What you see

- Intuitively, you simply see "the world."

  - That is, you are subjectively aware of the actual physical scene in front of you, simply because you can see it.

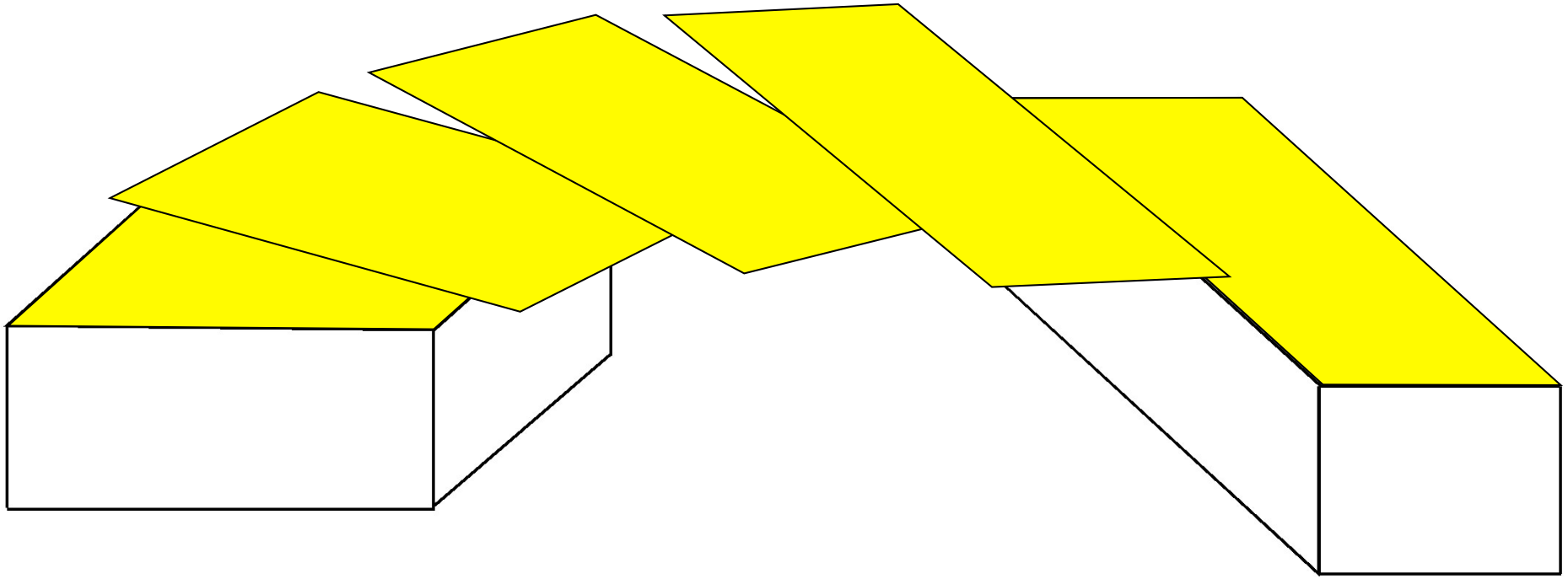
  - This idea is sometimes called naive Realism.

- In fact, the sense data (proximal stimulus) is the only thing the brain has "direct" access to.

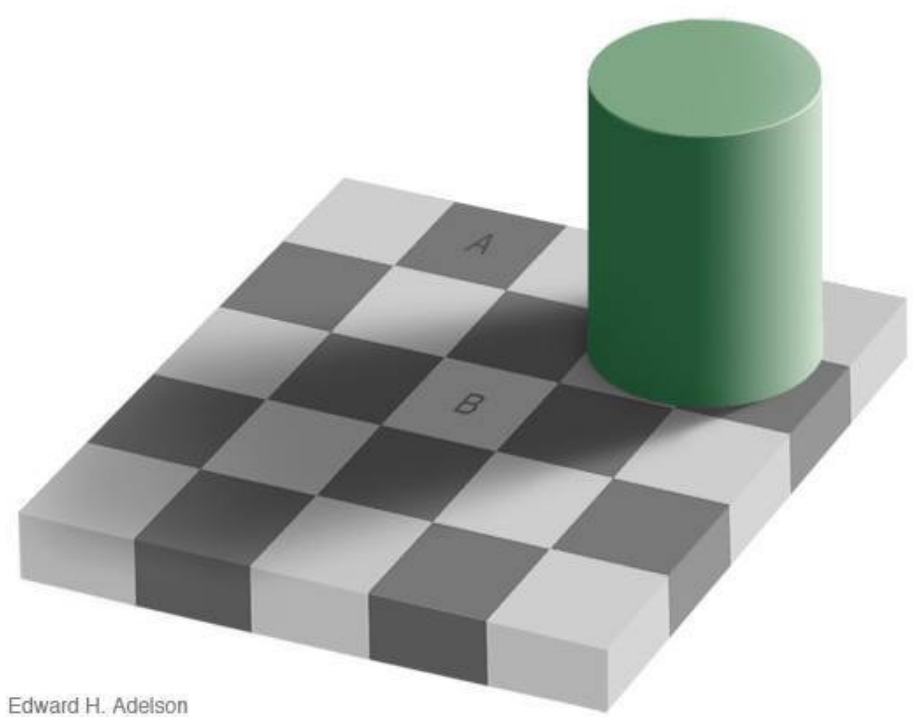
  - This has led to a misconception that what you actually "see" is the image (the proximal stimulus)

