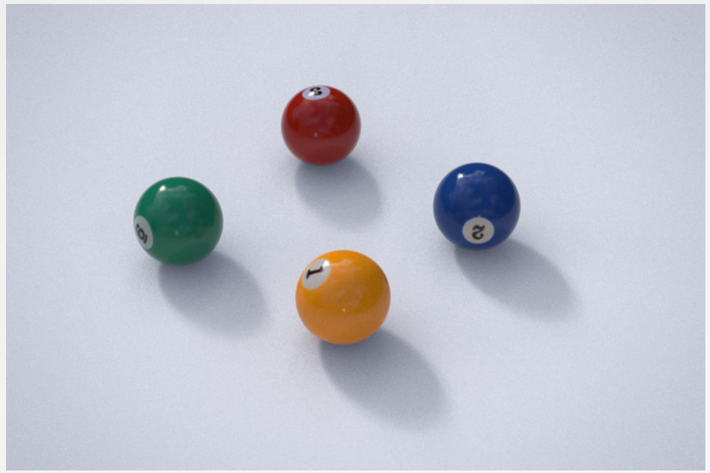
Self Referencing Test

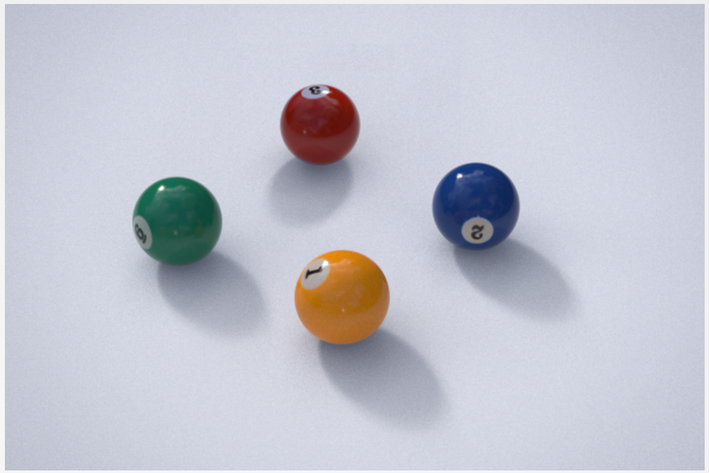
New perceptual test framework, for composition

Previous work compared two images side-by-side

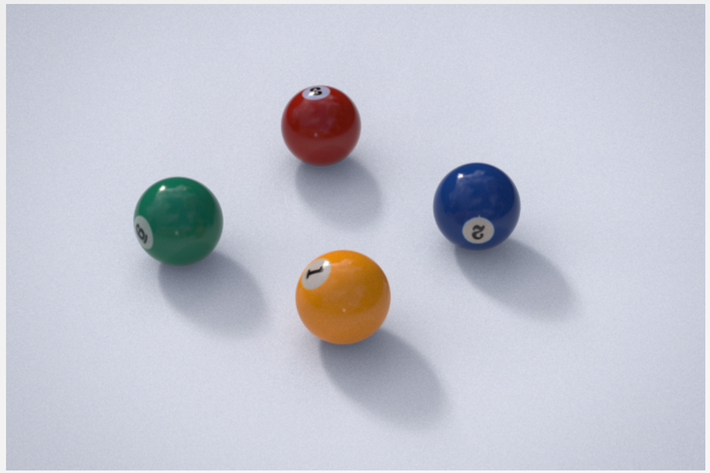
An object is altered in one image
(to better replicated mixed reality)

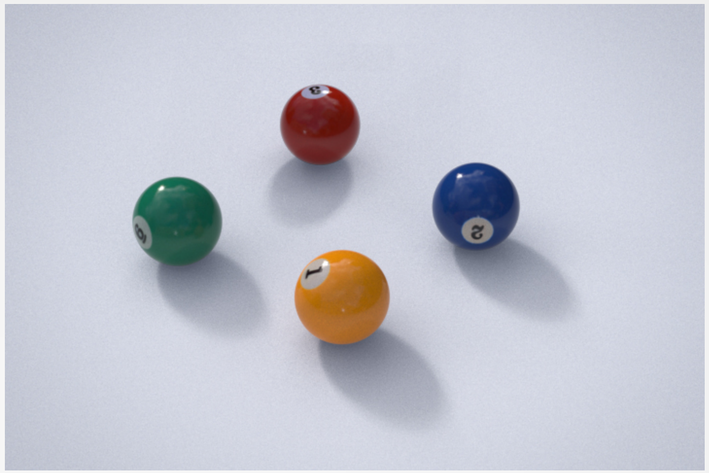
How sensitive is Illumination direction?



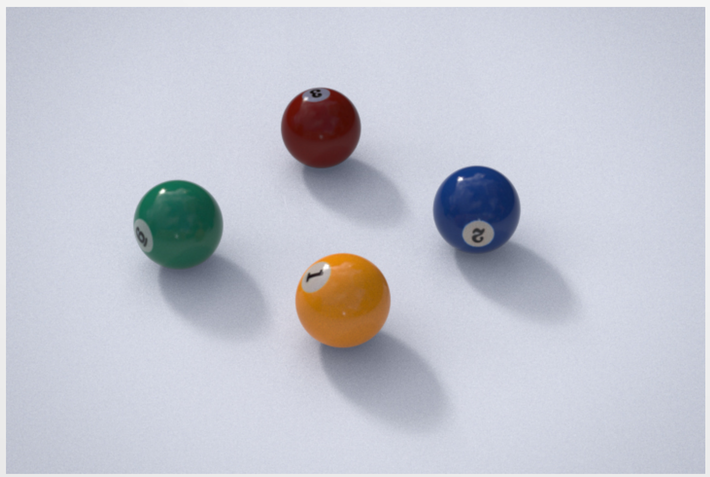


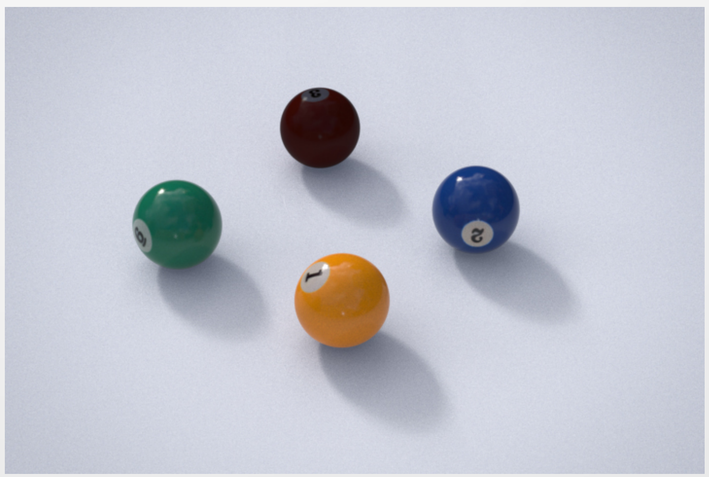
How sensitive is **Illumination direction**?





