



J5 Measuring the Frequency Occurrence of Handwritten Numerals: An Expanded Database

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Learning Overview: After attending this presentation, attendees will be informed of the most recent frequency occurrence measurements for the features added to the overall handwriting database. Attendees will know about the expanded database and understand the quality control processes that are the bases for the integrity of these studies.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing expanded foundational and statistical bases for associations of known handwriting specimens to writings in question.

Beginning in 2009, members of the forensic document examination community began making a concerted effort to design and implement a course of study to develop statistically based frequency of occurrence proportions of handwriting, hand printing, and numerals for use in handwriting comparison analyses. The group formed after noting several court rulings in which judges admitted handwriting comparison in court but noted concern over the limited foundational bases for the axioms of the science. In 2010, two document examiners and two statisticians received a grant from the National Institute of Justice to undertake the first of the frequency occurrence studies. This study was formally presented at the 2015 American Academy of Forensic Sciences (AAFS) Annual Scientific Meeting in Orlando, FL, and published in 2017.¹

There had been several studies in the past, most of which were of limited scope. It was also noted that there was little in the way of population sampling design built into the previous studies. The statisticians worked diligently to design an appropriate protocol for population sampling based on published material concerning intrinsic and extrinsic factors in handwriting and how those factors could, and should, be addressed in the collection process. A protocol was developed and overseen by the team during the first study.

In addition, the statisticians developed a protocol for quality assurance by utilizing attribute agreement analyses into the study protocols. These analyses studied the potential of variance by multiple forensic document examiners, or by one forensic document examiner, over time. It was decided that any feature used in the database must pass the protocol with a 100% score; in other words, no deviation of results scored by the assessors/forensic document examiners.

To date, the results have been approximately 1,000 features having been studied for frequency occurrence proportions within the United States. Several past studies have concluded that the pattern recognition areas of the forensic sciences should report conclusions based more on a statistical foundation than on experience alone. The development of a frequency occurrence proportion database is designed to directly address that recommendation. The results of the first two studies have been reported in court with resounding success. Additional studies have been mapped out for the purposes of expansion of the database. This expansion includes additional features and a larger population sampling.

This study is the third frequency occurrence study. Both the first and second studies have been published in the *Journal of Forensic Sciences*, the second being published in 2018. It is the purpose of this study to begin to expand the existing handwriting database to provide a larger foundation of statistical study into the heterogeneity of handwriting features.

Reference(s):

- ¹ Ellen M. Schuetzner, Thomas W. Vastrick, Mark Johnson, Kevin P. Kulbacki. Frequency Occurrence of Handwriting and Hand Printing Characteristics. J3. *Proceedings of the American Academy of Forensic Sciences, 67th Annual Scientific Meeting, Orlando, FL, 2015.*

Frequency Occurrence, Numerals, Statistics