



Optical Information

ICS 280: Visual Perception
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Visual Perception

- Depends on three factors
 - Light
 - Interaction of light with surfaces
 - Human visual system
 - Observes light both before and after the interaction with surfaces

Optical
Information



Light

- Made of small packets
 - Photons
 - Travel at 186,000 mph
 - Travels in straight line
 - Behaves like particles
 - Behave like waves
 - Important for color vision

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Light source

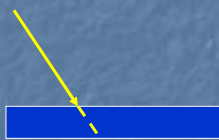
- Anything that emits light
- Point light source
 - Sharp shadows and shading effects
 - Unrealistic
- Extended light source
 - Blurred shadows and shading effects
 - Diffused illumination
 - Most real sources are extended

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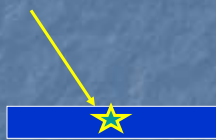
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Illumination

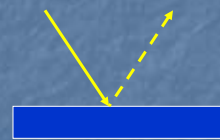
- Light strikes another surface
 - Reflected – Most of the time we see this
 - Transmitted
 - Absorbed



Transmission



Absorption

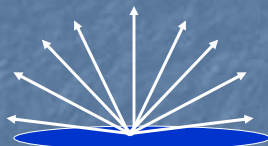


Reflection

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Diffused and Specular Surfaces



Diffused

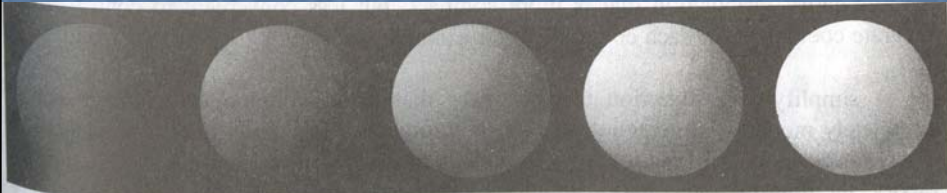


Specular

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Diffused Surfaces

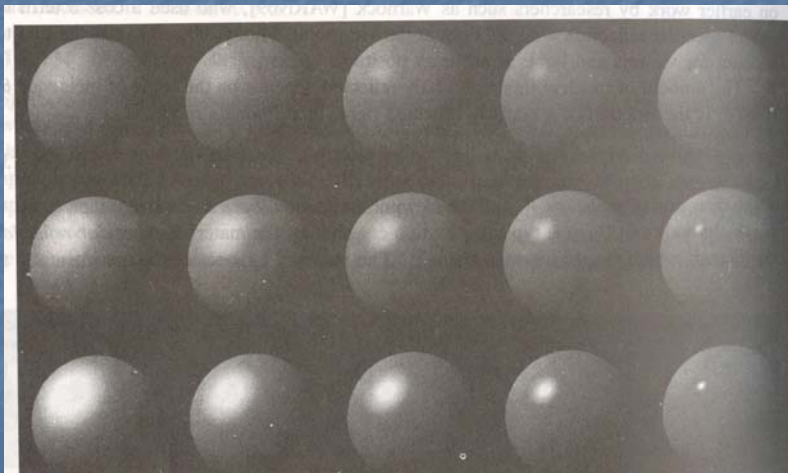


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Specular Surfaces

Relative amount of light reflected



Shape of the reflectance

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Illumination

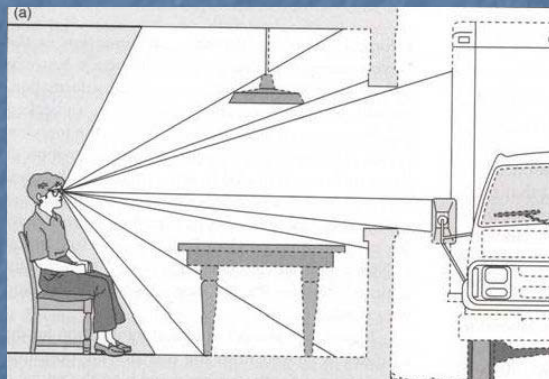
- Light source
- Reflected off the surface
- Reflection again
 - Secondary source
- Again and again and again ...
- Different amount of light coming from different directions help us distinguish objects
- Equal amount of light from all directions
 - Gray *Ganzfeld*