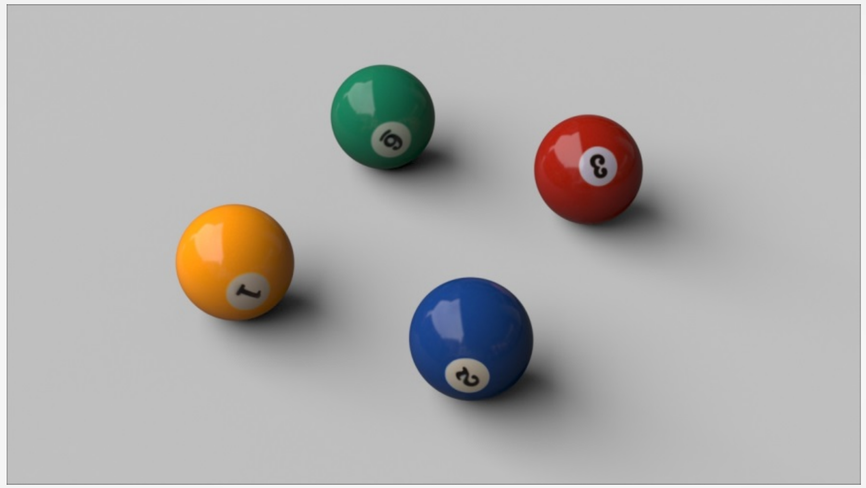
How sensitive is illumination **intensity**?





The Question
(self-referencing test)

Q. Can you identify the areas which have been altered?
If so, how noticeable is this adjustment?

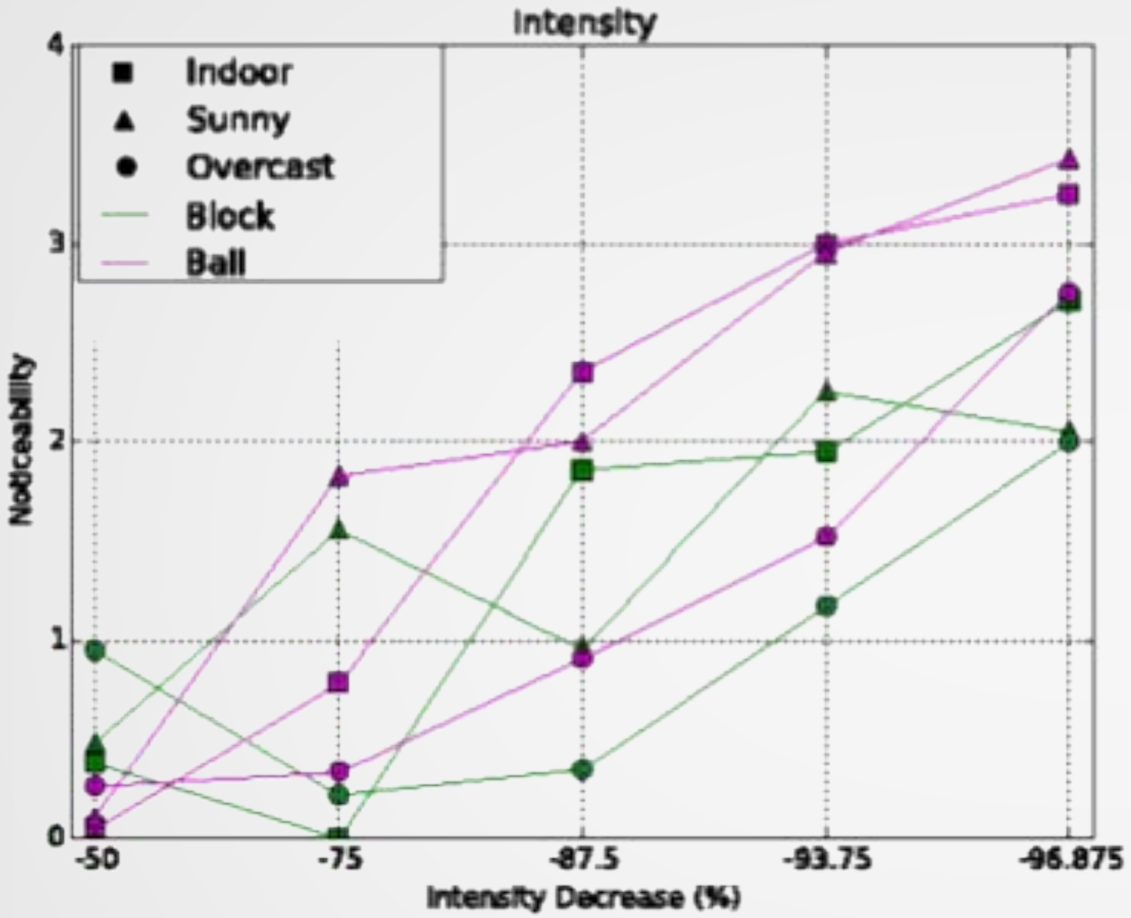


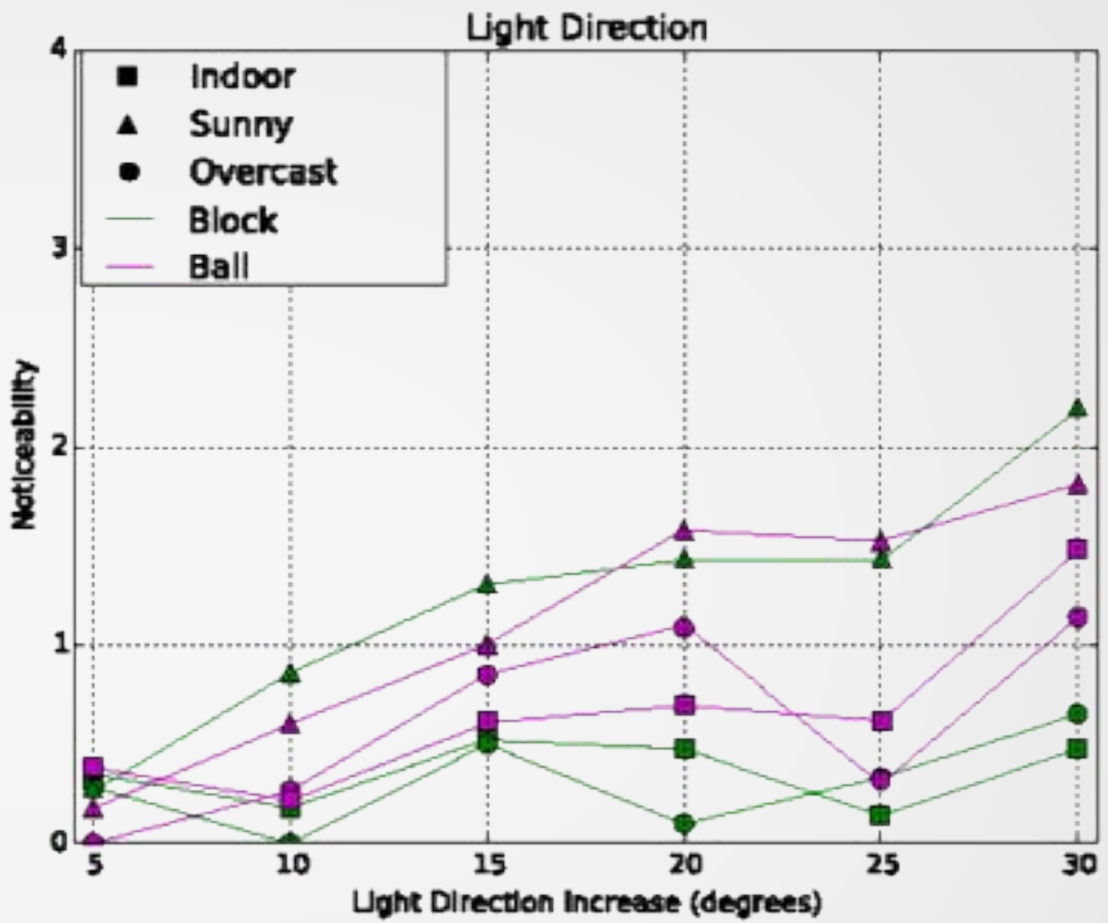
Which object or its nearby area has been altered?

