Lewis O. Harvey, Jr.–Instructor
Steven M. Parker –Assistant
9:30–10:45 TR

Homework 6: Size Constancy
10 Points: Due at the beginning of class, Thursday, 9 April 2015

There are two parts to this homework assignment. Each part counts 5 points. Late homework will receive a grade of zero.

Part 1:

The size in degrees of visual angle of an object's retinal image is a function of both the height (h) of the object and the distance (D) at which it is viewed. It is calculated by this formula: $rs = 2\tan^{-1}\left(h/2D\right)$. Here is an R function that takes the height of an object and the viewing distance and returns the size of the retinal image in degrees of visual angle:

```
subtense <- function(h,D) {2*atan2(h/2,D)*180/pi}
```

where h and D are in the same units (e.g., feet). The `(180/pi)` term converts radians, which `atan2()` returns, into degrees of angle. After you define this function you can use it to calculate the retinal image size of any object. For example, the moon is 2159 miles in diameter and is about 238,863 miles from the earth and therefore has a retinal size of about 0.52 degrees. In R you would type `subtense(2159, 238863)` to compute this value. Check it out to make sure it works!

Calculate the retinal size (RS) of a 6-foot tall person viewed from these distances:

Distance in feet	25	50	100	150	200	250	300	350	400
Visual Angle Degrees									
Perceived Size									

Plot a graph (Figure 1) of the results with Distance on the x-axis and degrees on the y-axis. What happens to the retinal image as viewing distance gets bigger?

Part 2:

The size-distance hypothesis predicts a relationship between perceived size (PS) and retinal size (RS) and apparent distance (AD): $PS = RS * AD$. To scale perceived size correctly, given accurate perception of apparent distance, this R function can be defined:

```
ps <- function(RS, AD) {RS * AD / (180 / pi)}
```

Assume that the perception of apparent distance (AD) is correct, what will be the perceived size of the person viewed at the above distances? Plot a graph (Figure 2) of perceived size (y-axis) as a function of distance (x-axis). Make the y-axis go from 0-13. What happens to perceived size as viewing distance changes?

Now assume that the apparent distances are inaccurate and, for whatever reasons, are only half the actual distance (i.e., 25 foot actual distance is perceived as being only 12.5. Compute the perceived sizes using these new apparent distances. Plot these results on your Figure 2, using the points() command in R. What happens to the perceived size when the apparent distances are closer?

Finally, assume that the apparent distances are twice as far as the real distances. Compute the perceived sizes using these new apparent distances. Add these results to you Figure 2. What happens to the perceived size when the apparent distances are farther than reality?

Your final Figure 2 should have three curves on it: one for accurate apparent distance, one for shorter apparent distances and one for farther apparent distances.