Biological Vision and Applications
Module 02-06: Peripheral vision

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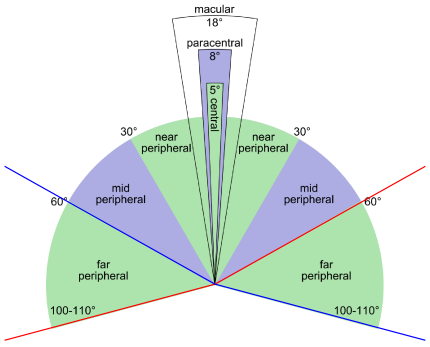
Foveal Vision and Peripheral Vision

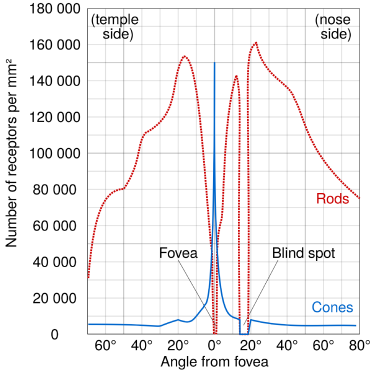


- Peripheral vision refers to vision beyond about 2 - 2.5^o from center of the eye
- Overlap area for both eyes is about 120^o
- Far peripheral region is seen with one eye
- Vision in mid/far peripheral region is predominantly black-and-white

Role of preipheral vision

- 99% of visual field is covered by peripheral vision
- Provides an approximate description of the visual field
- Useful for
  - Controls eye movement (saccade) in visual search
  - Shifts attention to desired place in image

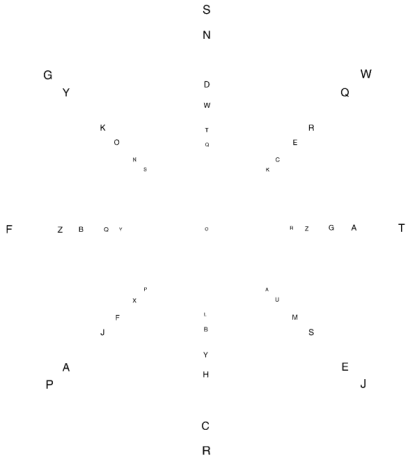
Cortical magnification



- As we move away from the foveal area of an eye
  - Linear decrease in rod density
  - The concentration of optic nerves also decreases.
  - rod:optic nerve ratio approx 600:1 at the far peripheral region
- Cortical magnification: equal volume of neurons cover more and more visual area
  - Less information is available

Effect of Cortical magnification

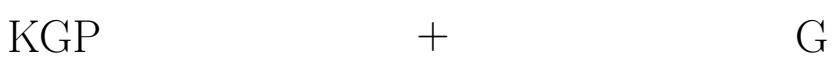
Minimum size of recognizable objects get bigger



Effect of Cortical magnification

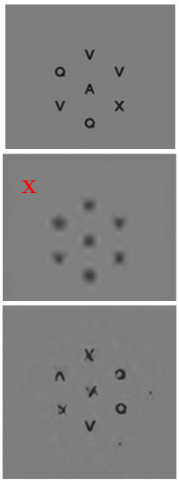
Crowding

- Focus on the cross-hair. Try to see the lettr 'G' in the left image, and in the right image



Model of Cortical magnification

Some distinctive textures are retained



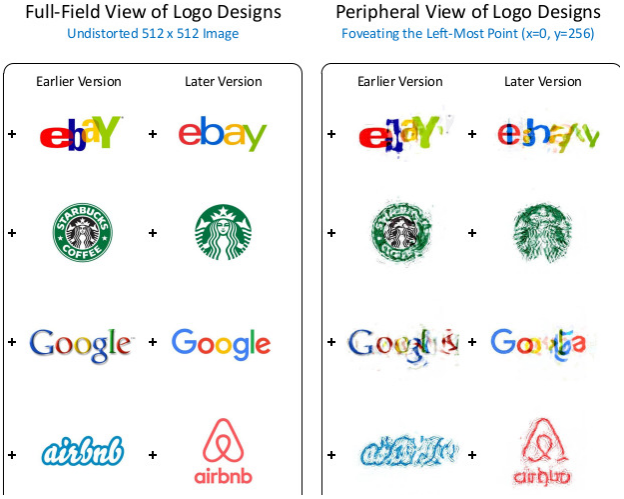
- Image compression (pooling / wavelet decomposition) results in blurred image
- Cortical magnification does not
  - Some distinctive textures are retained
  - There may be some disparity regarding locations
- The distinctive patterns help peripheral vision to guide the foveal vision in visual search
- Mathematical models for the peripheral texture representation
  - Summary statistics: autocorrelation and pooling
  - See Portilla 2000

Mongrels

- Mongrel: synthesized image to have the same summary statistics as a given original stimulus.
  - There can be many mongrels to an original stimulus

An interesting application

Logo design



Quiz

Quiz 02-06

End of Module 02-06