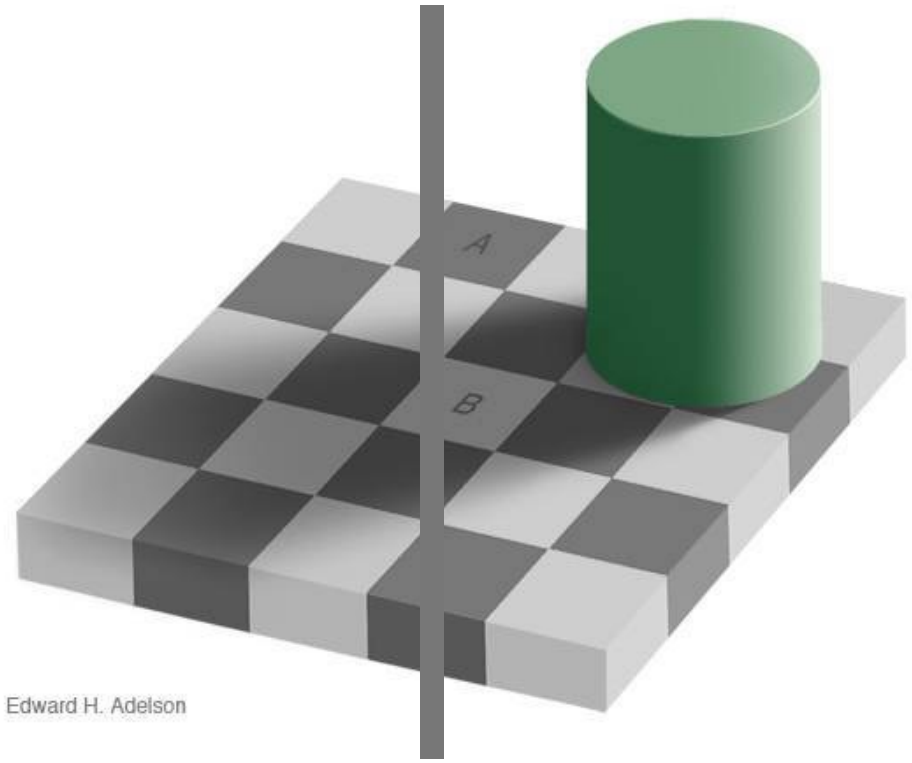
  - In fact, a model of the world—a mental representation—has to be inferred from the sense data. You don't see the sense data itself.

