Visual Perception and the Brain

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About the Course

- Not the usual approach to vision
- The focus will be on perception as a guide to strategy and mechanisms

The standard anatomical and physiological approaches to vision have not been able to explain perception.

Consider what the *phenomenology* of what we see is trying to tell us about how vision works.

Module # 1–Background

Visual Perception and the Brain

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Topic 1. What We Actually See

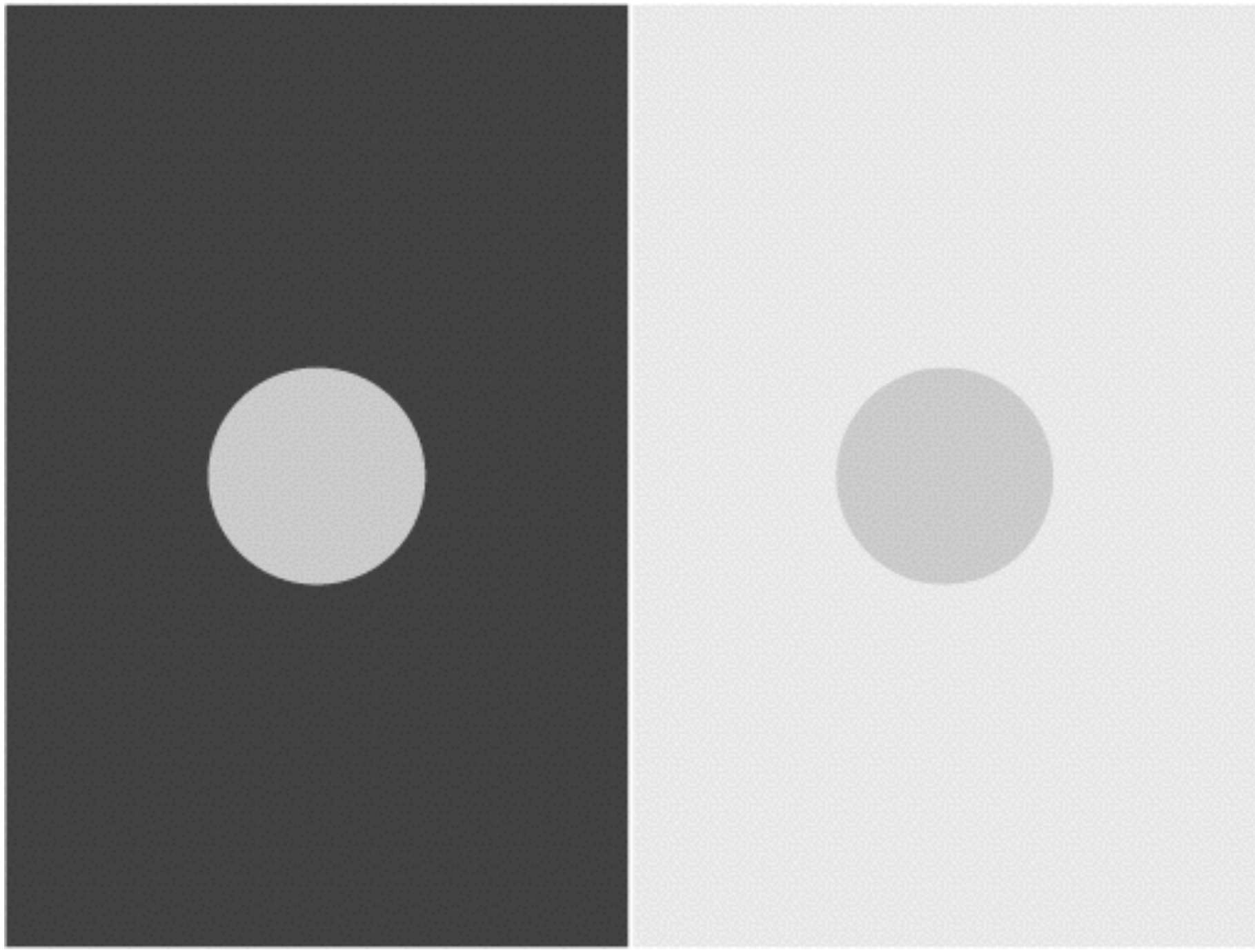
Lesson 1. Some Definitions

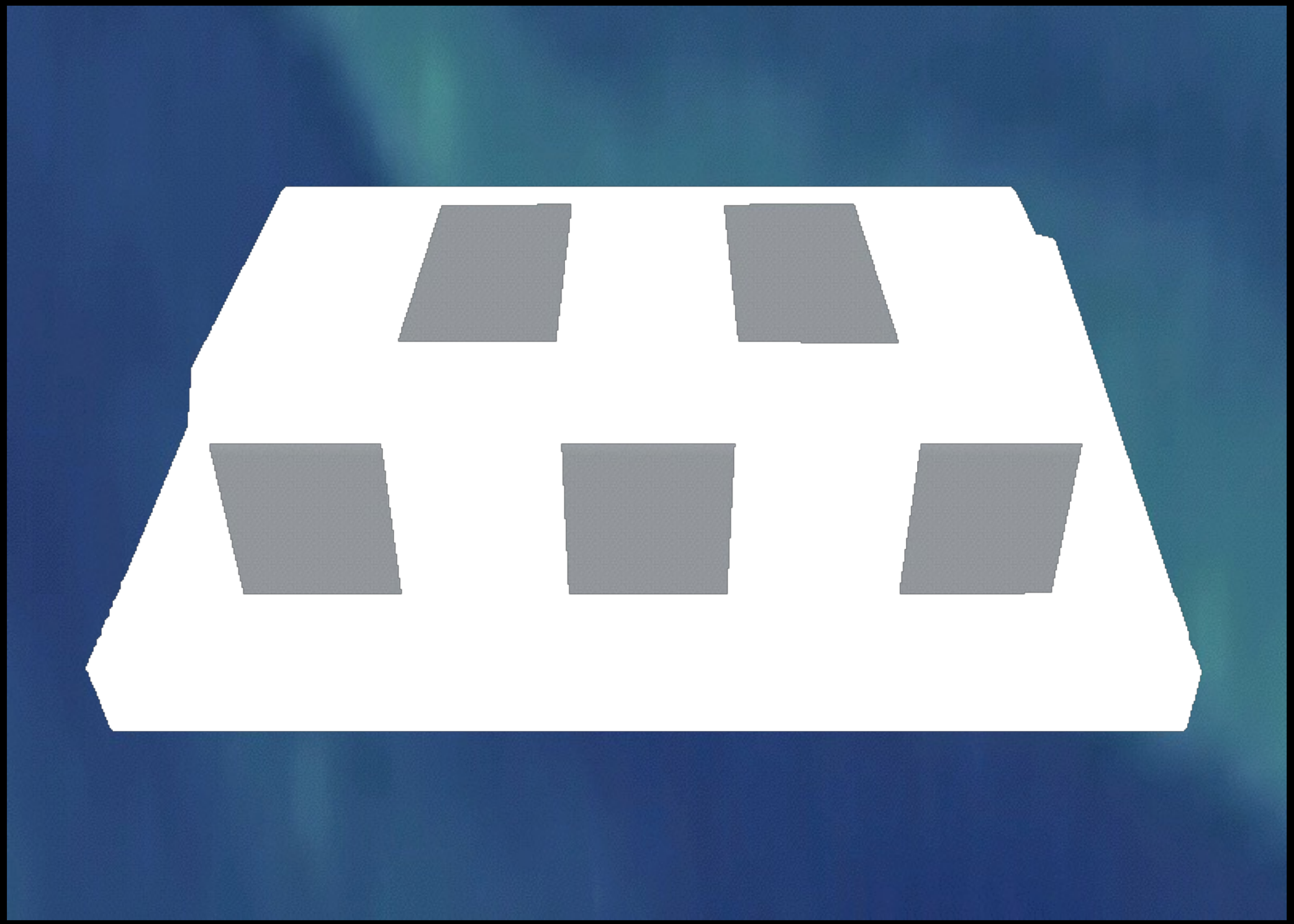
Definitions

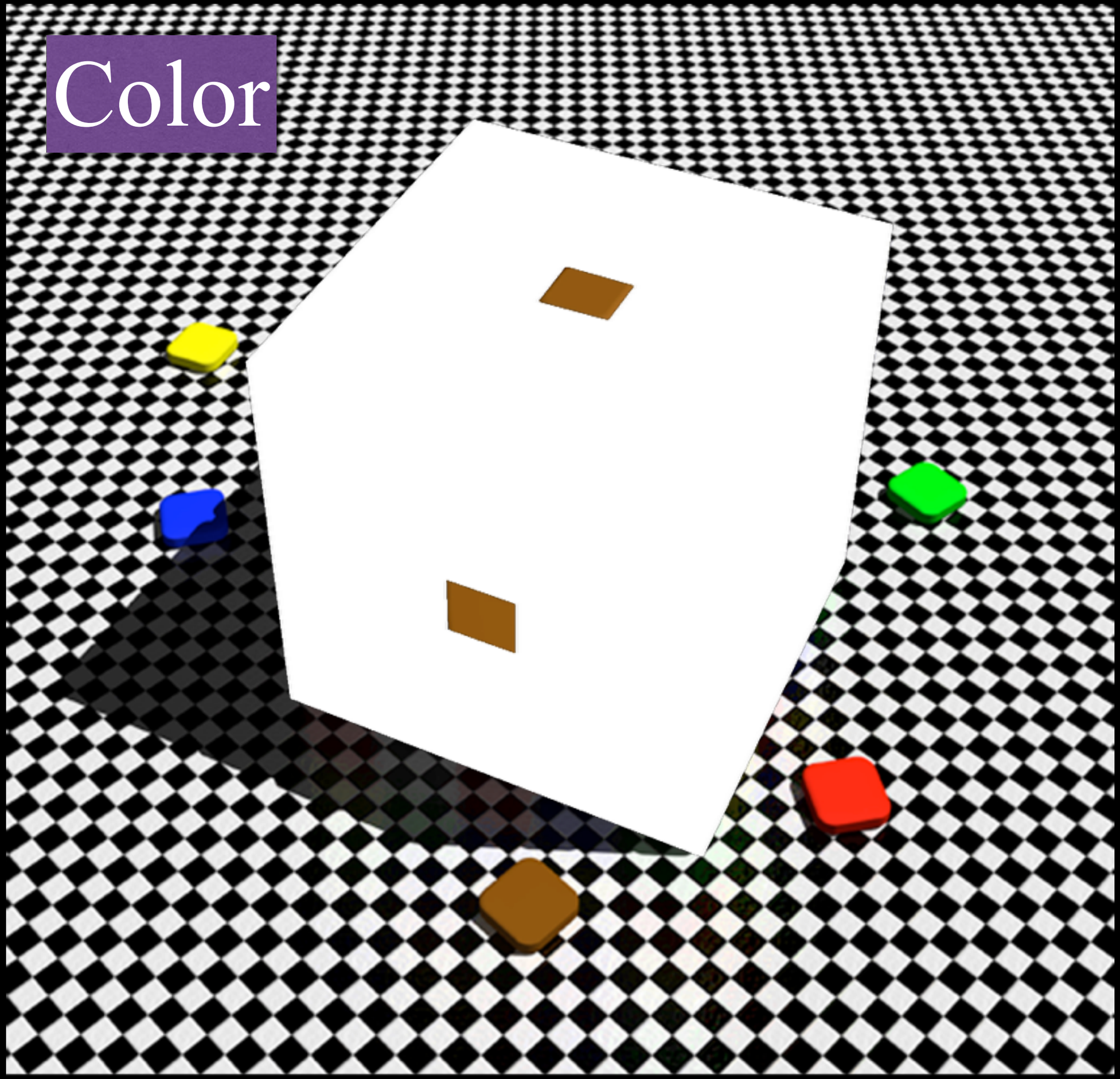
- Perception
- Physical measurements
- Psychophysical measurements

