Reflectance is a property of a SURFACE

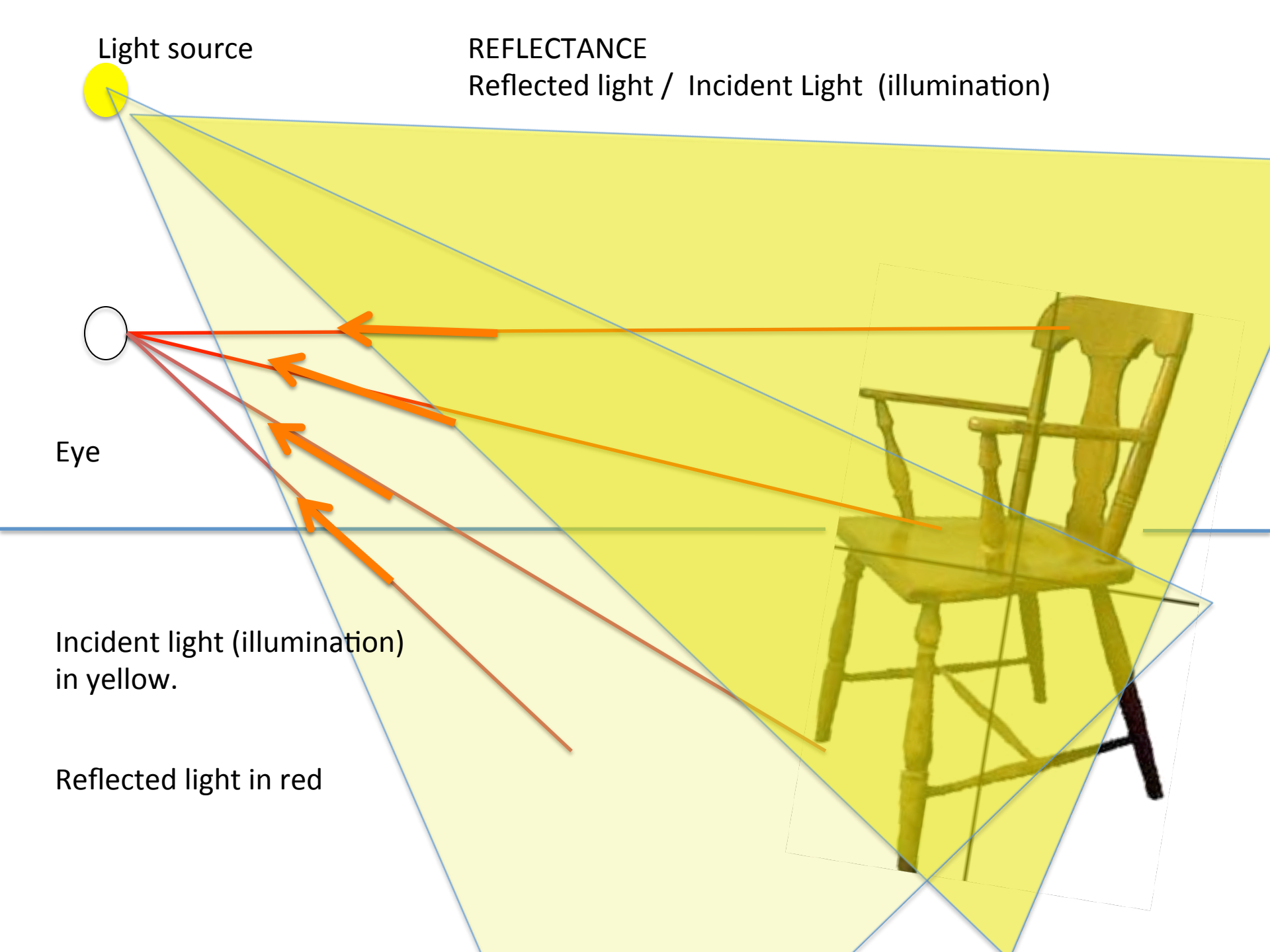
Light from sources strikes surfaces --- that's INCIDENT light

Then some of the incident light bounces off (the rest is absorbed). The amount of light that bounces off is the REFLECTED light.