  - What you actually see is the inferred mental representation

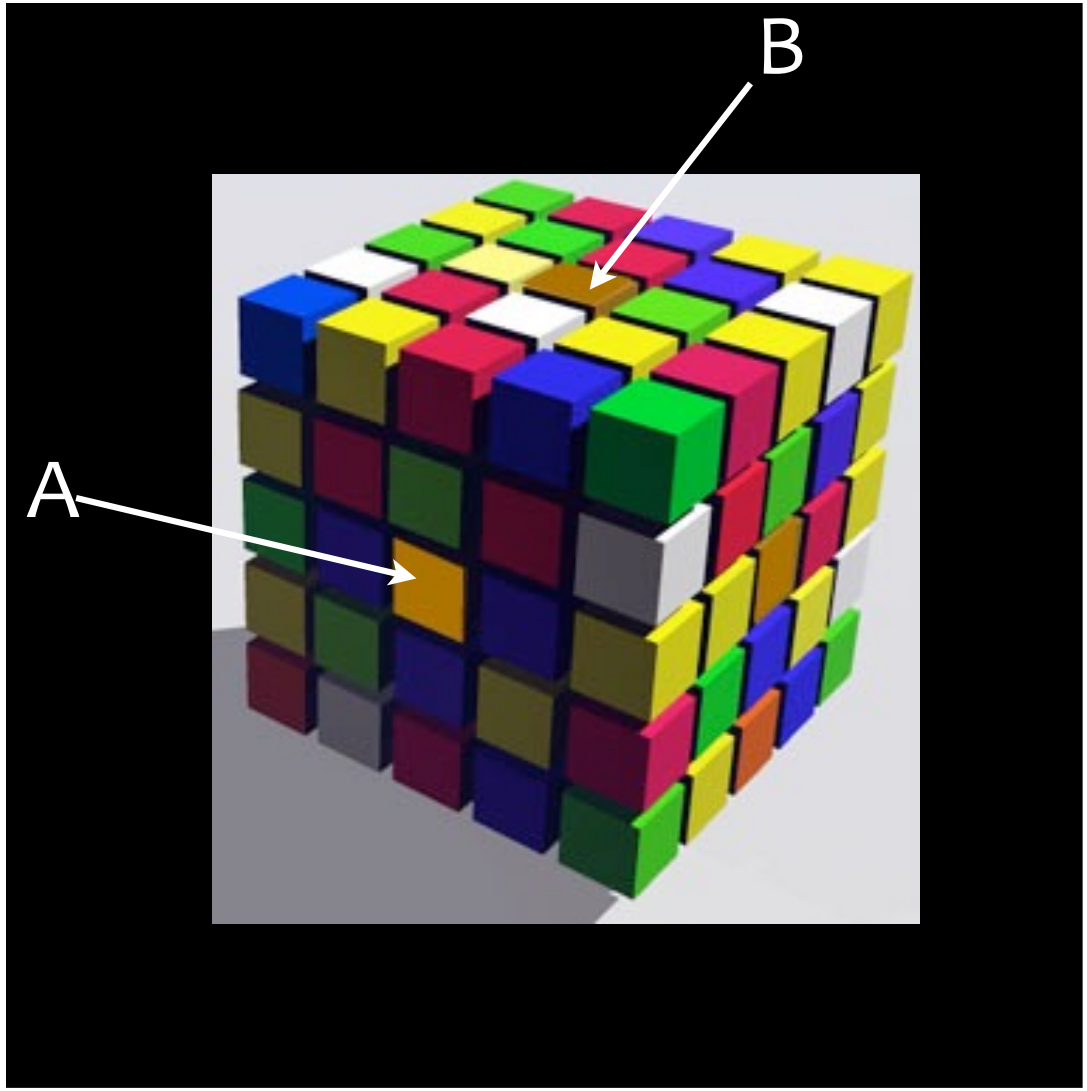


You see the interpretation, not the image!

