One of the key problems in data fusion is the estimation of a parameter vector from a set of noisy measurements. In many cases, the optimal estimate of such a parameter vector can be solved through the least squares problem. There are, however, a number of important problems whose solution instead takes the form of an eigenvalue-eigenvector problem. Furthermore, knowledge of the uncertainty of the optimal estimate is as important as the estimate itself for many practical applications-and this uncertainty is typically captured in the form of a covariance matrix. While the covariance matrix for a least squares estimate has been well studied, there has been substantially less research on the covariance of an optimal estimate originating from an eigenvalue-eigenvector problem. In this paper, we develop general expressions that determine the uncertainty in a vector estimate obtained from an eigenvalue-eigenvector problem given the uncertainty of the matrix. This includes developing expressions for the analytic derivatives of the eigenvalues and eigenvectors with respect to the matrix from which they come. Finally, the techniques developed are numerically validated with forward finite differencing and a Monte Carlo analysis and then used to determine covariance expressions for an ellipse fitting technique and the estimation of attitude quaternions