STEADY-STATE PURSUIT IS DRIVEN BY OBJECT MOTION RATHER THAN THE VECTOR AVERAGE OF LOCAL MOTIONS.

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Purpose. We have previously shown that humans can pursue the motion of objects whose trajectories can be recovered only by spatio-temporal integration of local motion signals (ECVP 96; Neuroscience 96). We now explore the integration rule used to derive the target-motion signal driving pursuit. **Methods.** We measured the pursuit response of 4 observers (2 naive) to the motion of a line-figure diamond viewed through two vertical bar apertures (0.2 cd/m^2). The corners were always occluded so that only four line segments (93 cd/m^2) were visible behind the occluding foreground (38 cd/m^2). The diamond was flattened (40 & 140° vertex angles) such that vector averaging of the local normal motions and veridical integration (e.g. IOC) yield very different predictions, analogous to using a Type II plaid. The diamond moved along Lissajous-figure trajectories (Ax = Ay = 2°; TFx = 0.8 Hz; TFy = 0.4 Hz). We presented only 1.25 cyles and used 6 different randomly interleaved initial relative phases to minimize the role of predictive strategies. Observers were instructed to track the diamond and reported that its motion was always coherent (unlike type II plaids). Saccade-free portions of the horizontal and vertical eye-position traces sampled at 240 Hz were fit by separate sinusoids. **Results.** Pursuit gain with respect to the diamond averaged 0.7 across subjects and directions. The ratio of the mean vertical to horizontal amplitude of the pursuit response was 1.7±0.7 averaged across subjects (±SD). This is close to the prediction of 1.0 from veridical motion-integration rules, but far from 7.7 predicted by vector averaging and ∞ predicted by segment- or terminator-tracking strategies. **Conclusion.** Because there is no retinal motion which directly corresponds to the diamond's motion, steady-state pursuit of our "virtual" diamond is not closed-loop in the traditional sense. Thus, accurate pursuit is unlikely to result simply from local retinal negative feedback. We conclude that the signal driving steady-state pursuit is not the vector average of local motion signals, but rather a more veridical estimate of object motion, derived in extrastriate cortical areas beyond V1, perhaps MT or MST.