Psychology of Perception
Psychology 4165, Section 100
Spring 2005

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MUEN D-156, 10:00–10:50, MWF

Homework 2: Visibility
20 Points: Due at beginning of class, Friday, 11 February 2005

There are two parts to this homework assignment. Each part counts 10 points. Late homework will receive a grade of zero. Use the definitions and equations on the back of this page to compute your answers.

Part 1:

Assume that the minimum contrast (c) required to make an object visible for different levels of ambient light are those given in the table (these data are only approximations of real human performance):

Ambient Illuminance	Visibility Contrast
3200.0 Lux	0.005
320.0 Lux	0.005
32.0 Lux	0.05
3.2 Lux	0.5

You have two objects viewed against a dark background that has a reflectance of 0.10 (it reflects 10% of the light falling on it). Object A has a reflectance of 0.104: At what levels of illumination will it be visible? Object B has a reflectance of 0.106: At what levels of illumination will it be visible?

Part 2:

Assume that illuminance (E) falls off proportional to the square of the distance (D) from a light source. Assume that you need at least a contrast of 0.5 for an object to be visible. Assume that the luminance (L) of the background is fixed at 0.1 cd/m^2. Assume that at a distance of 3 meters, the illuminance (E) from a car's headlights is 300 Lux. What is farthest distance, in meters, that an object with reflectance of 0.1 will be visible against the background?

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Useful definitions and equations

Luminous Intensity (candlepower) (I) is a measure of how much light is given off by a light source. The international unit is the candela.

Illumiance (E) is a measure of the amount of light falling onto a surface from a light source. The international unit of illuminance is meter-candle. The meter-candle unit is also called a Lux.

Luminance (L) is a measure of the amount of light coming off a surface in the direction of the eye. It is measured in candelas per square meter (cd/m^2).

Reflectance (R) is a measure of the proportion of light falling onto a surface that is reflected back off of the surface.

$$R = \frac{L_{cd/m^2}}{E_{Lux}}$$ Reflectance (R) of a surface

$$E = \frac{I}{D^2}$$ Illuminance (E) as a function of distance (D) light source I

$$c = \frac{L_{target} - L_{background}}{L_{background}}$$ Contrast of a target against its background