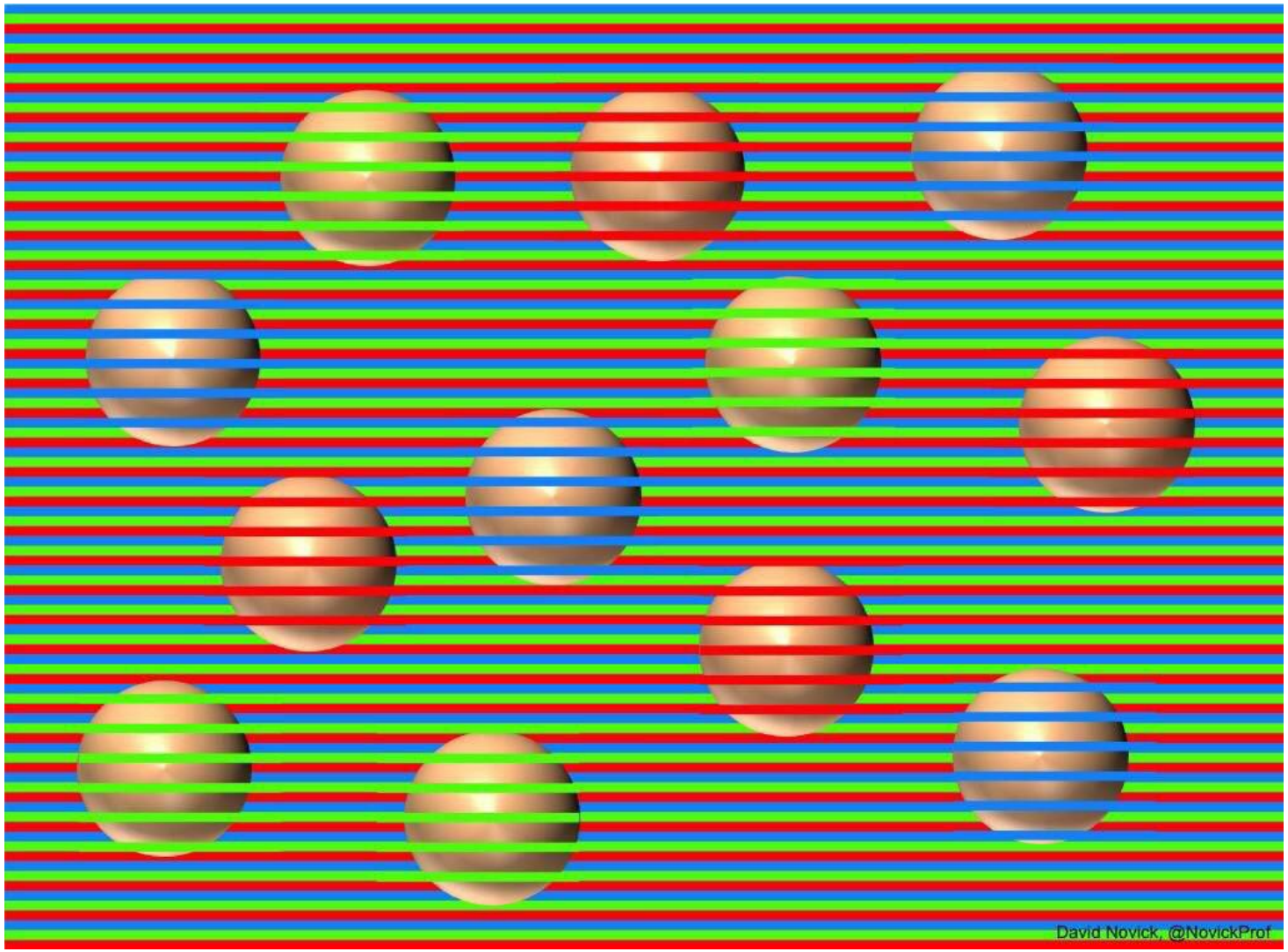




Squares A and B are the same (proximal) shade

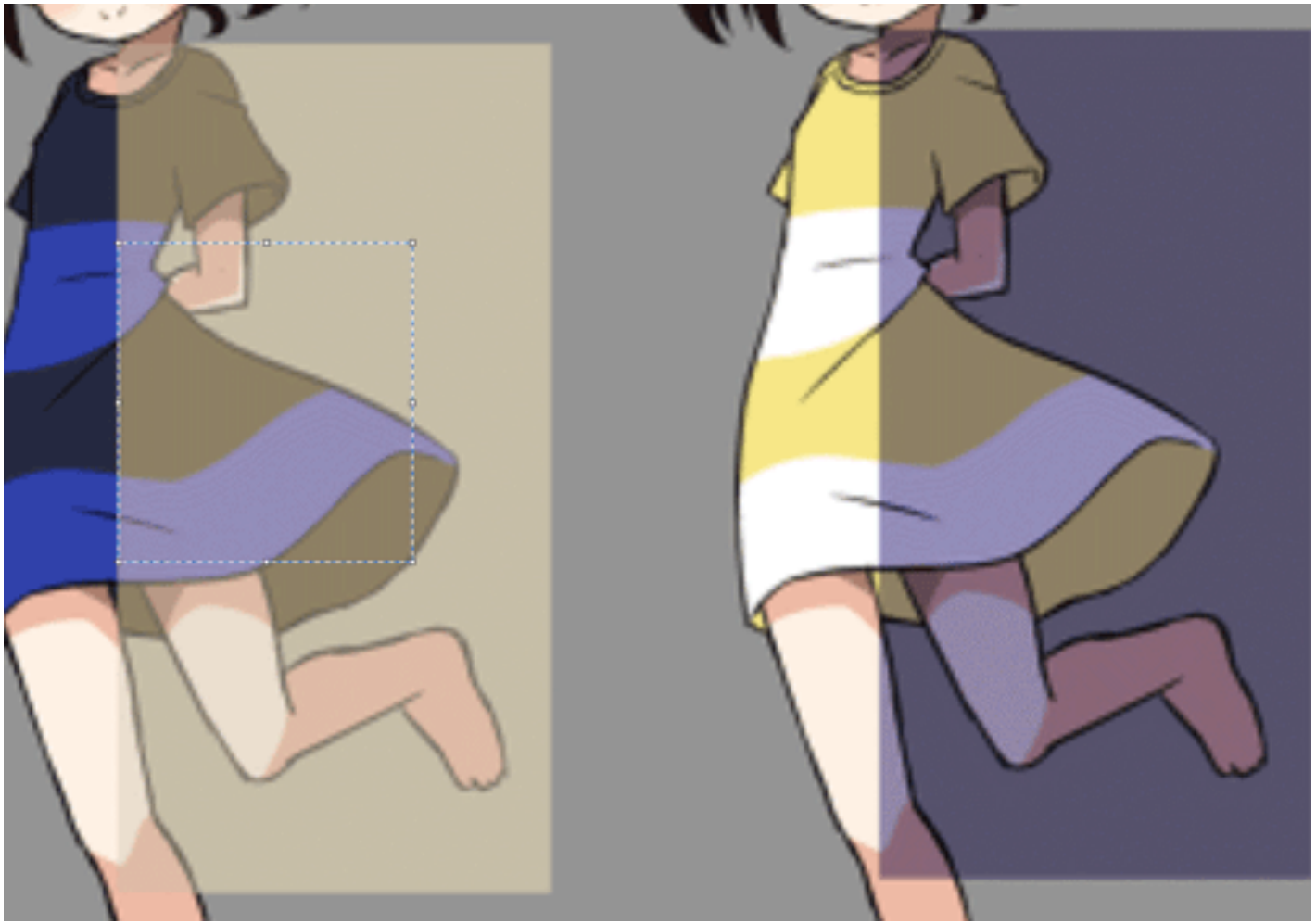


Squares A and B are the same color in the image

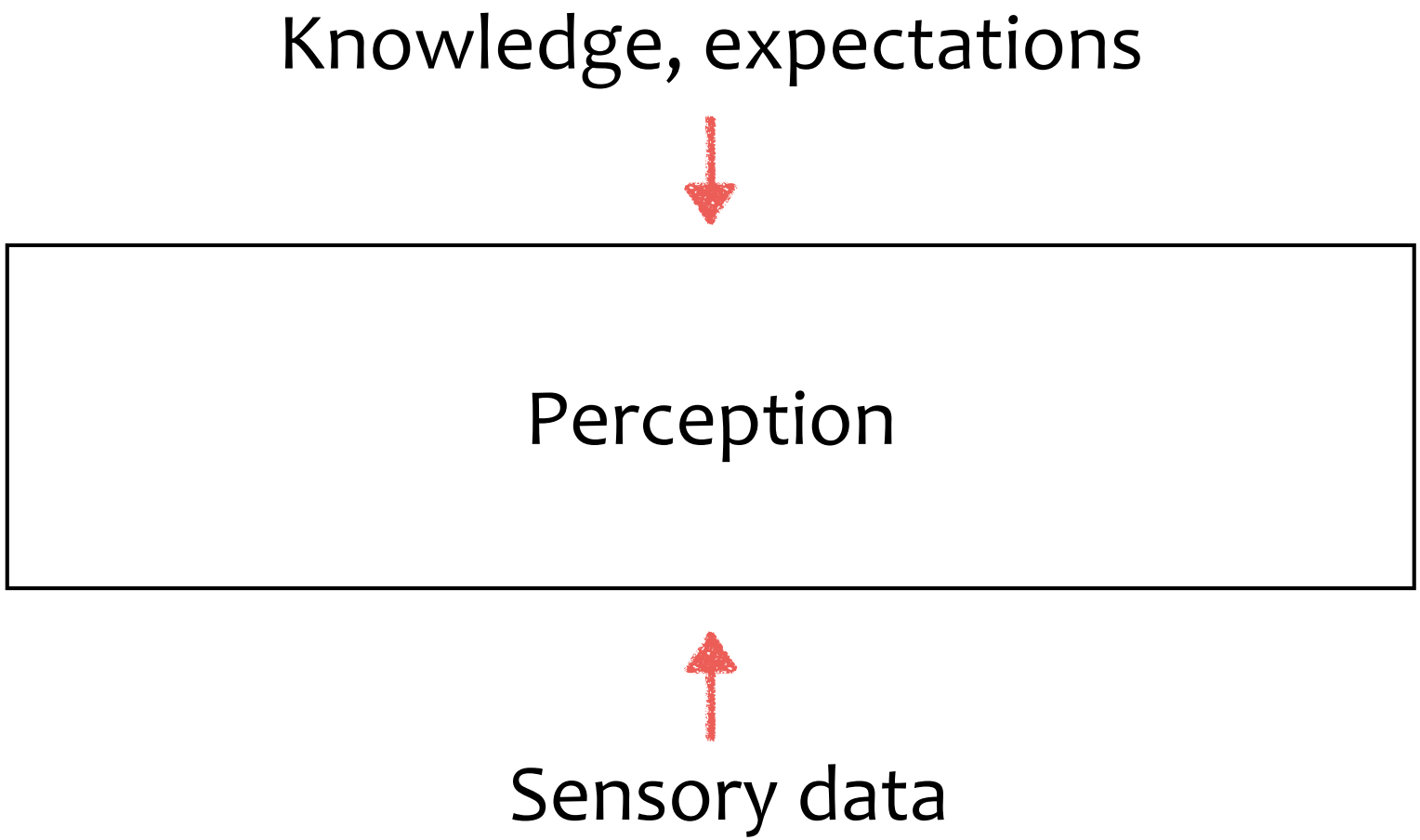


The balls are all the same color in the image

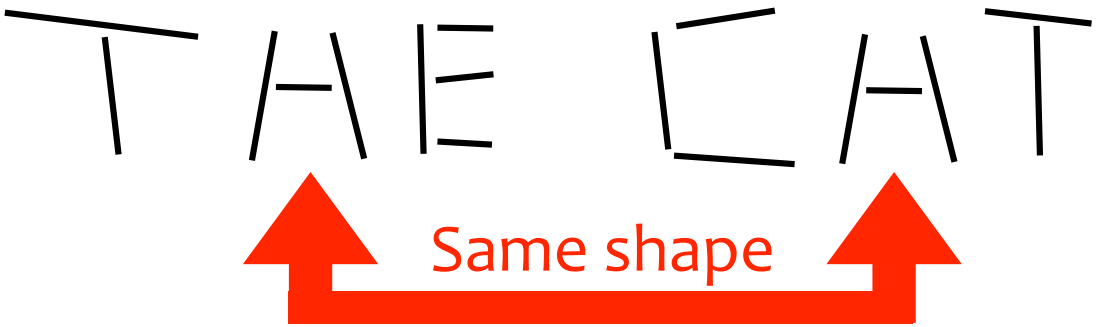
The famous dress

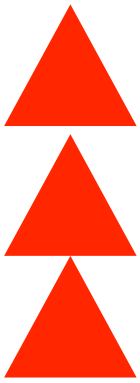


Top-down vs. bottom-up

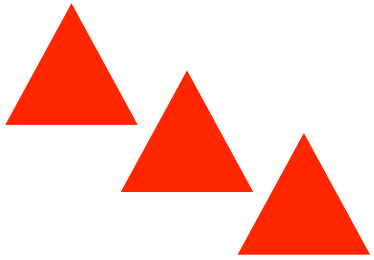


Top-down influences can change what you see…





These triangles point north



These triangles point south-east

Even though they are all the same shape!

