

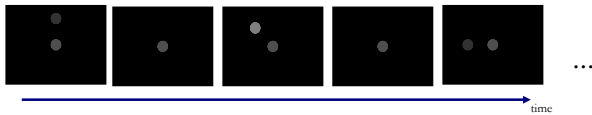
Spatiotemporal averaging along a moving trajectory

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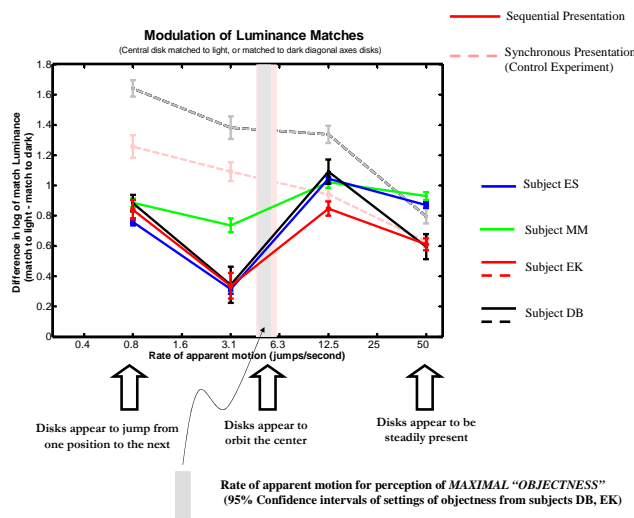
Does apparent motion impair sensitivity to luminance changes in a perceived object?

- * The object file metaphor suggests that each object has a “file” representing various perceptual properties of that object. Because continually updating each object file would be computationally costly, a useful strategy is to assume invariance.
- * Shimozaki, Eckstein and Thomas (1999) found luminance invariance when there was apparent motion between adjacent luminance squares.
- * Our stimuli were discs viewed in apparent motion through a sequence of 8 positions widely spaced around a circle
- * The disks changed in luminance as they moved between the major axes and the diagonal positions
- * The perceived brightness regressed strongly to the time average, making the luminance changes less perceptible
- * The temporal characteristics of the phenomenon are related closely to the subjective impression of “objectness”

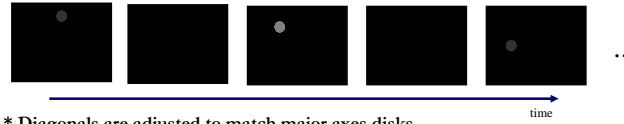
Experiment 1 – Adjust Central Disk to Match Diagonal Disks



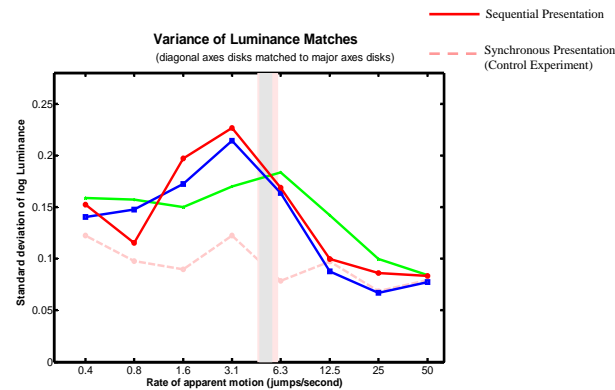
- * Diagonals are either five times darker or lighter than major axes disks (example above shows lighter diagonals).
- * If luminance is averaged along the motion trajectory, the difference between light diagonals and dark diagonals will be perceptually underestimated.
- * The difference between the matches to the light and dark disks is our dependent variable, which we measure for a range of rotation speeds.
 - A difference of 0.7 log units accurately matches the fivefold change of intensity in the moving stimulus
 - Lower modulation means luminance differences are less visible



Experiment 2 – Adjust Diagonals to Match Major Axes Disks

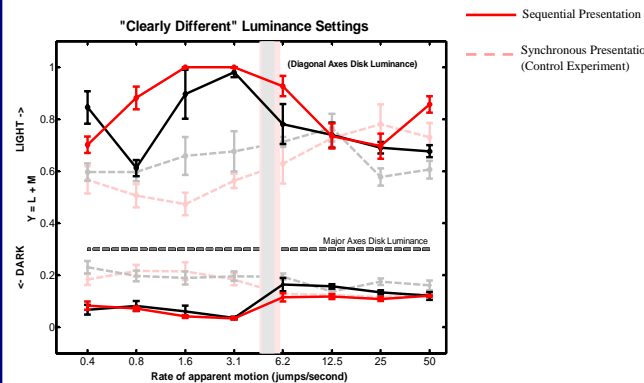


- * Diagonals are adjusted to match major axes disks
- * If luminance is averaged along the motion trajectory, sensitivity to luminance modulation will be reduced and the scatter in the settings will be increased.
- * The standard deviation of the matches is our measure.



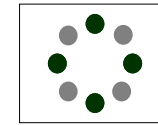
Experiment 3a – Adjust Diagonal Disks for a “Clearly Noticeable Difference” from the Major Axis Disks (Luminance CND)

- * Stimuli are identical to those in Experiment 2, above.
- * Diagonals are adjusted to be *clearly different* from major axes disks
- * If luminance differences are obscured, greater luminance difference from the major axes disks is required.

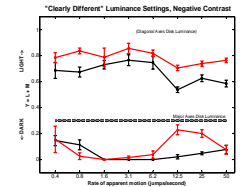


Experiment 3b (Luminance Decrement CND)

- * Repetition of Experiment 3a with a white surround: results are similar



(time-averaged stimulus shown here for illustration)

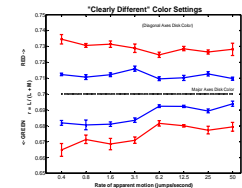


Experiment 3c (Isoluminant Red-Green CND)

- * Clearly noticeable differences set with disks isoluminant to each other in a dark surround



(time-averaged stimulus shown here for illustration)



Control Experiments – Matches Made With Synchronously Flashed Disks

- * Diagonal and major axes disks were shown simultaneously
- * Disk presentation time was equal that in the Experiments 1-3
- * Results are shown as **desaturated data points** in the experimental results (Experiments 1 – 3a, to the left)

7 Conclusions & Discussion

- * At speeds where stimuli appear to be an object in motion,
 - Luminance modulation is underestimated (Experiment 1)
 - Larger differences are required for a clearly visible modulation (Experiment 3)
 - Variability of luminance matches increases (Experiment 2)
- * There is a consistent 2- or 3-fold reduction in sensitivity in all three experiments
- * These effects are most pronounced at speeds just below the speed that gives the most convincing perception of a moving object.
- * The large visual angle between successive disks in our experiment precludes spatio-temporal averaging in the afferent pathways or V1
- * Evidently high-level vision incorporates a bias toward constancy in the properties of moving objects. The constancy assumption is usually correct, and allows economy in representation.