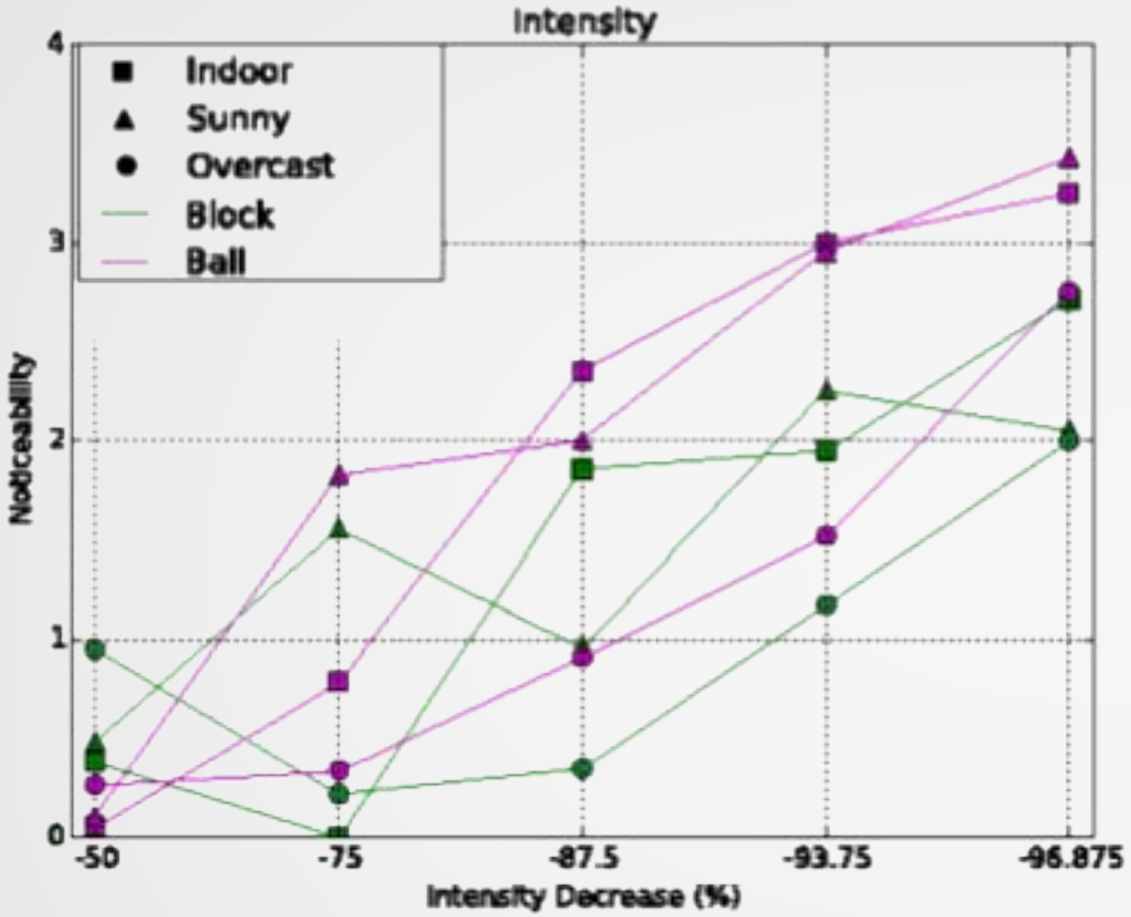
None | Red | Green | Blue | Yellow

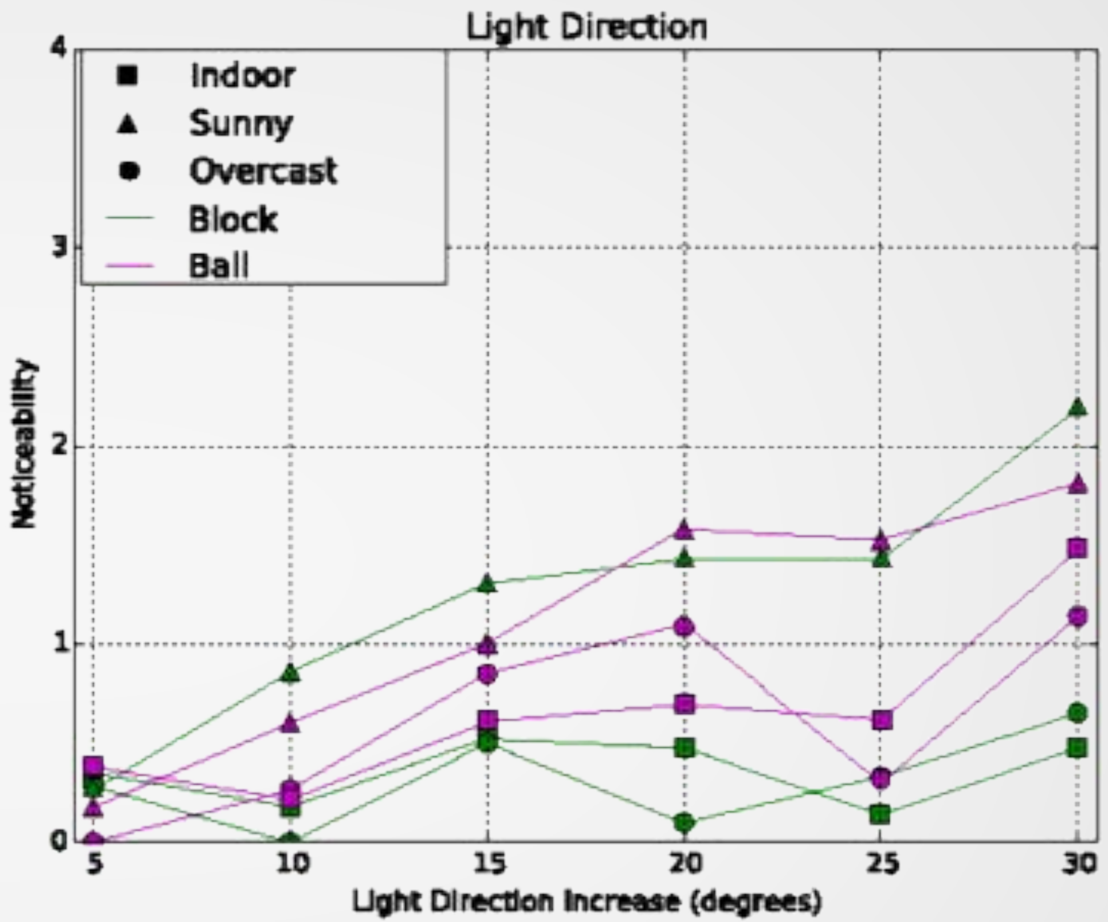
How noticeable is this adjustment?