But conscious knowledge usually doesn't!

- Visual illusions are mostly unaffected by what you "know"—e.g., "this is an illusion"
- Perception is informationally encapsulated; it is "walled-off" from consciously acquired knowledge

Lightness perception

- Lightness perception refers to the way the brain estimates the reflectance of a surface, i.e. the percent of light it reflects

  - More reflective surfaces (e.g. 90%) are perceived as white, less reflective (10%) as black, and intermediate ones (50%) as gray

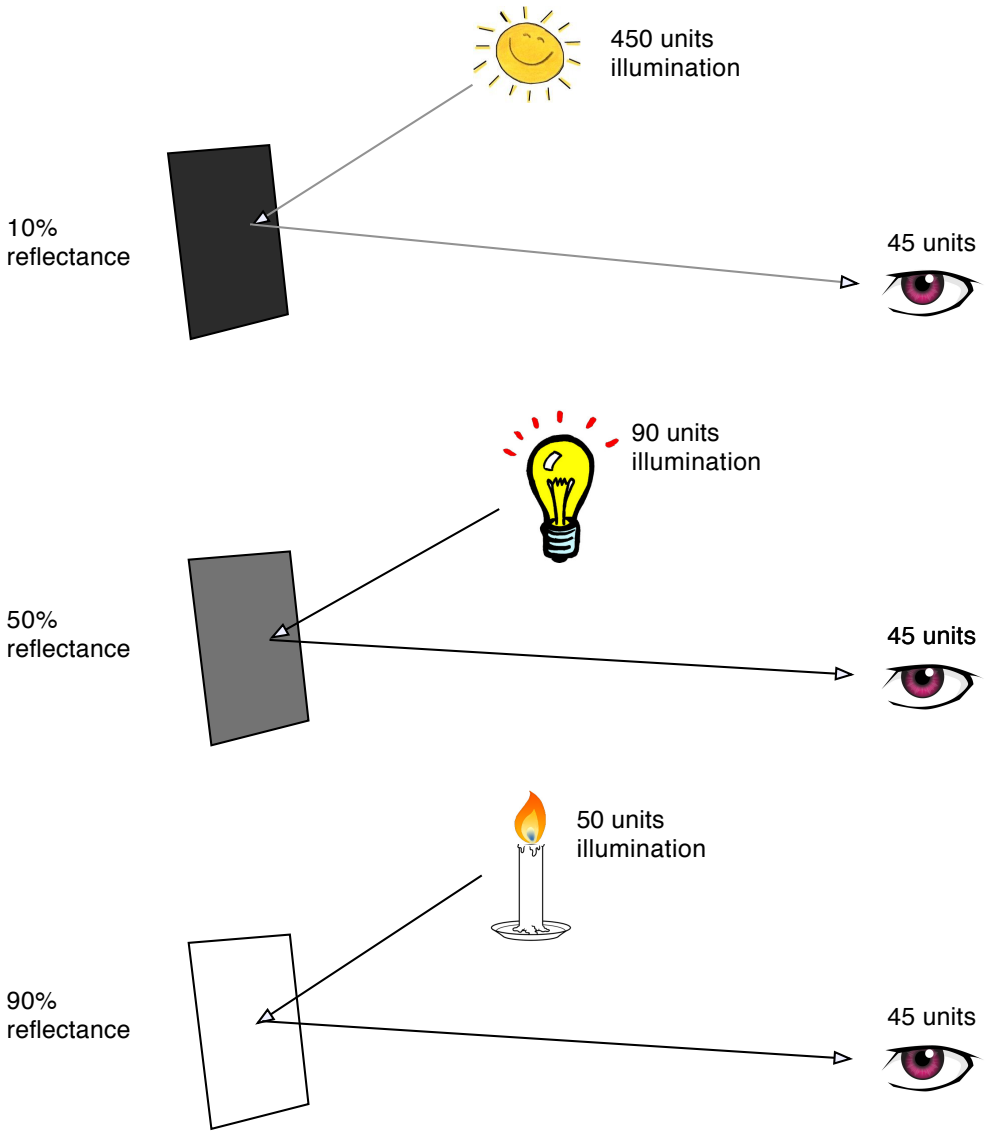
  - (Color is a separate matter.)

- The proximal stimulus contains information only about how much light there is at a particular point, not what percent of light was reflected

- But this also depends on the illumination, which you don't know!

- So how does the brain infer reflectance?

Illumination and reflectance are conflated in the image



So how do we solve it?

- The brain solves this problem (and many many other perception problems) by tacitly making assumptions
- Assume: a common illuminant over the entire scene

  - All surfaces are then relative to each other

  - Note that this assumption is often violated (e.g. spotlights)

- Assume: the brightest surface is white

  - All other surfaces are interpreted relative to it.

- This means that you can change how a surface is perceived just by adding another surface somewhere in the image—which is true.

