A Brief Organized List

Units

1. Radiometric units represent physical energy (e.g., radiance has units of watts sr^-1 m^-2)
2. Colorimetric units adjust radiometric units for visual wavelength sensitivity (e.g. luminance has units of cd m^-2); scotopic units are proportional to rod absorptions; photopic luminance units are proportional to a weighted sum of the L and M cone absorptions
3. Typical ambient luminance levels (in cd m^-2): starlight 10^-3; moonlight 10^-1; indoor lighting 10^2; sunlight 10^5; max intensity of common CRT monitors, 10^2
4. One Troland (Td) of retinal illumination is produced on the retina when the eye looks at a surface of 1 cd / m^2 through a pupil of area 1 mm^2.
5. Lens focal length: f (meters); lens power = 1/f (diopters)
6. Conversion of linear units (X) to decibels: Y = 20 log10(X); a change of 0.3 log10 units is a factor of 2, or 6 dB

Image Formation

1. The eyes are 6 cm apart and half-way down the head
2. Visual angle of the sun or moon = 0.5 deg
3. At arm's length: thumbnail = 1.5 deg; thumb joint= 2.0 deg; fist = 8-10 deg
4. Monocular visual field measured from central fixation: 160 deg (w) x 175 deg (h)
5. Binocular visual field measured from central fixation: 200 deg (w) x 135 deg (h)
6. Region of binocular overlap: 120 deg (w) x 135 deg (h)
7. Range of pupil diameters: 2mm -8mm.
8. Refractive indices: air 1.000; glass 1.520; water 1.333; cornea 1.376
9. Optical power (diopters): cornea, 43; lens, 20 (relaxed); whole eye, 60
10. Change in power due to accommodation, 8 diopters
11. Axial chromatic aberration over the visible spectrum: 2 diopters

Retina

1. Retinal size: 5 cm x 5 cm; 0.4 mm thick
2. One degree of visual angle = 0.3 mm on the retina
3. Number of cones in each retina: 5 x 10^6
4. Number of rods in each retina: 10^8
5. Diameter of the fovea: 1.5 mm (5.2 deg); rod-free fovea: 0.5 mm (1.7 deg); foveola (rod-free, capillary-free fovea): 0.3 mm (1 deg); size of the optic nerve head: 1.5 mm x 2.1 mm (5 deg (w) x 7 deg (h)) location of the optic nerve head: 15 deg nasal
6. Peak cone density: 1.6 x 10^5 cones/mm^2;

7. Foveal cone size: 1-4 mu (diameter) x 50-80 mu (length); extrafoveal cone size: 4-10 mu (diameter) x 40 mu (length)
8. Size of rods near fovea: 1 mu (diameter) x 60 mu (length)
9. S cone spacing (foveal): 10 arc min
10. L and M cone spacing (foveal): 0.5 arc min
11. Number of (L + M) cones / Number of S cones = 14 (though the ratio may be higher in the foveola)
12. 1.5 10^6 optic nerve fibers/retina; ratio of receptors to ganglion cell in fovea 1:3; ratio of receptors to ganglion cells for whole retina, 125:1

Cortex

1. Area of entire cortex: 1.3 x 10^5 mm^2; 1.7 mm thick
2. Total number of cortical neurons: 10^10; density: 10^5 neurons / mm^3
3. Synapses: 5 x 10^8 synapses / mm^3 4 x 10^3 synapses/neuron;
4. Axons: 3 kilometers / mm^3
5. Number of corpus callosum fibers: 5 x 10^8
6. Number of macaque visual areas: 30
7. Size of each area V1: 3cm by 8 cm
8. Half of area V1 represents the central 10 deg (2% of the visual field)
9. Width of a human ocular dominance column 0.5-1.0 mm; width of a macaque ocular dominance column 0.3 mm">.

Sensitivity

1. Minimum number of absorptions for: scotopic detection 1-5; detectable electrical excitation of a rod 1; photopic detection 10-15
2. The number of photoisomerisations per rod (per sec?) required to saturate the retinal rod circuit: 1
3. Following exposure to a sunny day, dark adaptation to a moonless night involves: 10 minutes (photopic); 40 minutes (scotopic); change in visual sensitivity 6 log10 units
4. Highest detectable spatial frequency at high ambient light levels, 50-60 cpd; low ambient light levels, 20-30 cpd
5. The contrast threshold (Delta L / L) for a static edge at photopic luminances is 1%.
6. Highest detectable temporal frequency: high ambient large field, 80 Hz; low ambient, large field 40 Hz.
7. Typical localization threshold: 6 arc sec (0.5 mu on the retina)
8. Minimum temporal separation needed to discriminate two small, brief light pulses from a single equal-energy pulse: 15-20 ms
9. Stereoscopic depth discrimination: step threshold, 3 arc sec; point threshold, 30 arc sec

Color

1. Visible spectrum: 370-730 nm
2. Peak wavelength sensitivity: 507nm (scotopic) and 555 nm (photopic)

3. Spectral equilibrium hues: 475 nm (blue), 500 nm (green), 575 nm (yellow), no spectral equilibrium red
4. Number of basic English color names: 11
5. Incidence of: anomalous trichromacy, 10^-2 (male), 10^-4 (female); protanopia and deuteranopia, 10^-2 (male), 10^-4 (female); tritanopia, 10^-4; rod monochromacy, 10^-4; cone monochromacy, 10^-5