Not Noticeable | Slightly Noticeable | Moderately Noticeable | Very Noticeable | Extremely Noticeable


Intensity
Indoor
Sunny
Overcast
Block
Ball
Noticeability
4
3
2
1
0
-50
-75
-87.5
-93.75
-96.875
Intensity Decrease (%)

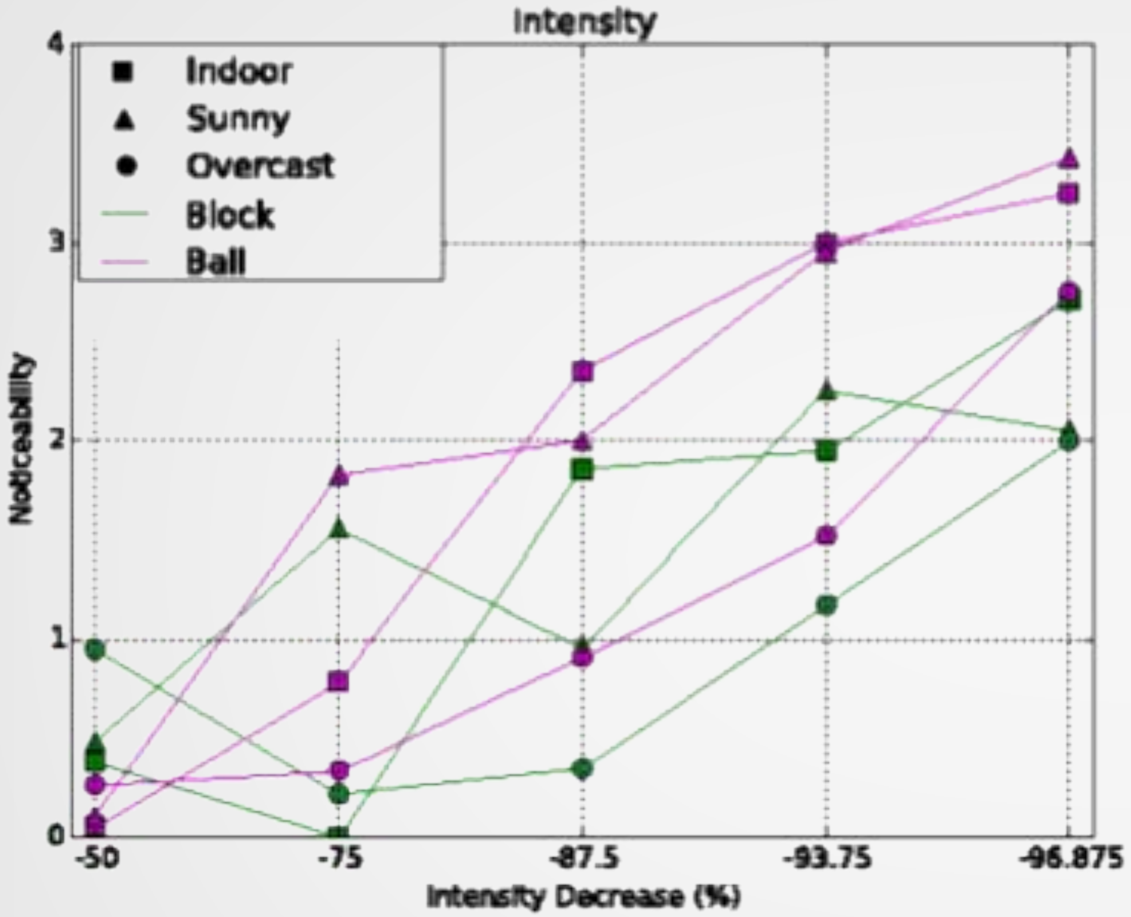

Light Direction
Indoor
Sunny
Overcast
Block
Ball
Noticeability
4
3
2
1
0
5
10
15
20
25
30
Light Direction Increase (degrees)