Lesson 2.The Strange Way We See the Physical World

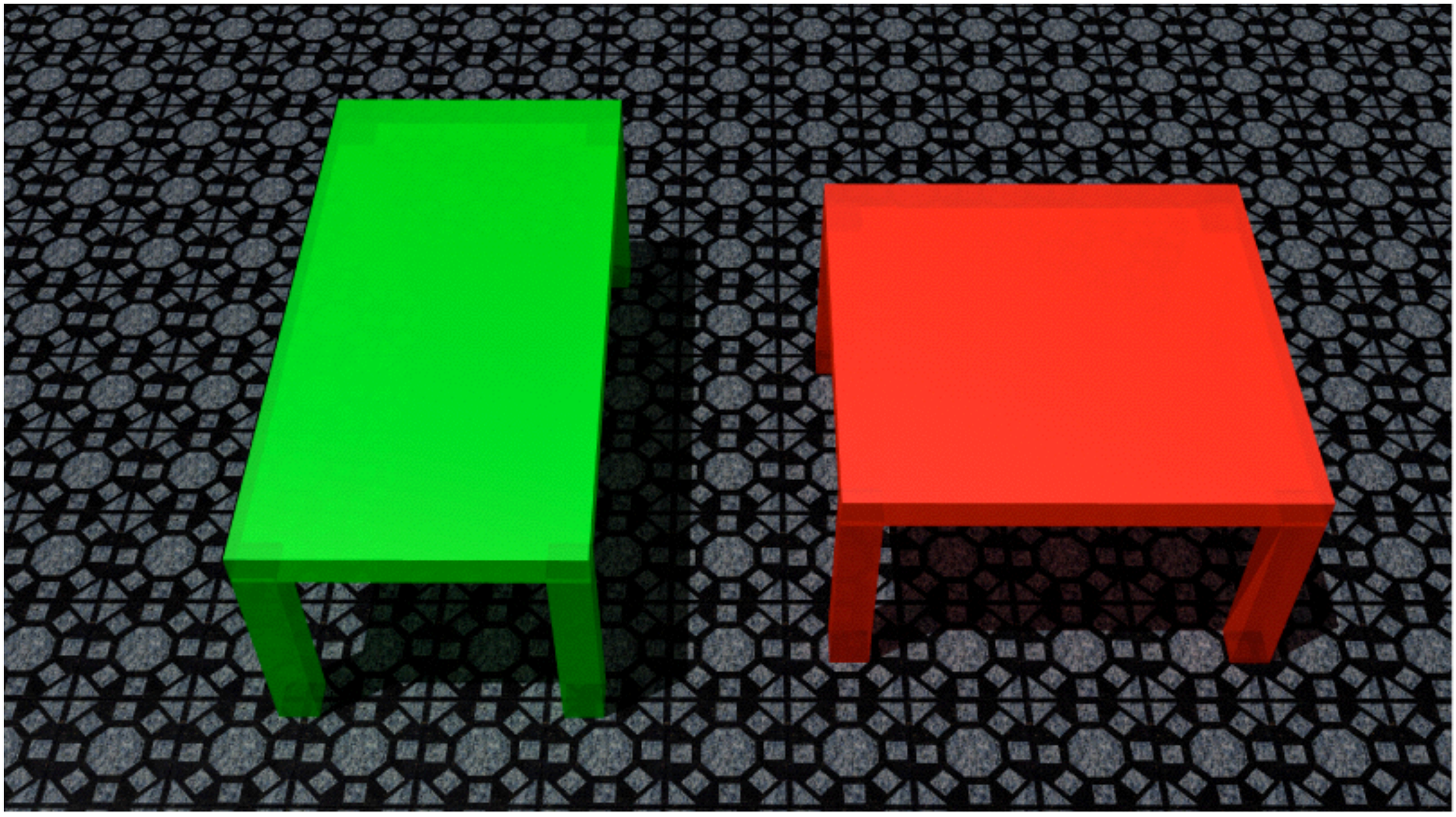
The Perception of Luminance (i.e., relative lightness)



