Supplementary Materials

***Experiment 1*:** For the analysis used for Experiment 1 in the Results, BCEAs were computed on a different SLO (see Methods) over a ten second interval (as is standard in the literature, *e.g.*, Crossland & Rubin, 2002). To determine whether our results were an artifact of the much longer fixation period or different SLO, we also calculated BCEA parameters for each fixation period that preceded a smooth pursuit trial (1 second each). To account for any variation that occurred for these shorter fixations from trial to trial, we computed the median major axis value for each participant and used this value to construct a median BCEA: a circle with the radius of the median major axis. We then repeated the analysis illustrated in Figure 4 and obtained very similar results (Figure S1, ANOVA with Bonferroni correction for multiple comparisons $F(3, 26) = 22.12$, $p<0.0001$).

***Experiment 2*:** Figure S2 illustrates a sample saccade trial for participant P1.

	0.6° Target		***1.7° Target***	
Participant	***Mean Distance (°)***	***t-test Statistics***	***Mean Distance (°)***	***t-test Statistics***
P1	0.471	$t(8) = 6.338$, $p < 0.00001$	0.435	$t(7) = 8.817$, $p < 0.00001$
P2	1.013	$t(9) = 6.502$, $p < 0.00001$	1.204	$t(9) = 6.294$, $p < 0.00001$
P3	0.440	$t(12) = 5.952$, $p < 0.00001$	0.546	$t(6) = 4.509$, $p = 0.004$
P4	0.560	$t(7) = 4.685$, $p = 0.002$	0.437	$t(7) = 6.339$, $p < 0.00001$
P5	0.525	$t(7) = 6.329$, $p < 0.00001$	0.604	$t(9) = 8.826$, $p < 0.00001$
P6	0.539	$t(7) = 8.714$, $p < 0.00001$	0.678	$t(6) = 5.919$, $p = 0.001$
P8	0.503	$t(7) = 12.365$, $p < 0.00001$	0.703	$t(9) = 9.138$, $p < 0.00001$

Table S1. T-test statistics for eye distance from the eccentric target after a saccade, for each participant. Mean distances correspond to per-trial radius values in Figure 6 B&C.

***Experiment 4*:** Due to a direction dependence of mean eye-target distance for P1 during smooth pursuit, we analyzed the relationship between target size and eye-target distance for each target direction separately (Figure S3), as well as for all trials combined (Figure 7C).