- Wednesday, October 7, 1998
  The Moon Illusion

2.1 The moon illusion is that the moon is commonly perceived as being being larger when it is closer to the horizon. This is an illusion familiar to many people but its explanation has created debate since ancient times and still is not settled.
3.0 Kaufman briefly reveiwed some historical studies on the moon illusion, including Boring and Hallway (who attributed the illusion to the direction of gaze); studies that claimed it was to do with convergence etc... And he described his failure to get the illusion when projecting an artificial moon in the Hayden Planetarium which seemed in conflict to the "looking up" theory.

3.1 Feeling that some of the confusion might arise from the methods used to measure this effect, especially Boring's use of a "nearby" comparison disc, Kaufman set up an artificial moon, using collimated light to present the image at optical infinity. He got a lovely effect with the elevated artificial moon needing to be set to twice the diameter of an artificial moon near the horizon to match the size of the real moon when it was near the horizon.
3.2.1 Kaufman's preferred explanation of the moon illusion is that the moon has a constant retinal size and is perceived (at some level) to be closer when it is straight up that when it is on the horizon. Converting the (angular) retinal image into an external size (linear) requires an estimate of distance and if this is wrong then distortions of size can be expected.
3.2.2 A problem that arises from this apparently simple explanation is known as the "size-distance paradox". This can be stated as follows: To explain the moon illusion (above) it is necessary that the moon be judged further away when it is on the horizon. The result of this is to make the moon look LARGER. But larger objects (including the moon under illusion conditions) usually appear CLOSER. So the result of the moon being perceived as further away is to make it be perceived as nearer: a paradox indeed! Kaufman adds: Only if the term "appear CLOSER" has the same logical status as"look LARGER". The latter may be due to the processing of distance cues, and the former related to a judgment based on the outcome of that processing.
3.2.3 Kaufman rejects the paradox as a paradox since it is not necessary that the before-size-is-allocated process has anything to do with the final perception. Any perceptual results of the apparent size are quite independent of the mechanism that produced that apparent size in the first place.
4.0 To try and obtain direct measurements of the perceived distance of the moon, Kaufman optically arranged an artificial moon to appear close to the real moon. Observers then adjusted the disparity of the artificial moon until it appeared to lie half way to the real moon. Disparity is inversely related to the square of the distance. Amazingly, subjects were able to do this task and set the position as equivalent to 9-10 metres when the moon was overhead and around 45m when the moon was on the horizon (ie. indicating the moon was perceived at 20 and 90 m respectively).

4.1 Subsequently observers were asked to view the moon through optics that allowed its disparity to be varied. They were asked to make the moon look half its original size. The amount of disparity they used was again compatible with the above result and seeing the moon as further when it was on the horizon.

Lloyd Kaufman