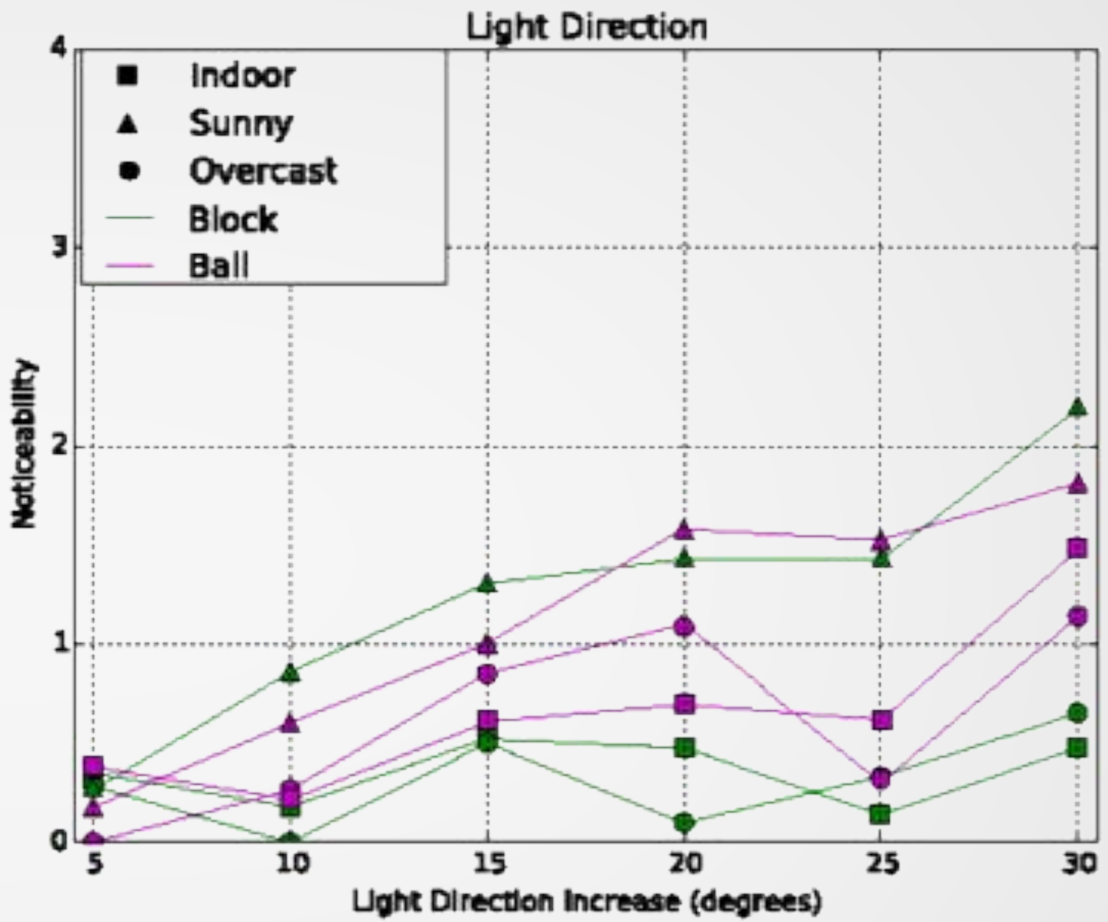




Overcast least affected

- Glossy, indoor and sunny
- Diffuse, indoor and sunny





Overcast least affected

- Gloss, indoor and sunny
- Diffuse, indoor and sunny

Block least affected

- Sunny, both materials
- Glossy balls

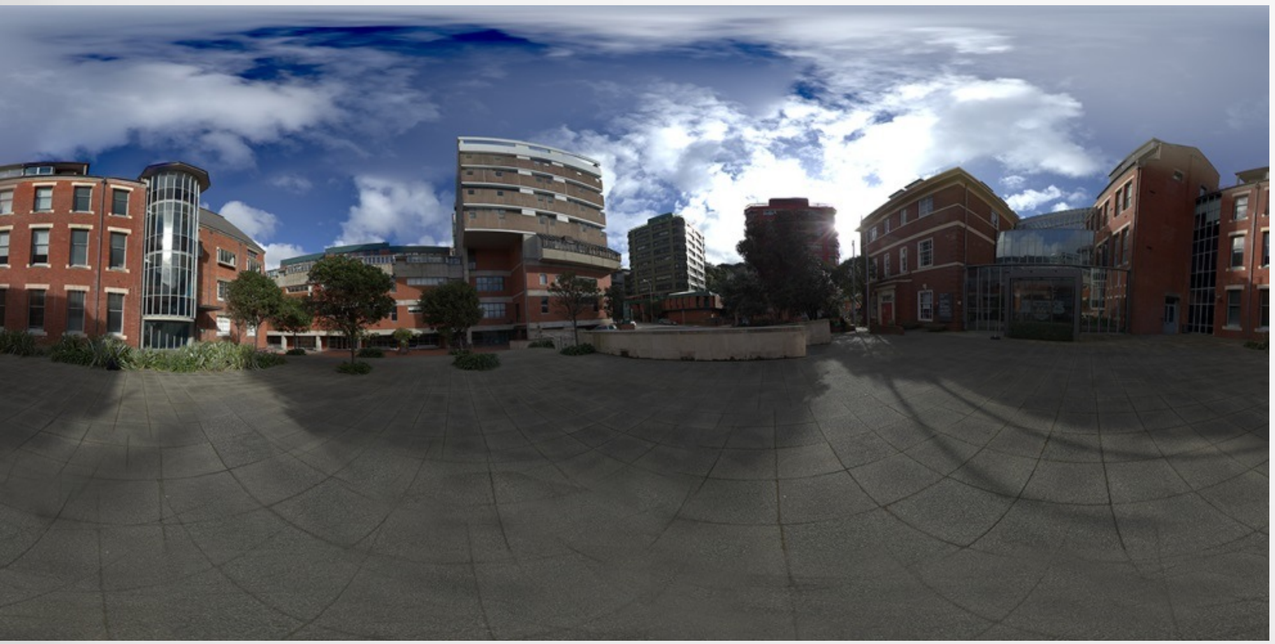
Interpretation

1. Light intensity and direction affects **highlights**, and **shadows**

Interpretation

1. Light intensity and direction affects **highlights**, and **shadows**

2. Scene dependant

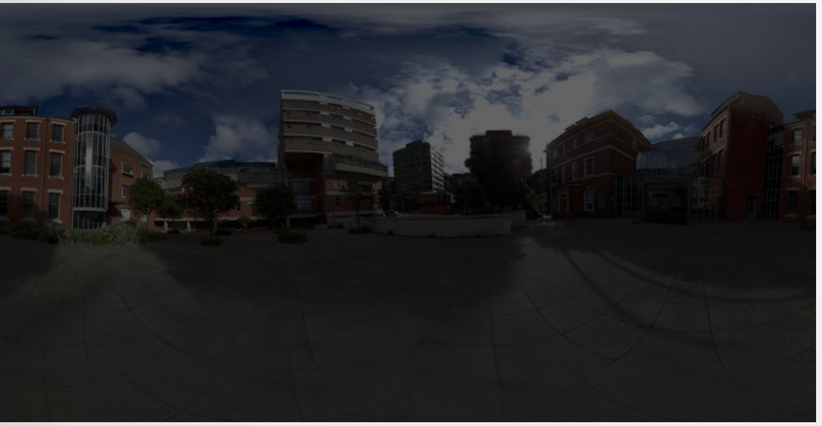


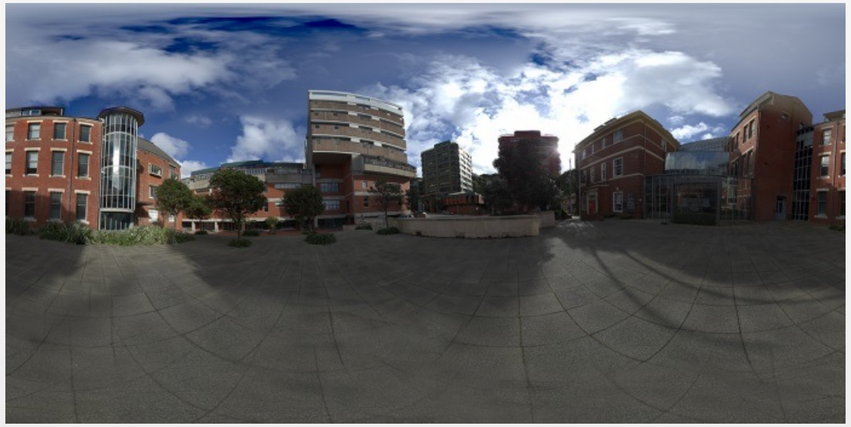
Direct

Diffuse

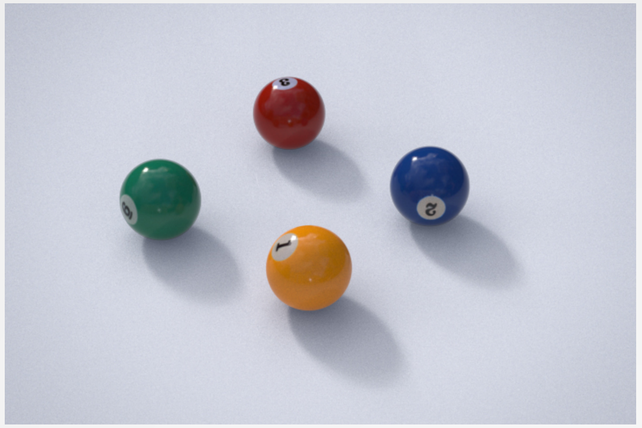
Optimisation

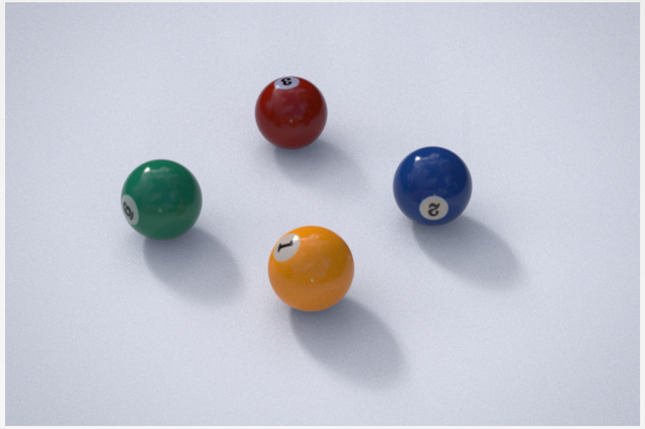
To find optimisations, we test the **perceptual threshold** of dynamic range and resolution