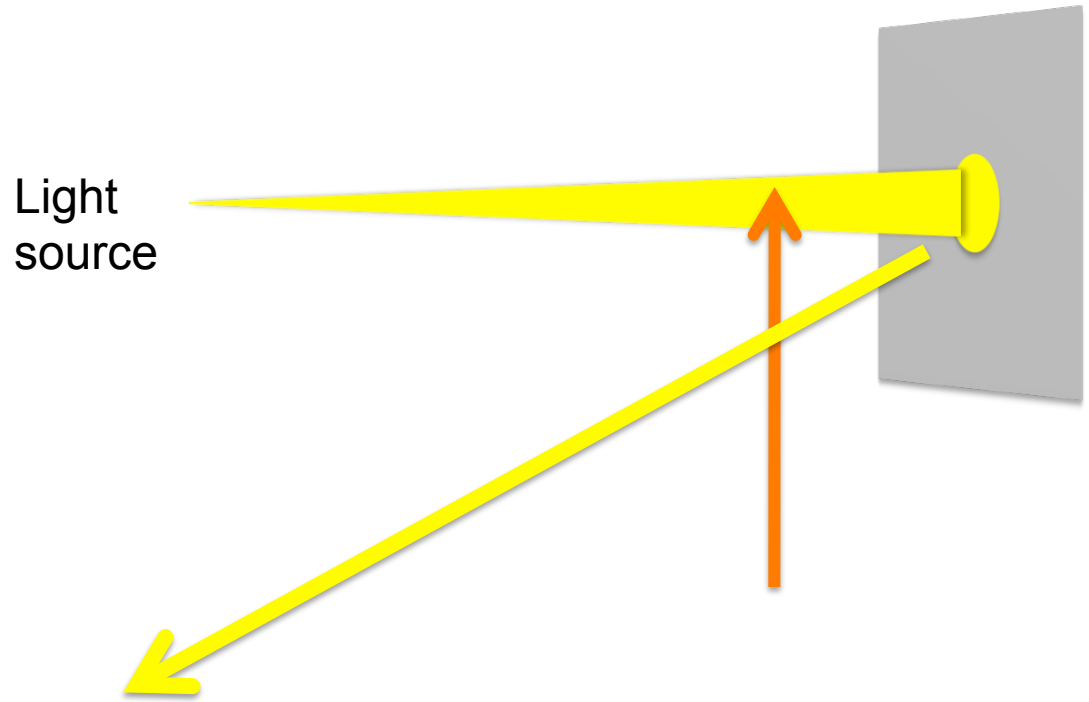
Reflectances of materials are expressed in percentages.

A material that reflects 90% of the incident light is white (if no wavelength is especially dominant). A 50% reflectance is a middle gray. A 10% reflectance is fairly black. Notice: A black material is, therefore, absorbing 90% of the incident light. That light energy can turn to heat, and you can feel the difference between black and white materials on a hot day.

Reflectance of surfaces and transmittance of filters are the same thing except for the direction of the light. The difference between the amounts of incident light and reflected light, or incident light and transmitted light, is the amount ABSORBED by a material. Light is absorbed by both reflecting and transmitting materials.


Light source
REFLECTANCE
Reflected light / Incident Light (illumination)
Eye
Incident light (illumination)
in yellow.
Reflected light in red

Another way to show the same things as the previous slide




Light bouncing off the surface. That is reflected light.

Measure this amount. It has to be less than the incident light.

Light Shining on Surface

Measure here. That is the measure of the amount of incident light.

# The Perceptual Problem concerning reflectance

Reflectance is the ratio of reflected light (amount) to incident light (amount) and is a property of a material surface.

What gets to the eye is just light, not a surface as such. For the most part, what gets to the eye is reflected light, light coming from a surface.

Perceptually, people seem to be able to see this reflectance property.

HOW IS THAT POSSIBLE ?

Reflectance is a RATIO

For any ratio, any 2 values determine the third.

Reflectance = Reflected light / Incident light
Multiply each side by "incident light"
THEN Reflected light (to the eye) = Reflectance x Incident light

PROBLEM: We SEEM to know reflectance [perceptually, we call it "lightness."]

But we are "given" only the reflected light, and that is a product of two things, neither one of which is "given" by itself. Some people say that the light at the eye is AMBIGUOUS. The word "ambiguous" means "more than one interpretation." Here, the light at the eye is determined by both reflectance and incident light, and neither one is given separately. They are folded in together at the light to the eye.

How can we perceive something that requires 2 values, when we are given only 1?

If we could perceive the incident light (illumination) and reflected light separately, there would be no problem. But there is ample evidence that people are much better at perceiving lightness than they are at perceiving illumination levels.

Solution 1 --- People somehow DO perceive illumination (incident light).

Some theorists are so locked into the definition of reflectance that they can't see any other way that an animal does what it does. Such theorists devote research time to trying to figure out how an animal gets illumination. Maybe by guessing? Estimating from past experience [but experience of what?]