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Ambient Optic Array

- Proposed by famous psychologist J. J. Gibson
- Light coming towards a given observer from all directions

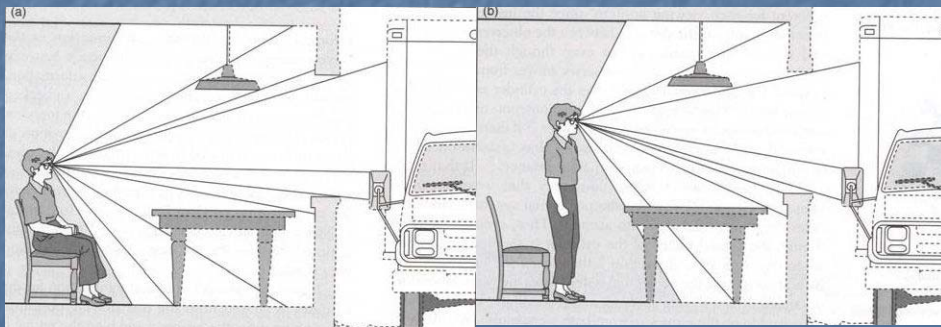


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Ambient Optic Array

- Changes with changing view point – Optic flow
- Used to detect motion, depth and size

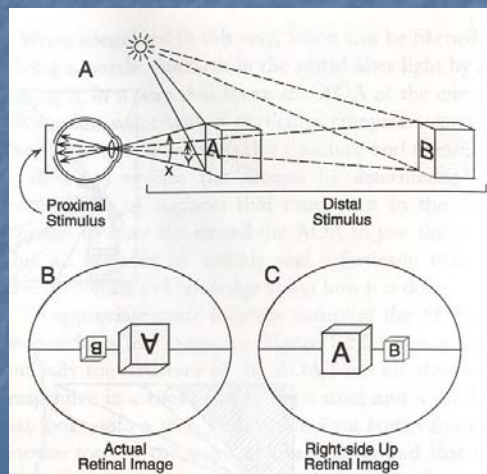


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Image Formation

- Distal and proximal stimulus
- Size depends on the visual angle
- Depth is lost
- Occlusion
 - Light from non-occluded surfaces reach the eye



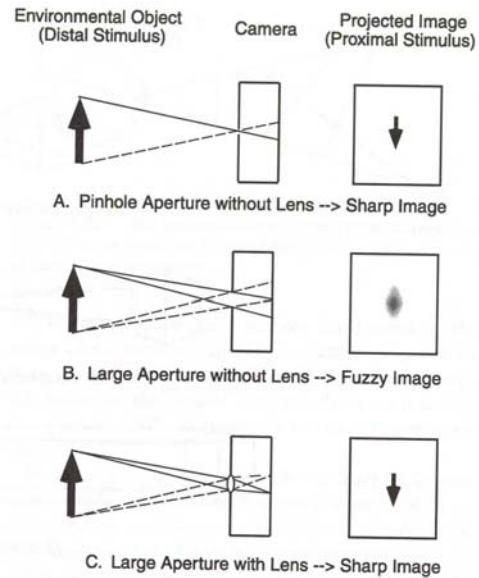
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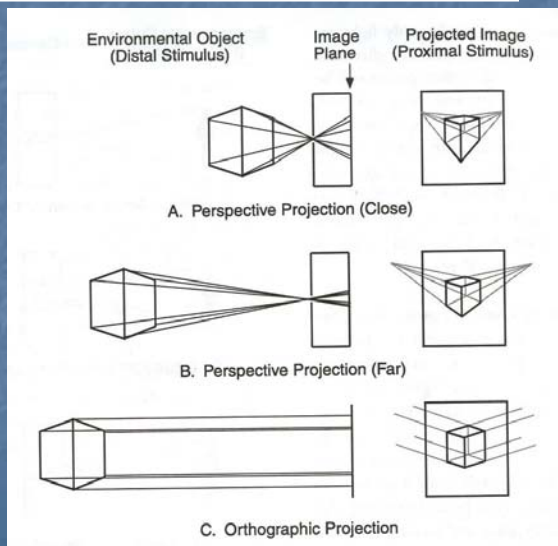
Projective Geometry