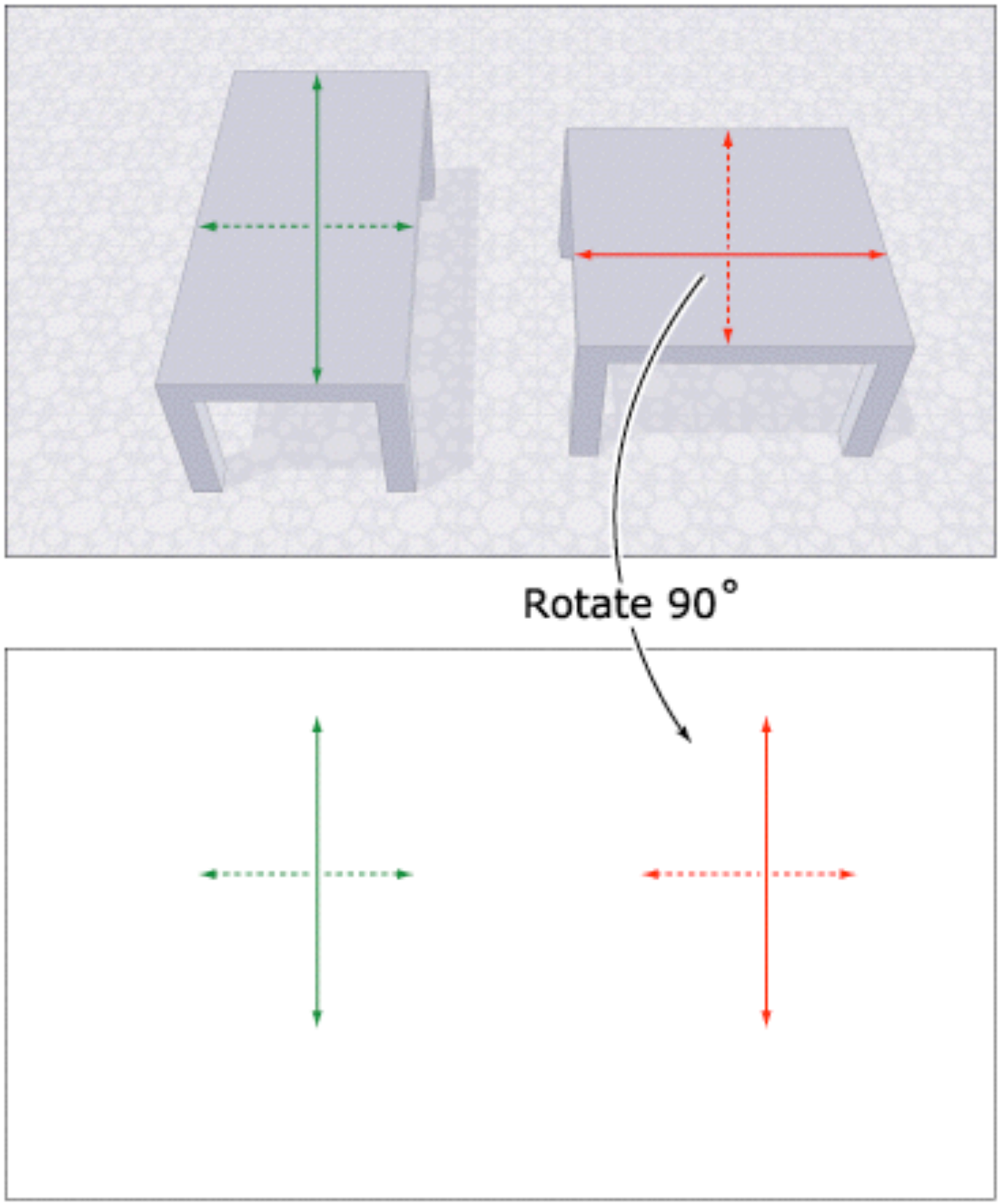



Color

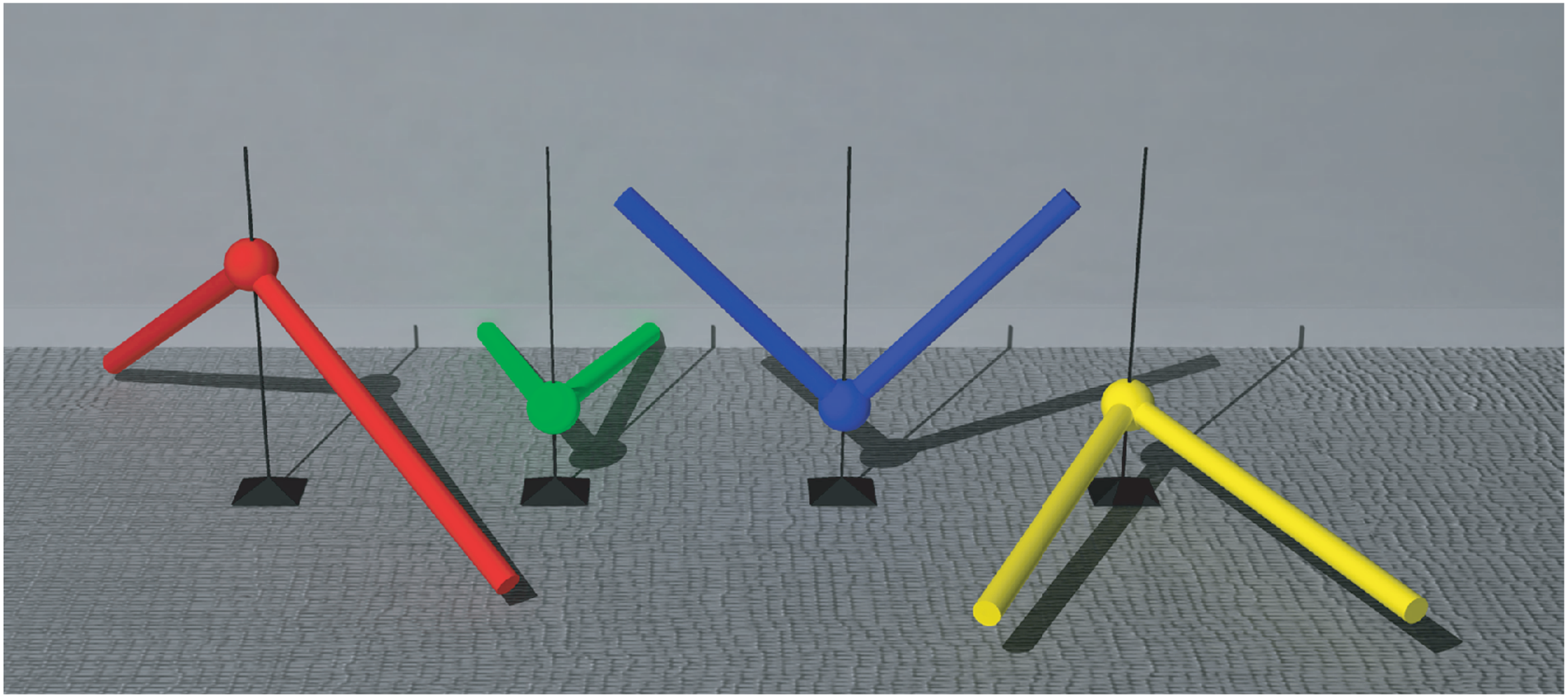
Geometry



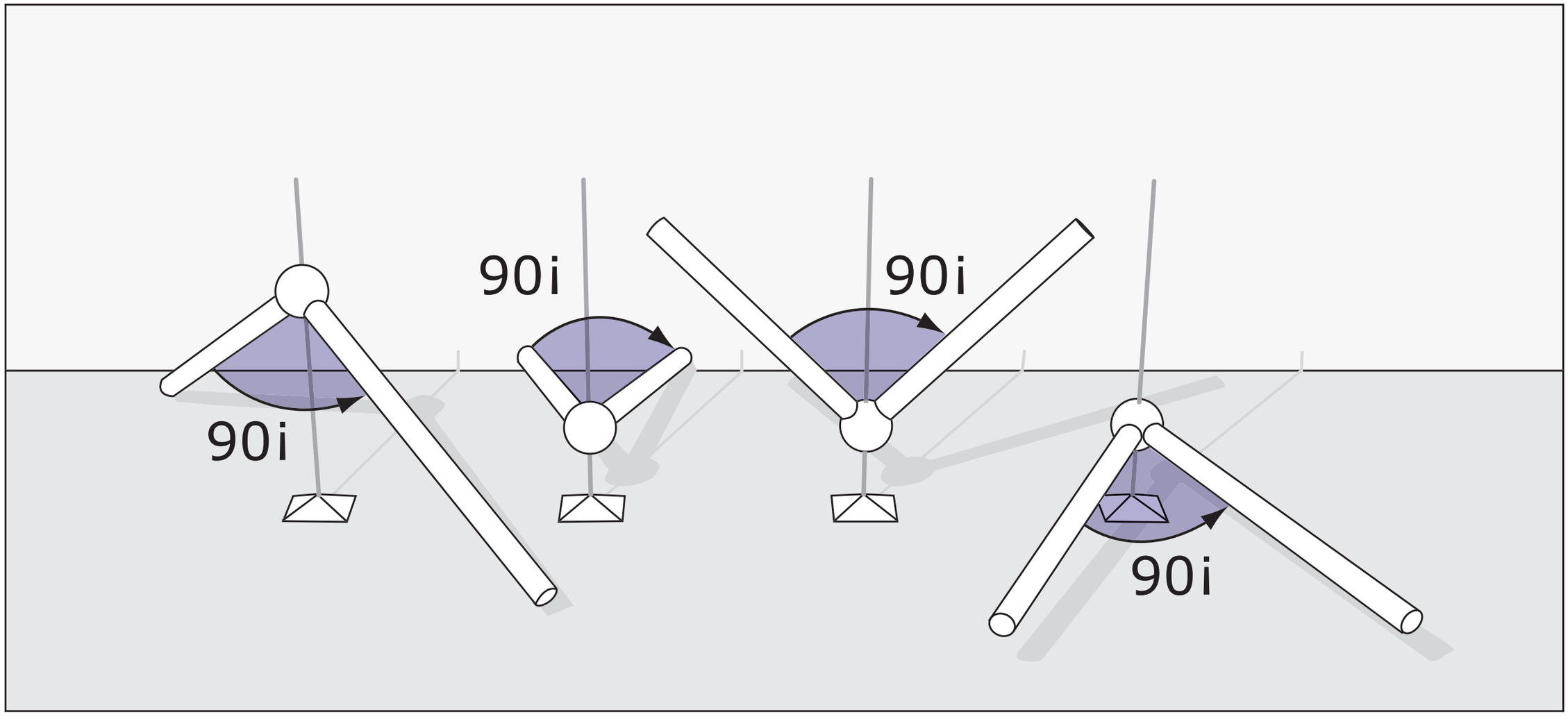
