Ocular pursuit of flicker-defined motion

A moving luminance-defined spot elicits smooth pursuit eye movements which respond rapidly to changes in direction of motion. This study examined eye movements evoked by a 2nd order (non-Fourier) motion target defined by polarity reversal in a binary random texture. On each frame transition (60 Hz), a Gaussian probability density function determined whether the corresponding array element reversed polarity. Moving the density function from frame to frame evoked a vivid percept of motion in spite of the fact that there were no 1st order (Fourier-based) motion cues. Subjects viewed a series of trials in which this flicker-defined spot moved downward at 6 degrees/second, changing direction by 30 degrees (right or left) at a variable point within the trajectory. Eye position was recorded with a video ophthalmoscope having a resolution of 1 minute of arc.

Unlike a luminance-defined spot, these targets do not cause rapid initiation of pursuit. Instead, the eye saccades to the target 4-500 milliseconds after the onset of motion. Following this initial saccade, some smooth motion was seen, perhaps due to prediction. Direction-change events in mid-trajectory were similarly ineffective at driving pursuit, and produced high-latency saccades. These results suggest that flicker-defined motion is seen by perceptual, but not oculomotor pathways.