TRACKING VIRTUAL TRAJECTORIES. Leland S. Stone*, Brent R. Beutter, & Jean D. Lorenceau, NASA Ames Res. Ctr., Moffett Field, CA 94035-1000.

Current models of smooth pursuit eye movements assume that it is largely driven by retinal image motion (e.g. Krauzlis & Lisberger, 1991). We tested this hypothesis by measuring pursuit of elliptical motion (3.2s, 0.9 Hz, 1.4° x 1.6°, 4 randomly interleaved phases) of either a small spot ("real" motion) or of a line-figure diamond viewed through apertures such that only the motion of four isolated oblique line segments was visible ("virtual" motion). Each segment moved sinusoidally along a linear trajectory yet subjects perceived a diamond moving along an elliptical path behind the aperture (Lorenceau & Shiffrar, 1992). We found, as expected, that real motion produced accurate tracking (N = 2) with mean gain (over horizontal and vertical) of 0.9, mean phase of -6° (lag), mean relative phase (H vs V) of 90±8° (RMS error). Virtual motion behind an X-shaped aperture (N= 4 with one naive) yielded a mean gain of 0.7, mean phase of -11°, mean relative phase of 87±15°. We also measured pursuit with the X-shaped aperture using a higher segment luminance which prevents the segments from being grouped into a coherently moving diamond while keeping the motion otherwise identical. In this incoherent case, the same four subjects no longer showed

consistent elliptical tracking (RMS error in relative phase rose to 60°) suggesting that perceptual coherence is critical. Furthermore, to rule out tracking of the centroid, we also used vertical apertures so that all segment motion was vertical (N = 3). This stimulus still produced elliptical tracking (mean relative phase of 84±19°), albeit with a lower gain (0.6). These data show that humans can track moving objects reasonably accurately even when the trajectory can only be derived by spatial integration of motion signals. Models that merely seek to minimize retinal or local stimulus motion cannot explain these results. *NASA RTOP 199-16-12-37*