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### ADVANCED COMPUTER GRAPHICS

### Realism

 (soft) shadows; reflections (mirrors and glossy); transparency (water, glass); Interreflection (color bleeding); Complex illumination (natural, area light); realistic materials (paints, glasses); and many more



# Propagates along straight-line rays in empty space, stopping when it meets a surface Light bounces "like a billiard ball" from any shiny surface that it meets, following an "angle of incidence equals angle of reflection" model, or is absorbed by the surface, or some combination of the two (e.g., 40% absorbed, 60% reflected). Most apparently smooth surfaces, like the surface of a piece of chalk, are microscopically rough. These behave as if they were made of many tiny smooth facets, each following the previous rules; as a result, light hitting such a surface scatters in many directions (or is absorbed, as in the mirrorreflection) A pixel of a camera, or one of the cells in the eye that detects light, sums up (by integration) all the slight that arrives at a small area over a small period of time. The value of the integral is the sensor response" that corresponds to how much total light, based on the number of incident photons, the pixel (or cell) " "saw". A pixel of a display can be adjusted to emit light of a specified intensity and color. CMSC 635 January 15, 2013 Lighting <#>/25

ADVANCED COMPUTER GRAPHICS

Light



### ADVANCED COMPUTER GRAPHICS

# Ray tracing

- Pixel by pixel instead of object by object
- A brief history
  - Appel 68
  - Whitted 80 [recursive ray tracking) (Landmark in computer graphics)
  - Lots of work on various geometric primitives
  - Lots of work on accelerations
- Current research
  - Real-time ray tracing (historically, slow technique)
  - Ray tracing architecture
- Be careful with whom you talk to

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# ADVANCED COMPUTER GRAPHICS Ray tracing transformed objs We have an optimized raysphere test - But we want to ray trace an ellipsoid... Solution: Ellipsoid transforms sphere - Apply inverse transform to ray, use ray-sphere – Allows for instancing (traffic jam of cars) • Math details will be worked out in class CMSC 635 January 15, 2013 Lighting <#>/25

• Testing	each object for	each
ray is s	low	
– Fewe	r rays	
• Ada cor	aptive sampling, de itrol	pth
– Gene	ralized rays	
• Bea per	am tracing, cone tra ncil tracing etc.	acing,
– Faste	r intersections	
• Opt inte	timized ray-object ersections	
• Fev	ver intersections	
CMSC 635	January 15, 2013 Ligi	nting <#>/25



