- Mathematics that guide 2D image formation of 3D world
 - Pin-hole camera model
 - Perspective Projection

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Perspective and Orthographic Projection



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Graphics Problem

- Graphics deals with
 - How 2D images are created from 3D information?
- Rendering
 - 3D Model of the Scene
 - Locations of lights, Surface reflectance properties
 - Color at every 3D point can be calculated
 - Geometric Model, Viewpoint
 - Projection of the objects from the eye
 - Use the colors to create the 3D image

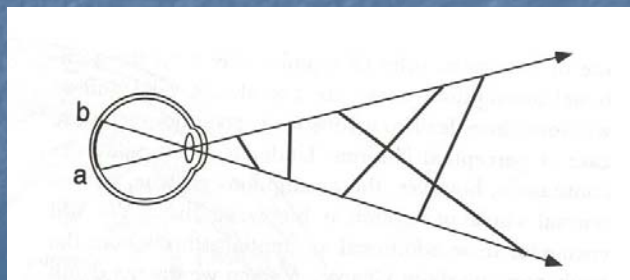
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Inverse Vision Problem

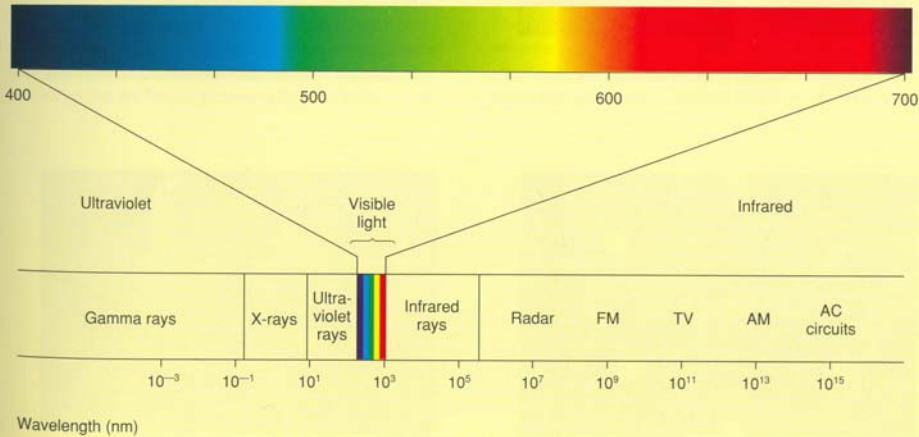
- Vision deals with
 - How to get back 3D information from 2D images?
 - Underdetermined problem
 - How does the visual system solve this problem?



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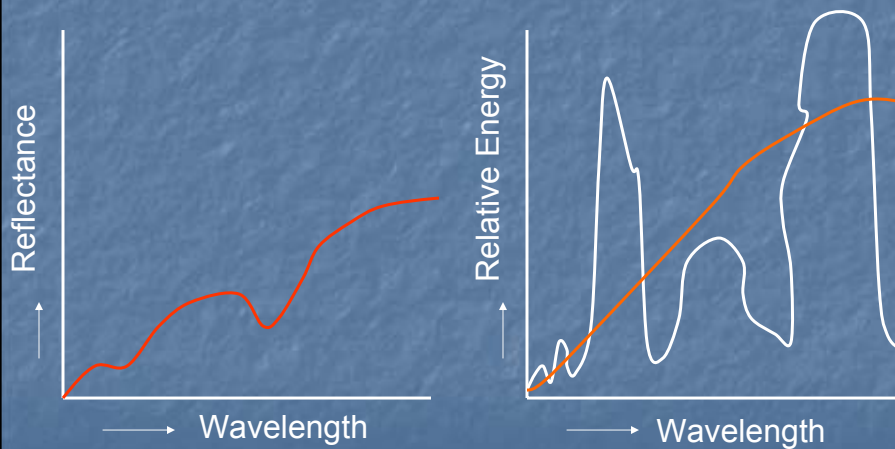
Photons with wavelengths



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Spectrum



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