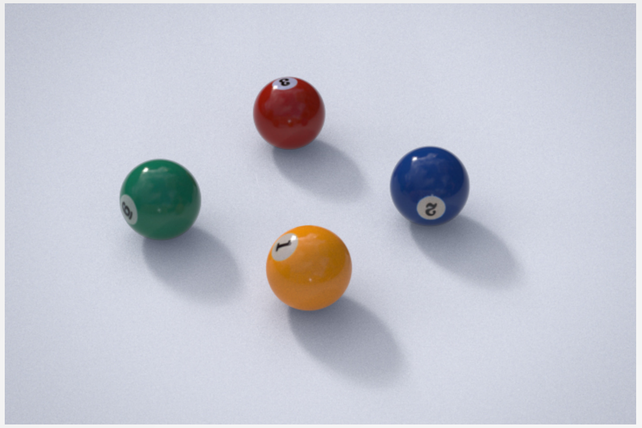


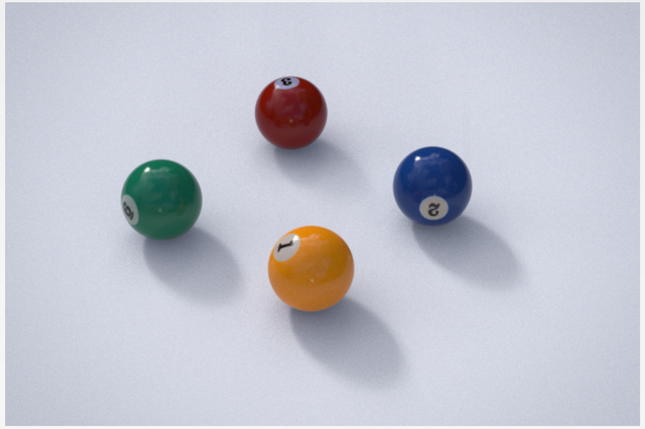
How sensitive is **dynamic range?**



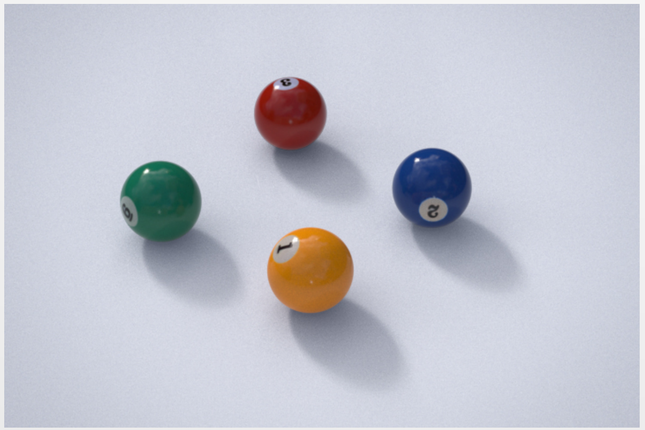


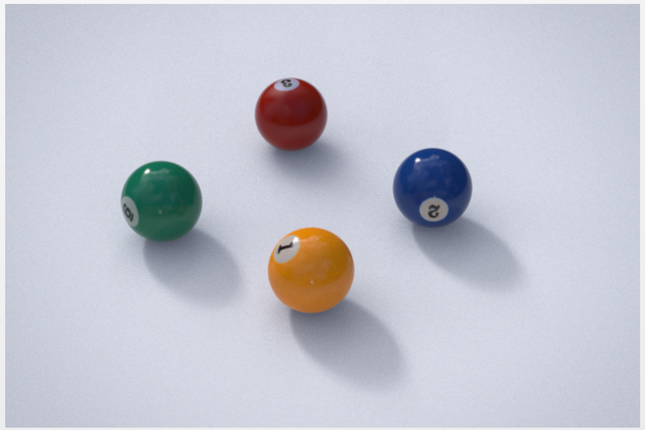
How sensitive is **dynamic range**?

