- Friday, January 10, 1997
  Role of Vergence in Binocular Stereopsis

  3.0 Brian Rogers from the Psychology Department at Oxford told us about vergence and stereoscopic vision.

  3.1 Some stereograms are reputed to take ages to see: more than a minute for some complicated ones according to Ramachandran (hey, another link between the two halves - Ramachandran has contributed famously to both topics). Is this may be because of learning to make appropriate eye movements or perhaps just the complexity of the correspondence problem (deciding which dot in one eye's image to map with any given dot in the other eye's image)?

  3.2.1 Is it "complexity" or the amount of depth in Julesz'"complex" stereograms? SOLUTION: use a spiral whose vertical extent (depth) can be varied.

  3.2.2. Need a criterion of performance. SOLUTION: report on direction of twist of spiral.

  3.3 EXP 1. Using Oxford-generated spirals as stereograms on 20 x 25 deg screens, the time to make a direction judgement averaged only 2-3 secs, even for naive observers, which was much faster then period of over a minute reported in previous studies.

  3.4 EXP 2. One thing that does affect latency is distance (further away - keeping visual angles and disparities constant - takes longer although never more than about 8 secs)

  3.5 EXP 3. Remove the effect of vergence by cancelling their retinal effect by moving the images (yoked eye movements are not cancelled so the images are not stabilized). Looking at stereograms of floating squares, wedding cakes (several concentric circles at different depths) or slanting surfaces shows, amazingly, no effects of cancelling the visual consequences of vergence eye movements. Often very large vergence eye movements are evoked under these 'open loop' conditions so this suggests that vergence eye movements do not contribute very much to the depth perception of these stimuli. Observers are often unaware that vergence is cancelled.

  3.6 EXP 4. Disparity differences between the different parts of a given physical object decrease with eccentricity (as well as with distance). That is the disparity difference between two points separated by a fixed distance are less if the object is located off to one side rather if it is straight ahead. This is a consequence of the geometry. By comparing the depth associated with a particular disparity at different eccentricities, Brian has shown CONSTANCY SCALING as a function of eccentricity complementing earlier studies showing CONSTANCY SCALING as a function of distance. That is the perceived depth evoked by a given disparity varies not only with the distance of the object but also with its eccentricity. Since the ACTUAL DEPTH associated with that particular disparity varies in exactly the same way, this is a GOOD THING.

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