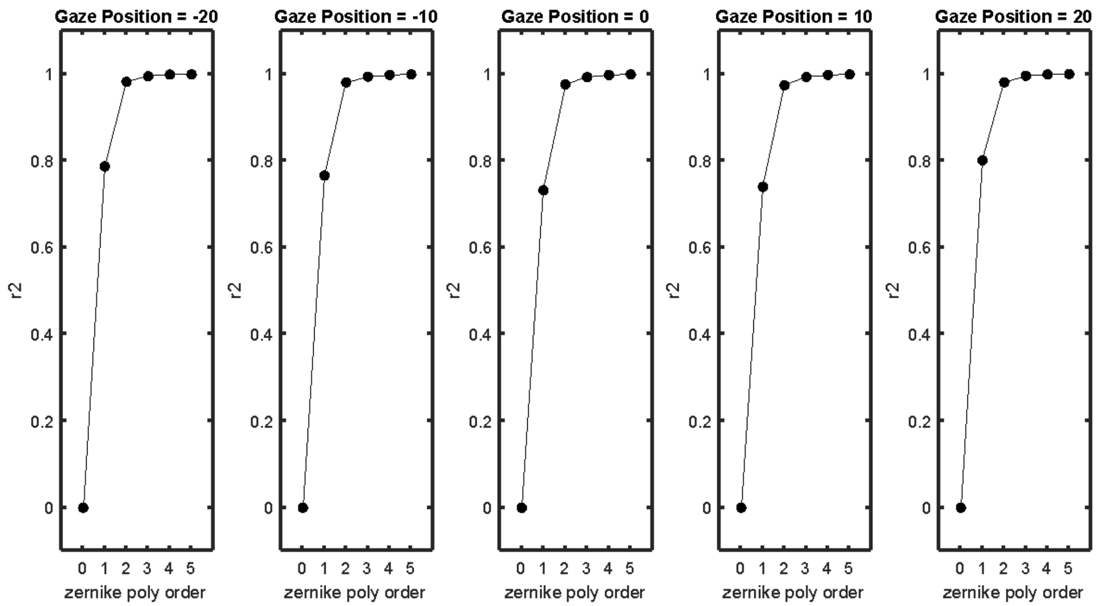
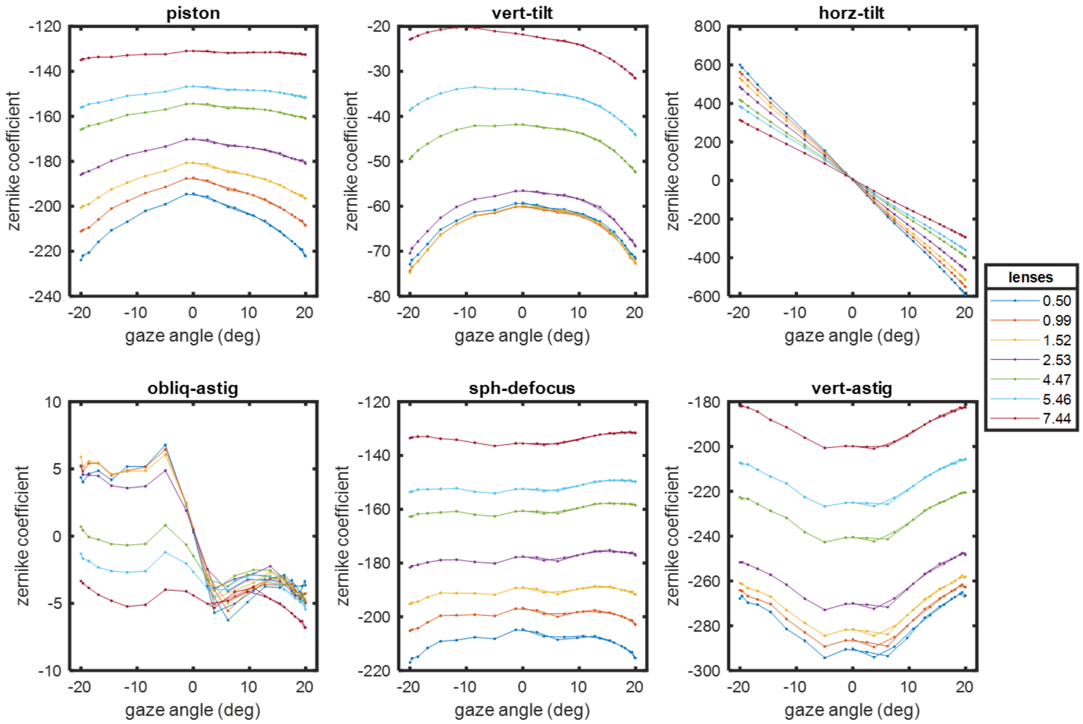
Supplementary Document



Supplementary Figure 1: Optimizing the Zernike polynomial fits. R-squared values are plotted as a function of Zernike polynomial order ranging from 0 to 5 for horizontal VOR eye movement simulations at 5 linearly spaced gaze positions from -20 degrees to +20 degrees. This figure shows results obtained from the user study participant with the highest anisometropia in the cohort (P4). The second order polynomial consists of six terms; the zeroth order term, piston; the first order terms, vertical and horizontal tilt; and the second order terms, oblique astigmatism, spherical defocus, and vertical astigmatism. This selection of the 2nd order polynomial was based on optimization procedures to determine the smallest Zernike polynomial order (which defines the number of terms and thus, model complexity) that will most reliably describe our binocular horopter surface. We fitted Zernike polynomials with orders ranging from 0 to 5 to the binocular horopter surfaces determined for horizontal VOR eye movement simulations at 5 linearly spaced gaze positions from -20 degrees to +20 degrees using lens prescription power from the user study participant with the highest anisometropia in the cohort. Performance of different Zernike models were compared using r-squared goodness of fit measure to select the most parsimonious model. Figure 2 shows that using a 2nd order Zernike polynomial model is sufficient in describing the binocular horopter surfaces generated by our simulation and data. Across all subplots, r-squared values increased sharply from the 0th order to 2nd order model, from where there seems to be a plateau.



Supplementary Figure 2: Raw Zernike coefficients across gaze angles during a Horizontal VOR eye movement. In each subplot, the different colored lines represent changes in coefficients for lenses with different front surface curvatures. vert- vertical; horz- horizontal; obliq-oblique; astig-astigmatism, sph-spherical