Geometry

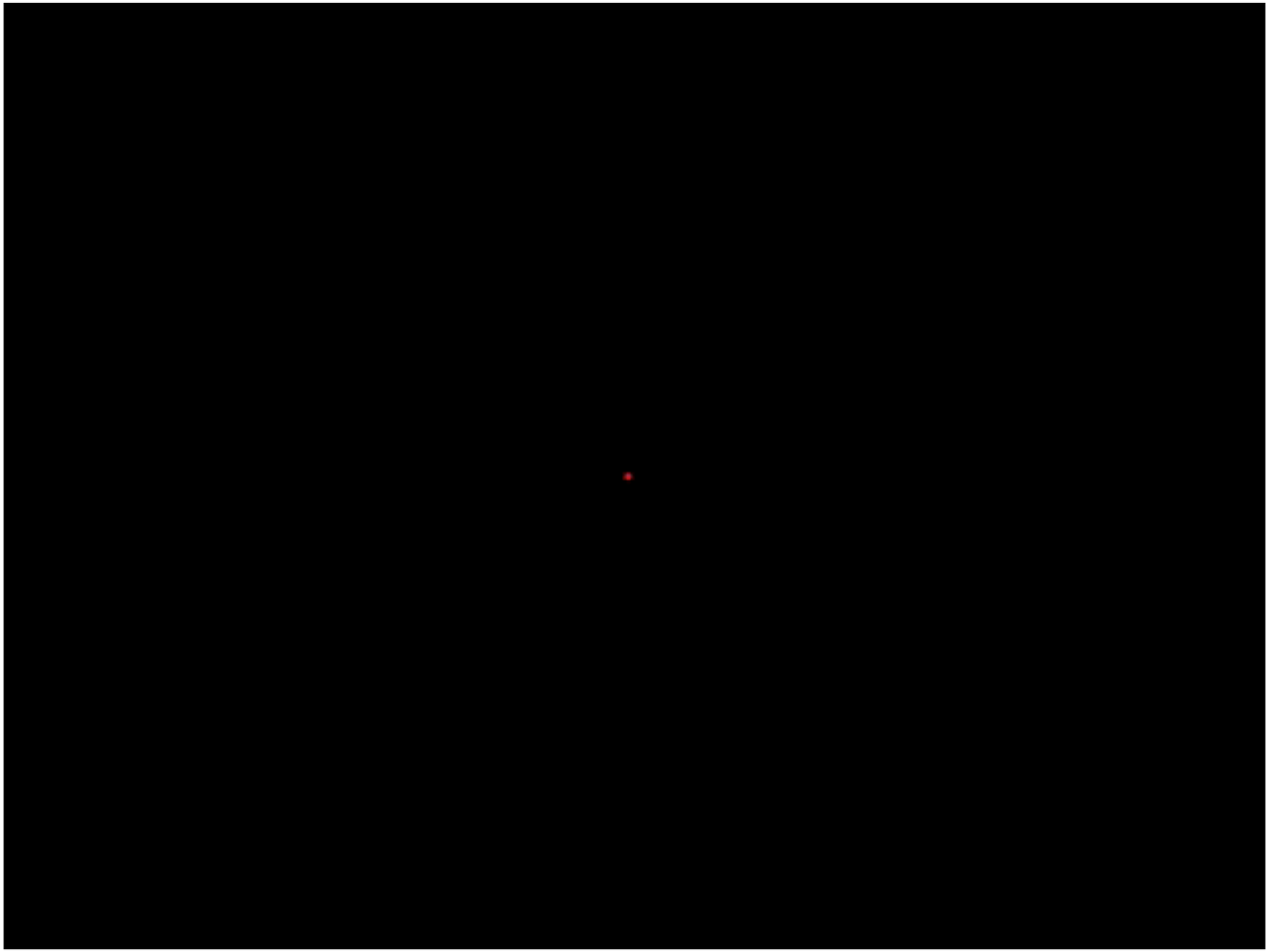


An example of angle perception



An example of angle perception