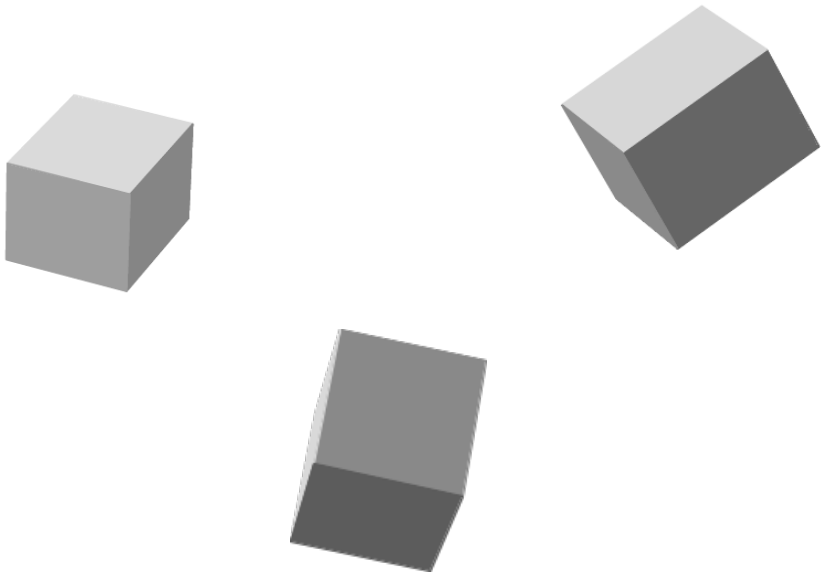
Constancies

A constancy is an apparent invariance of some property of the distal stimulus despite enormous variation in the corresponding property in the proximal stimulus

You have constancies because your brain is successful at estimating the distal property

Shape constancy

Apparent shape remains constant despite changes in 3D pose



Lightness constancy

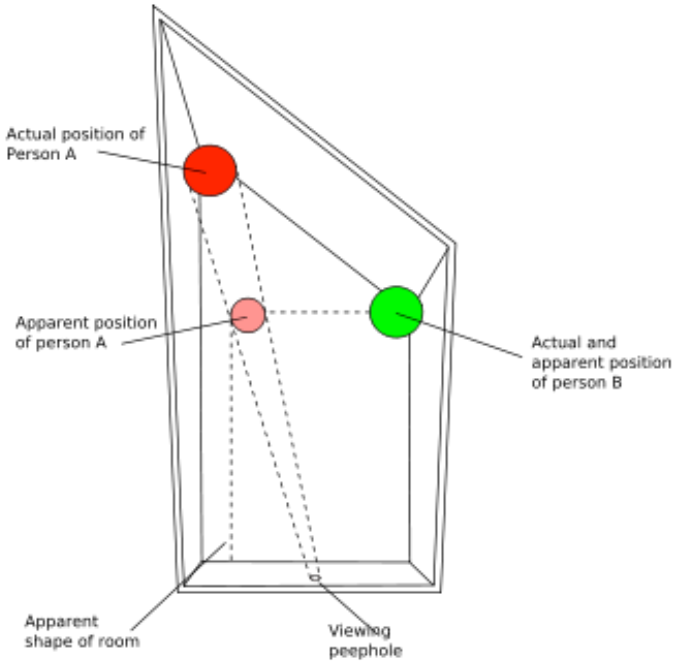
- Apparent surface reflectance remains constant despite changes in illumination

Color constancy

- Apparent surface color remains constant despite changes in illuminant color

A failure of size constancy

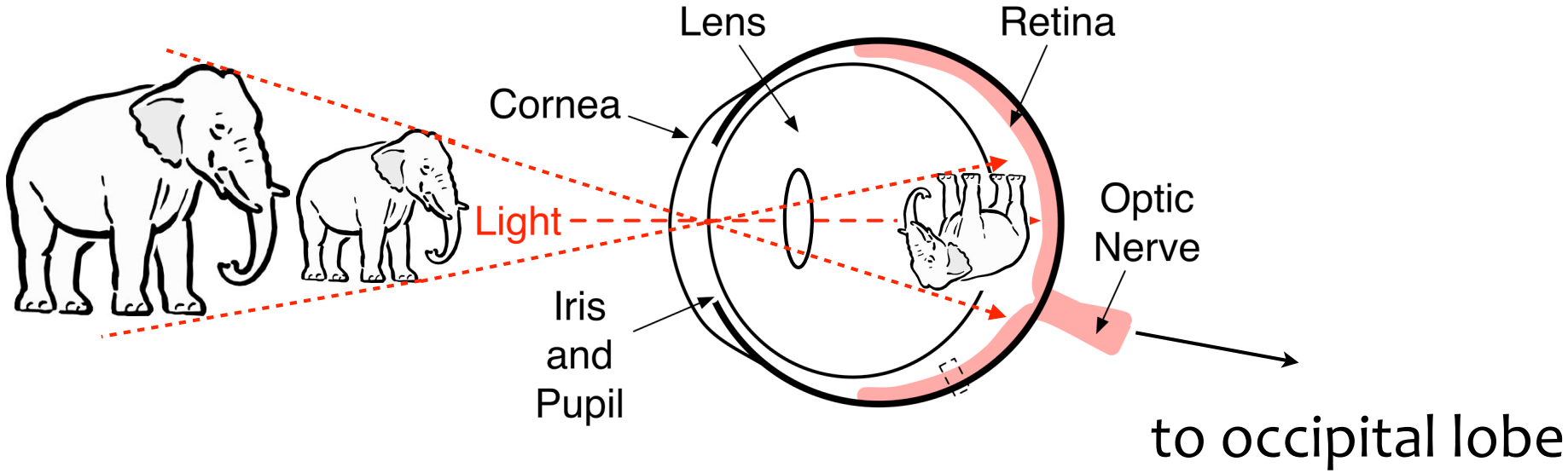
- Apparent physical size remains constant despite enormous changes in retinal size as distance changes



