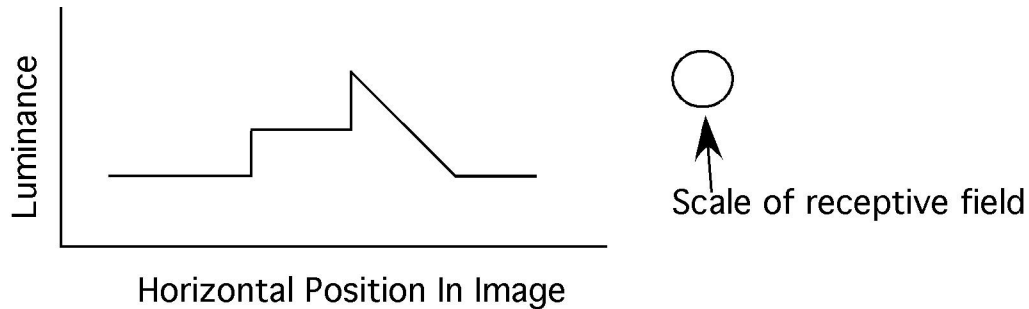


9.35 Homework 3

Due Tuesday, March 2 2004

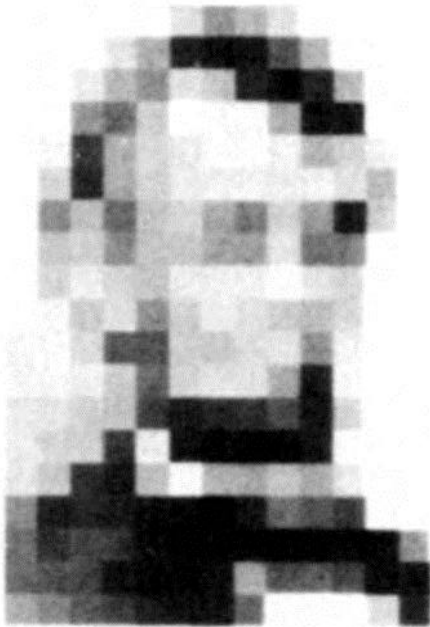
1. Consider an image with the following luminance profile



Draw a graph of what the response of each of the following neurons would be at each point along the image profile. Be sure to mark the location of a zero response. Assume the neurons cannot give a negative response, and assume the neuronal receptive fields in question are the size of the indicated circle.

- a balanced on-center off-surround neuron (balanced means the center and surround integrate to zero)
- a balanced, vertically oriented, odd-symmetric simple cell
- a vertically oriented complex cell that computes energy by summing the squared inputs of an even and an odd simple cell

2.



Courtesy of Palmer, Stephen E. 1999. Vision Science: Photons to Phenomenology. The MIT Press. Used with permission.

Above is an image of Abraham Lincoln, displayed with very coarse pixels.

Which spatial frequencies carry the information necessary to identify the face, low or high? What sort of receptive field could extract these frequencies?

3. a) Suppose that MIT is infiltrated by evil aliens from Pluto who are just like humans except for possessing a fourth cone in their retinas in addition to the three normal human cones. This fourth cone has a spectral sensitivity curve that is distinct from any of the three normal human cones. Design a test of color vision that could be used to identify these tetrachromatic aliens.

b) Under what conditions might normal humans be expected to exhibit tetrachromacy, and why?

4. What is a depth cue? Name four depth cues.