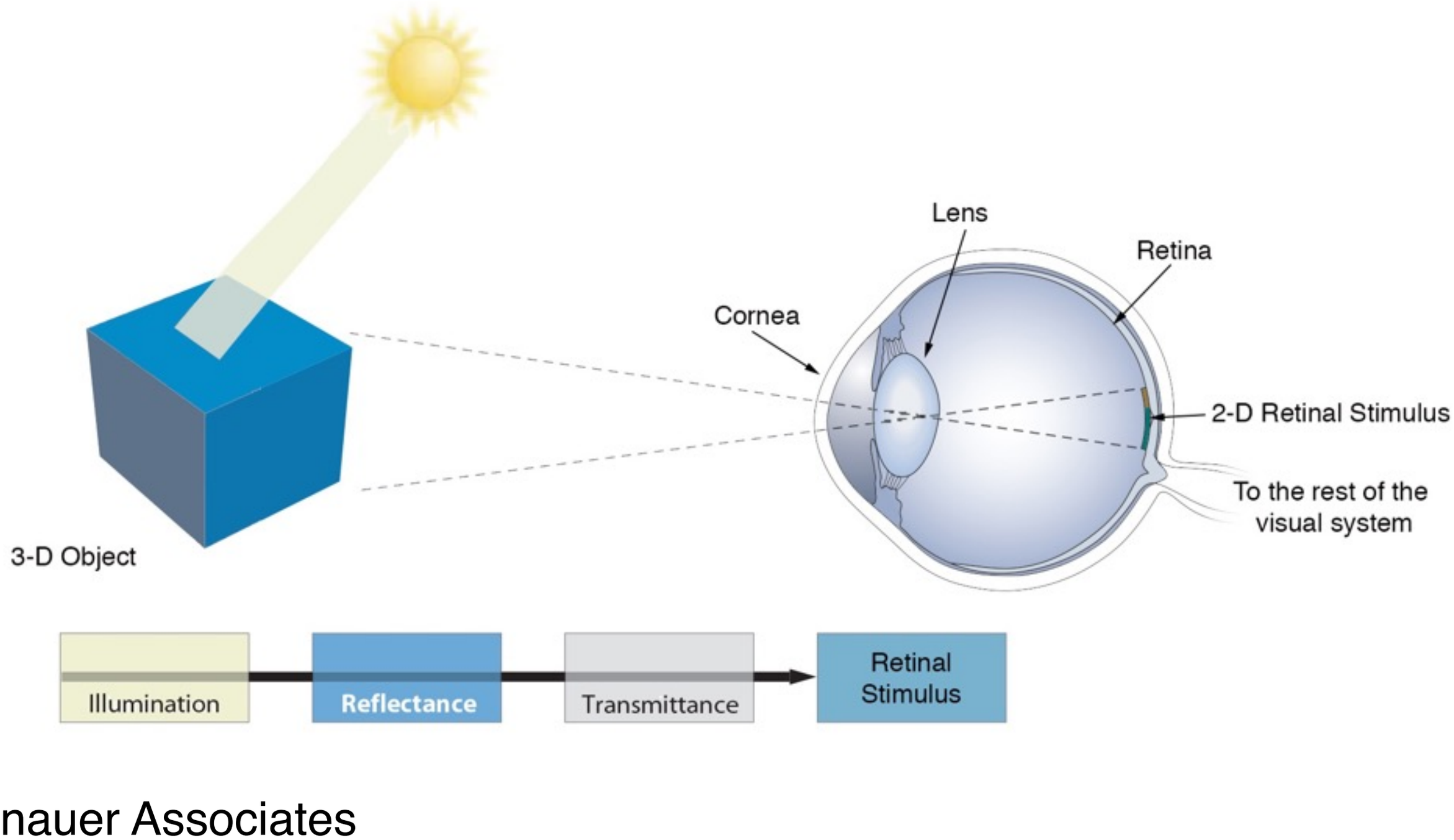
Even though we behave successfully in the physical world, we don't see it according to measured reality.