Ames room

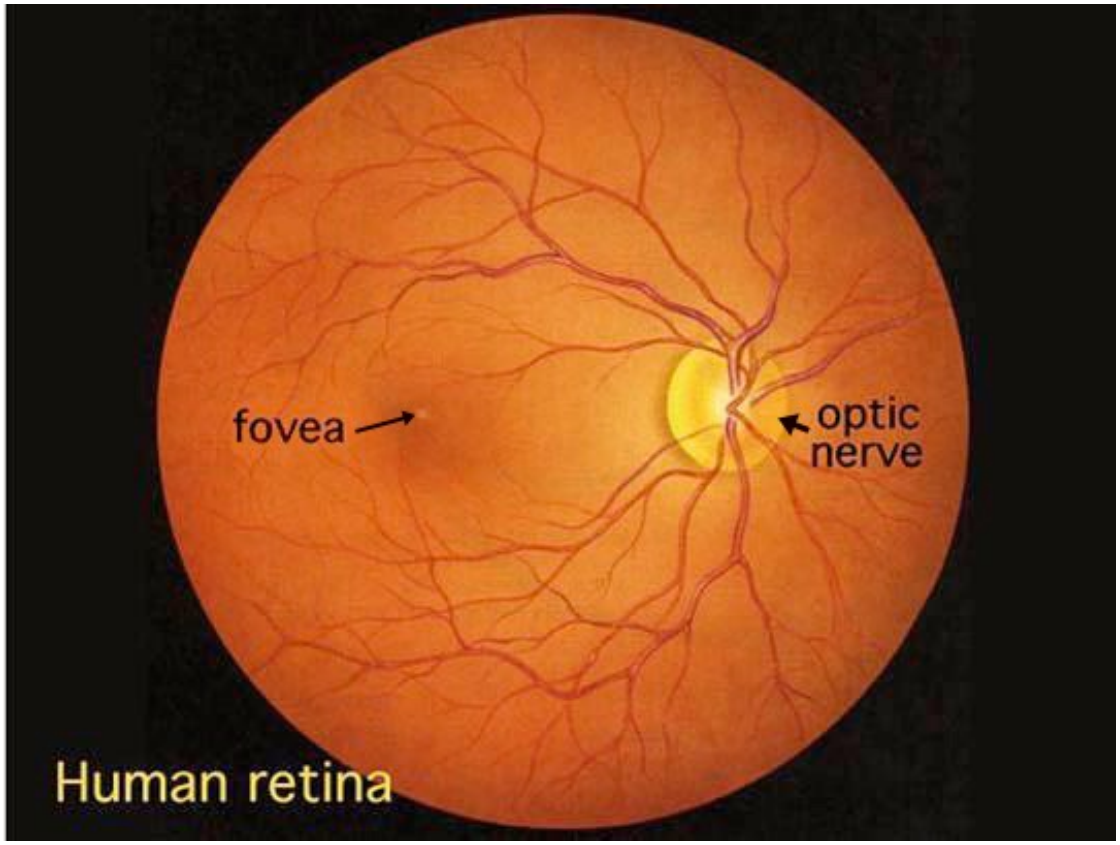
https://www.youtube.com/watch?v=W_5wpPxCcyw

Size estimates depend on distance estimates

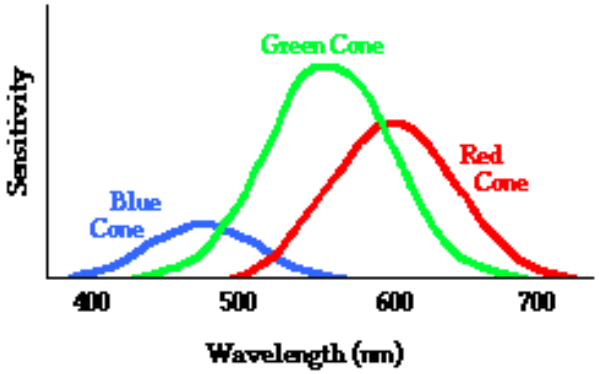


More distant objects are project to smaller images on the retina, but are not perceived as smaller (size constancy)

Retina, photoreceptors



Cones: 3 types:
short, medium & long wavelength



Rods: just 1 type, but more sensitive, faster response

Fovea -- central area of retina with high density of photoreceptors, so high resolution. Mostly cones. The fovea is what you point at something when you "look at it"

Periphery -- low density of photoreceptors -- mostly rods