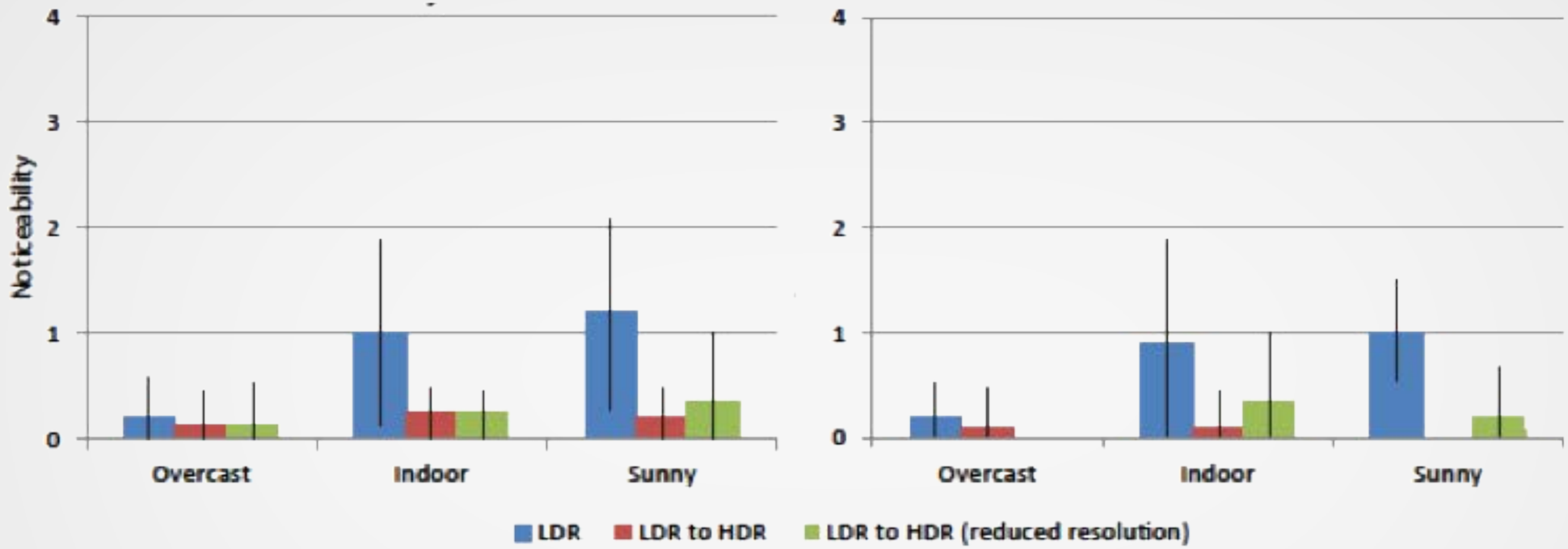




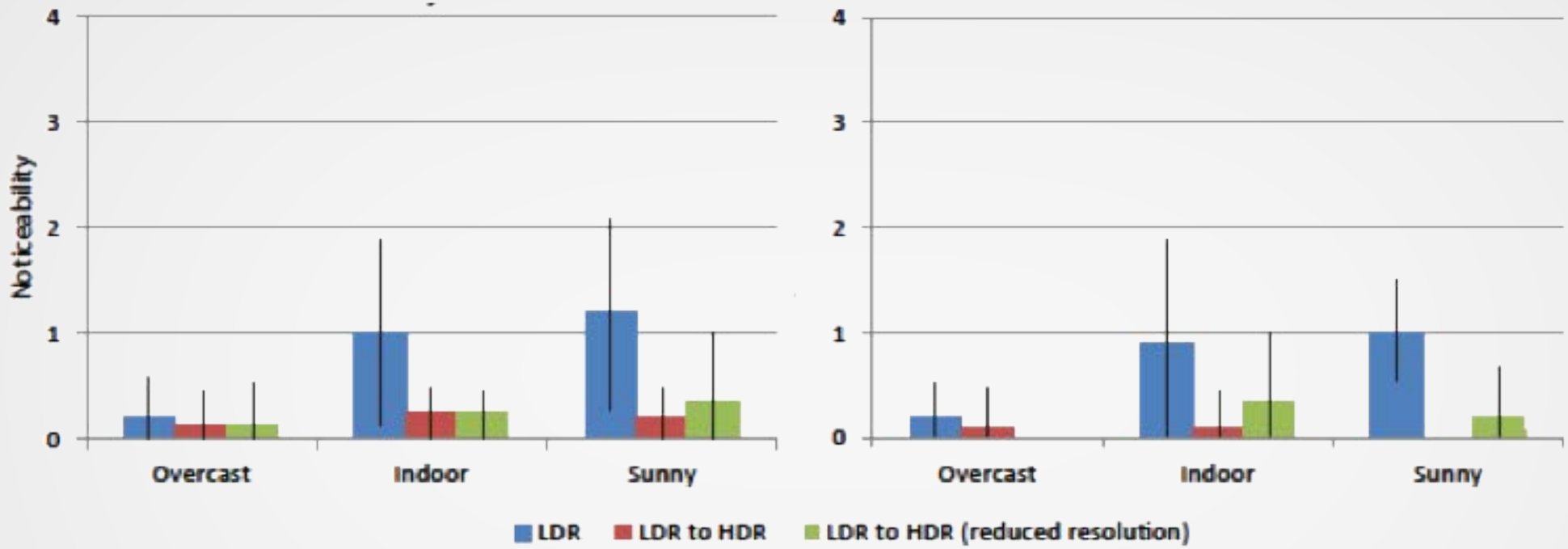
How sensitive is **resolution**?





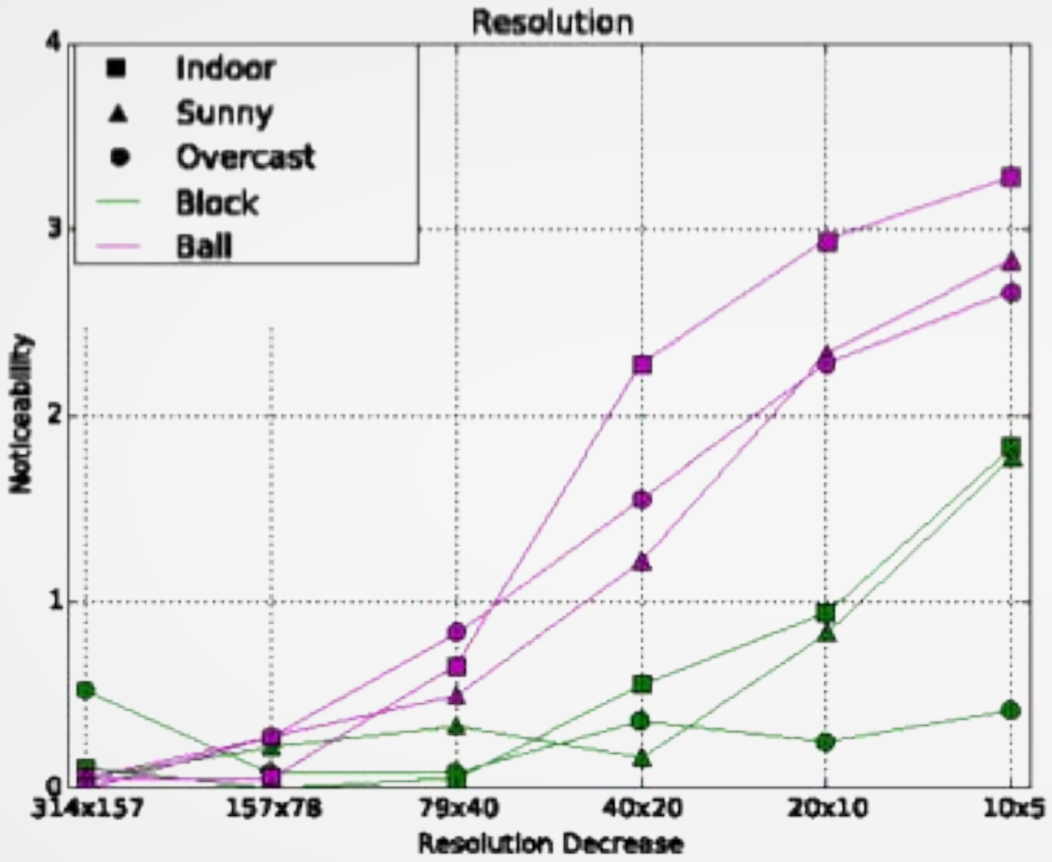


Overcast scenes are **less noticeable** (perceptually)

