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Determinations About Writership in
Questioned Handprinting and Handwriting

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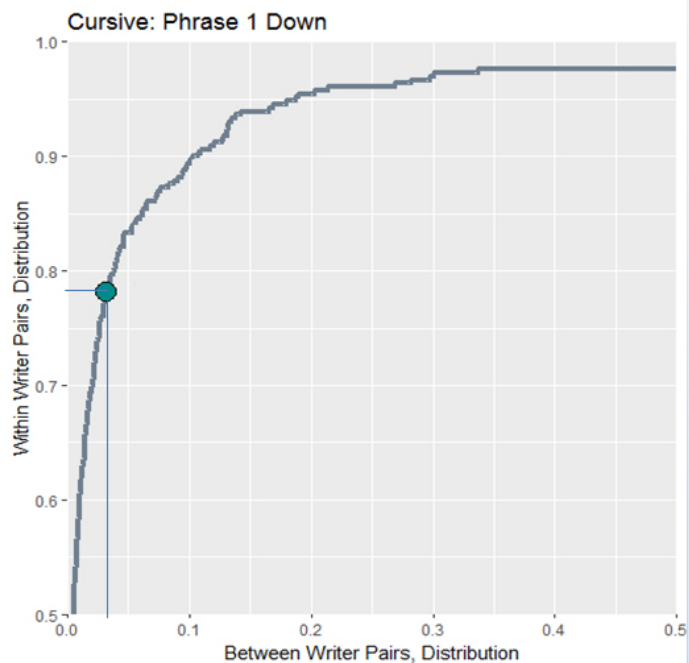
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In order to control the multidimensionality problem necessary to reduce the kinematics to feature sets, we first calculated a kinematic dissimilarity score from the difference between the two members of a sample pair for each kinematic feature. We developed a new dissimilarity score to measure the difference between two documents by writing style (print or cursive). This new dissimilarity score is constructed by first dividing the writing sample into up-strokes and then projecting the feature set into a new dimension that maximizes the separation between the two sets of points; one set for each of the two writing samples being compared. Once we have projected these two sets into the univariate space, we then measure the similarity between the two distributions of points by looking at the integrated squared error difference of the corresponding quantile functions. This procedure resulted in a measure of the dissimilarity between two quantile functions or the Wasserstein distance score (WDS; Del Barrio et al., 1999). An analogous set of steps are then repeated for the down strokes.

Two additional covariates were calculated from the cumulative distribution of the WDS relative to the population distribution (all other between or within-writer WDS not used in the survey). These covariates reflect the probability (ranging from 0-1) that a given WDS calculated from the population of available sample between-writer and within-writer pairs would be less than or equal to the WDS of the survey sample pair and is referred to as the empirical cumulative distribution function or ECDFb and ECDFw, respectively. An example of the ECDF scores for within and between writer distributions for a WDS score of 0.25 is shown in the figure to the right. Higher ECDF values indicate that a large number of



WDS in the population of scores are less than or equal to the WDS for the given sample pair. Conversely, an ECDF value near zero indicates that a very small number of WDS in the population of scores are less than or equal to the WDS for the given sample pair. An ECDF near 1.0 indicates that the WDS for the