So what is going on?

- These are not illusions but just the way we see stuff.
- But why are our perceptions at odds with respect to reality?

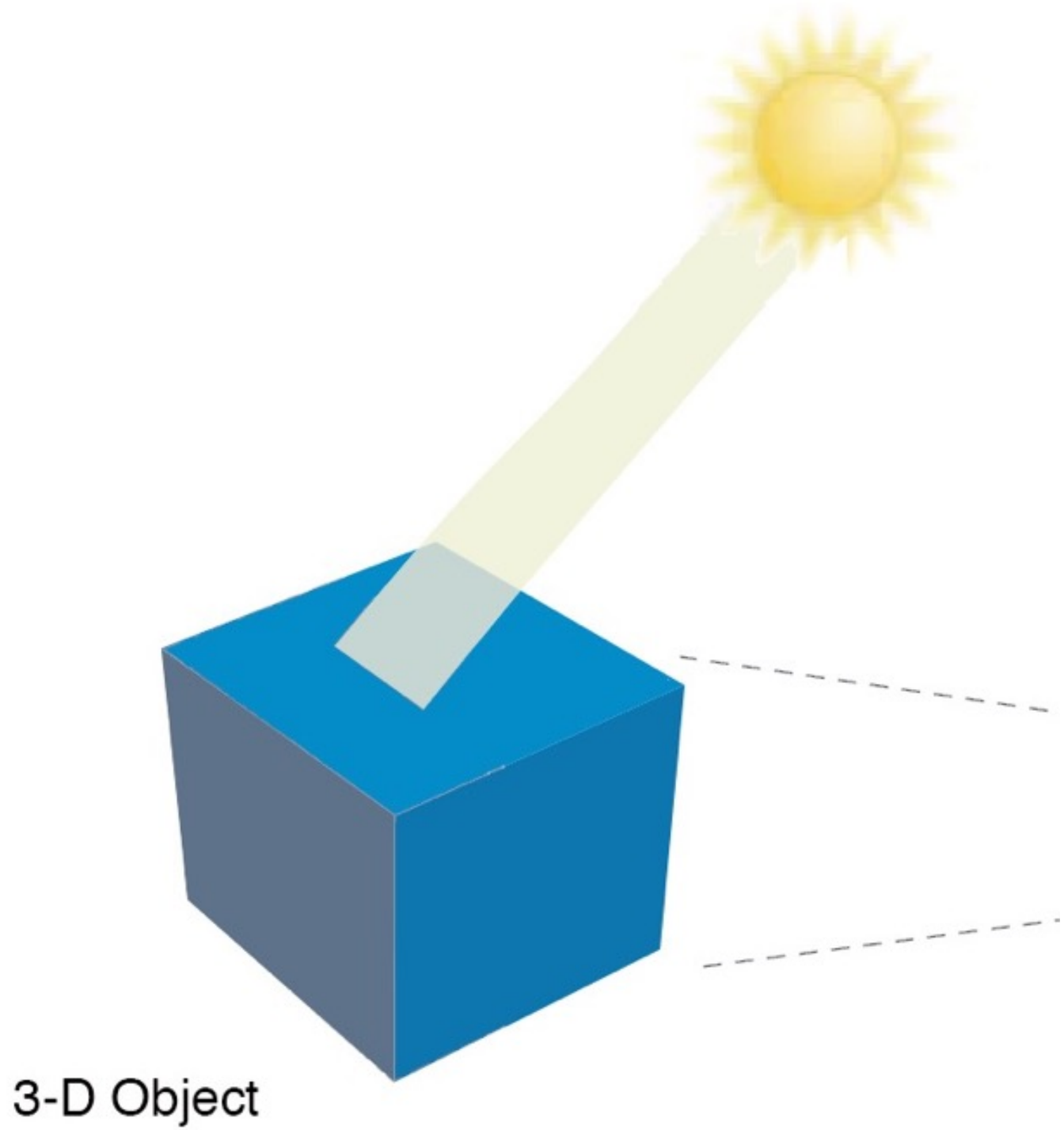
Lesson 3.The Inverse Problem

The inverse problem as it applies to luminance

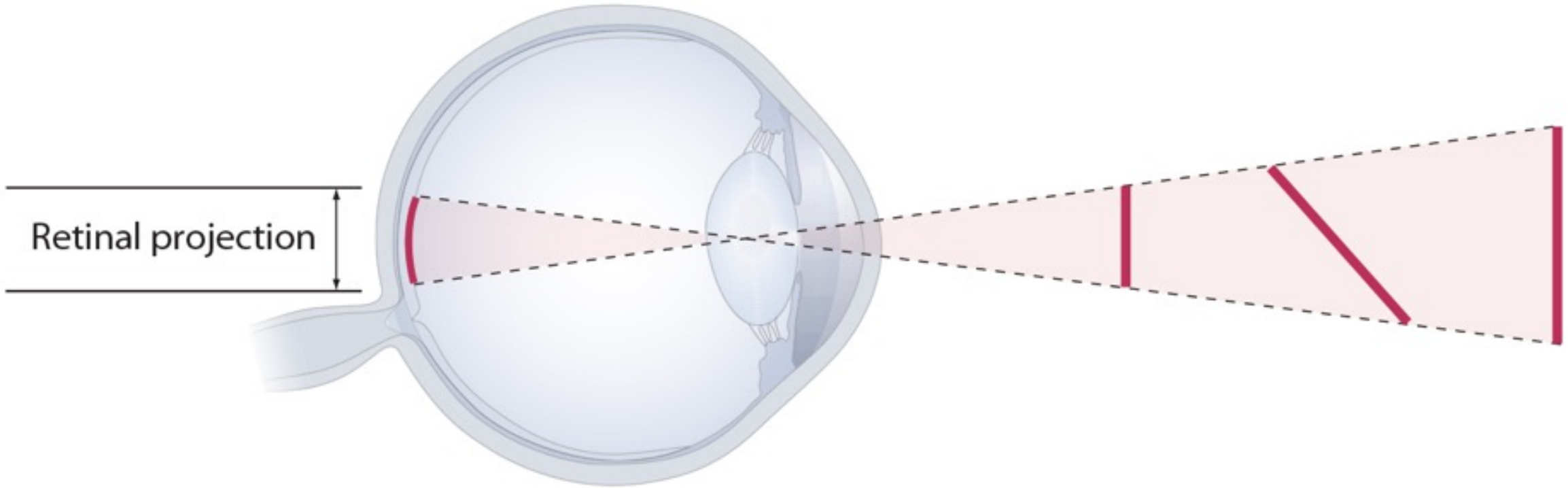


Photons from Light Source

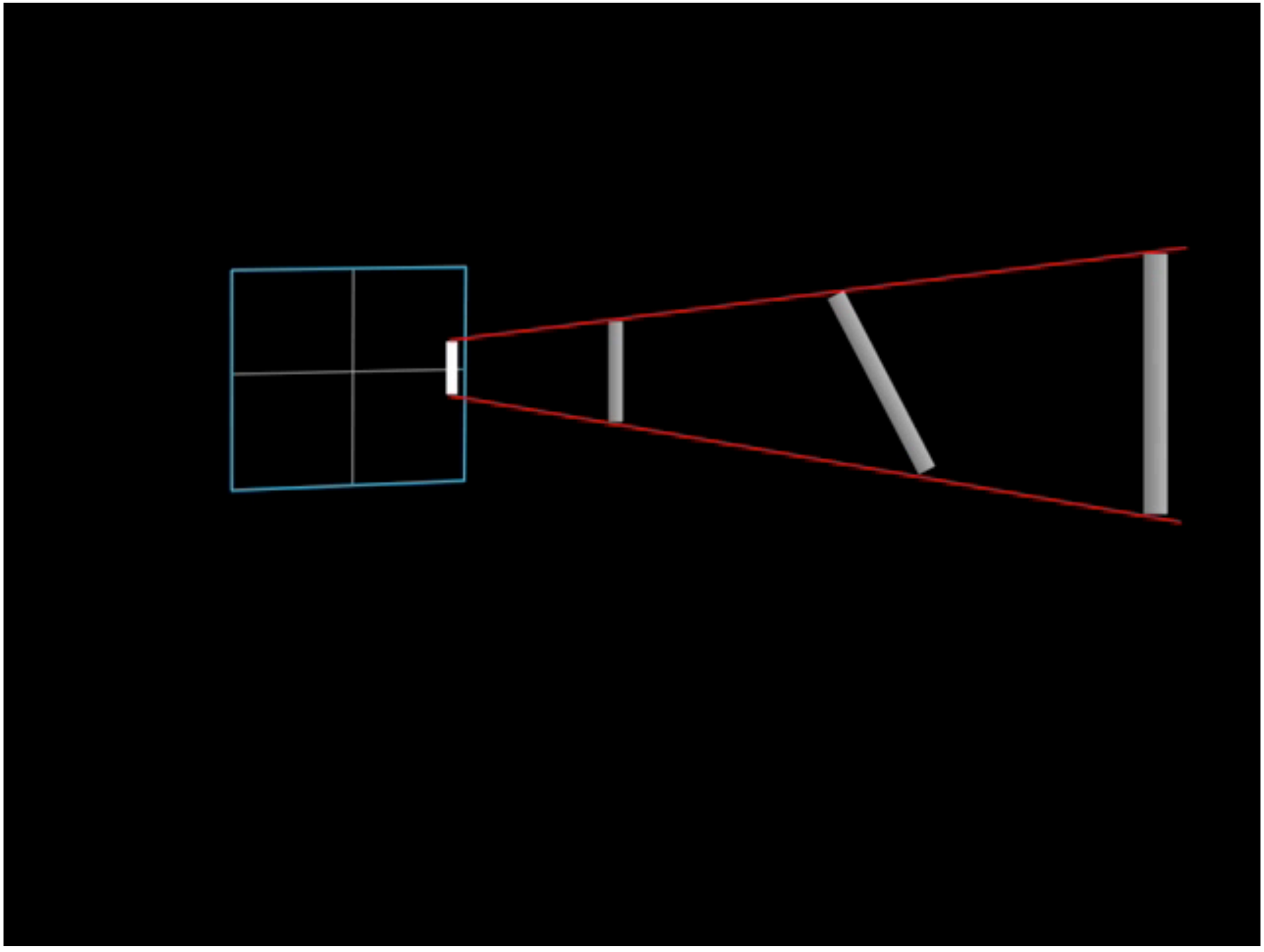
Reflections of Light from Object Surfaces



The inverse problem as it applies to geometry



The inverse problem as it applies to seeing motion



Summary of the Main Points

- The significance of visual images for behavior in the physical world is inherently uncertain
- This means that the real world is “unknowable” by any direct, logical operation on retinal images
- How then does vision succeed in a hidden physical world?

Credits

Dale Purves, R. Beau Lotto. *Why We See What We Do Redux*, Sinauer Associates Inc. 2011:

- Dots in boxes, pg. 24
- Gray and white stripes, pg. 25
- Box with colored squares, pg. 79
- Box with colored squares, pg. 93

Angles. Dale Purves, R. Beau Lotto, *Why We See What We Do*, Sinauer Associates Inc., 2003, pg. 153

Dale Purves, R. Beau Lotto. *Why We See What We Do Redux*, Sinauer Associates Inc. 2011:

- Inverse problem and luminance, pg. 71 and 92
- Retinal projection, pg. 92
- Inverse problem and motion, pg. 159