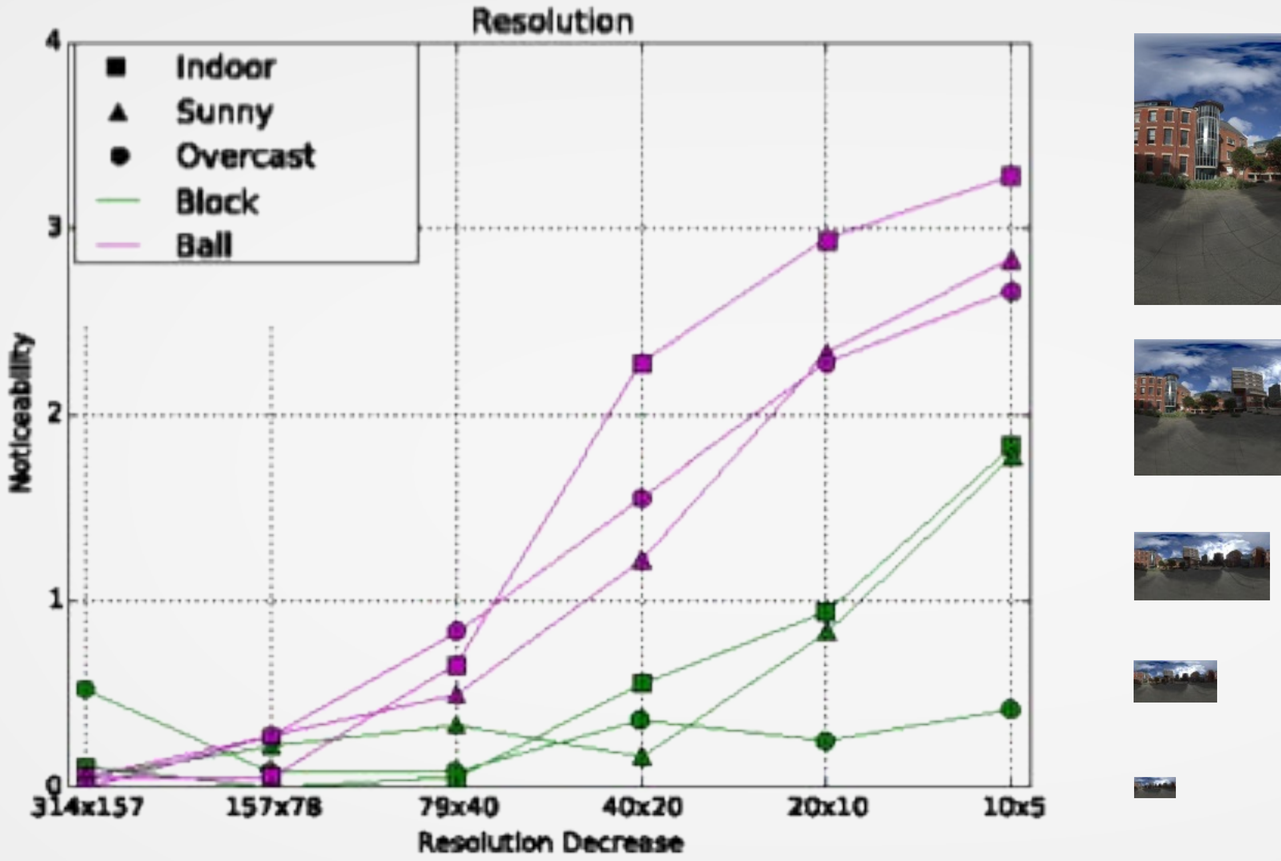


Overcast scenes are less noticeable (perceptually)

LDR to HDR works well

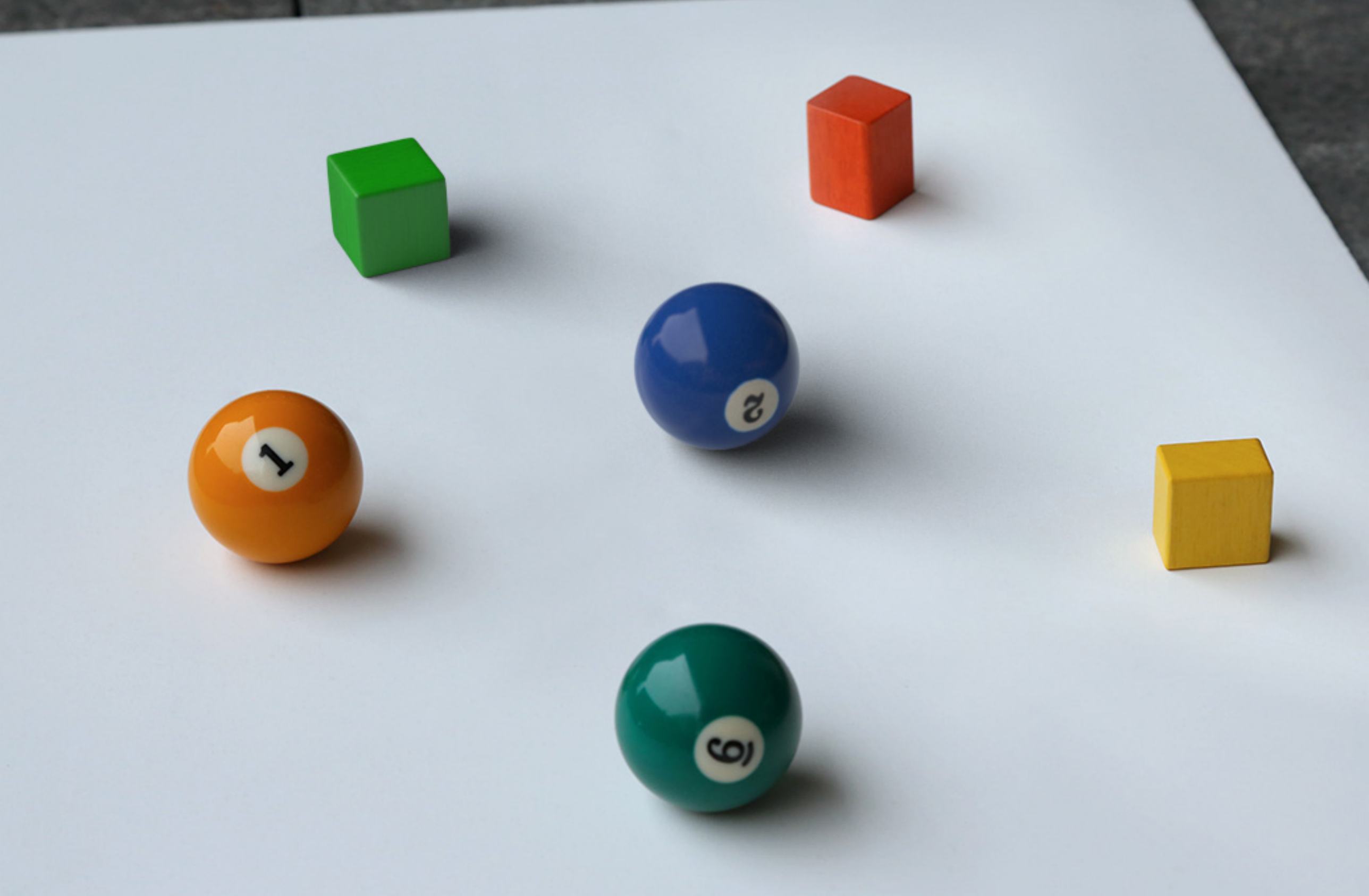


160x80 is **not perceptually noticeable** for all scenes



160x80 is not perceptually noticeable for all scenes

~99% saving


1
2
9

Future Work

BRDF captured materials

Future Work

BRDF captured materials

Measured distribution from specular to diffuse

Future Work

BRDF captured materials

Measured distribution from specular to diffuse

Eye tracking

Looking at highlight or shadow?

Future Work

BRDF captured materials

Measured distribution from specular to diffuse

Eye tracking

Looking at highlight or shadow?

Mixing materials and shapes

Specular cube

Diffuse sphere

Future Work

BRDF captured materials

Measured distribution from specular to diffuse

Eye tracking

Looking at highlight or shadow?

Mixing materials and shapes

Specular cube

Diffuse sphere

Comparison or application to other compression techniques

Spherical harmonics

Wavelets

Questions