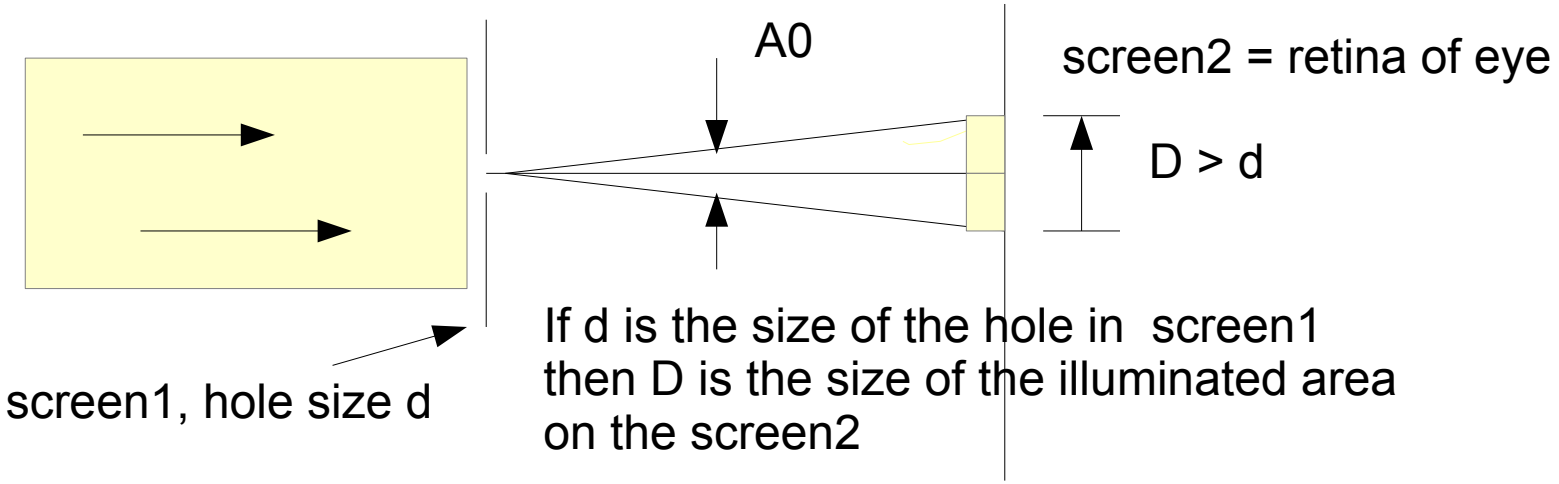
Resolving power of the human eye, θ_{eye}

Light is a wave phenomenon. If you try to pass light through a circular opening there is a spreading of the light which is bigger than the diameter of the hole if the illumination at the hole covers, or is bigger than, the hole. This is called diffraction.



A0 is the angular width of the cone of light leaving the screen1 with a hole of width d. $A0 = 2*\theta_{eye}$, $\theta_{eye} = 1.22*\lambda/d$. d is the diameter of the pupil of the eye, and λ is the wave length of light. For a pupil diameter of 2mm and a wave length of $5x10^{-7}$ m, yellow light, we find that θ_{eye} = 1' (arc minute) of angle.

Tycho Brahe's measurement of Mars's position was good to 2' of angle. Tycho took the process of naked eye observation to the limit of human capability.
The biggest parallax angle for Mars using the earth's diameter as a base line is 1' arc. Naked eye observations alone would never have let us know the astronomical unit.