J12 Measuring the Frequency Occurrence of Handwritten Numerals

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The goal of this presentation is to provide attendees with objective pre-established frequency of occurrence proportions that provide the soundest foundation for authorship determination and probability estimations.

Pre-established frequency of occurrence proportions is generally acknowledged to be the most objective form of rarity determination available to the forensic document examiner. This presentation will impact the forensic science community by addressing the issue of handwritten numerals and is designed to serve as a sister study to "Measuring the Frequency Occurrence of Handwriting and Handprinting Characteristics" published in January 2017 in the *Journal of Forensic Sciences*.[1]

This presentation describes the results of a statistical research study. The motivation was to strengthen the statistical basis for overall handwriting comparisons in conjunction with the previous paper on which this study expands.[1] Multiple studies and recommendations for purposes of strengthening forensic science have highlighted the need for more comprehensive foundational studies.[2-4] In response to these and other requests, the objectives of this study were to develop statistically valid frequency occurrence proportions for handwritten numeral specimens from sampling representative of the United States adult population for the purposes of providing forensic document examiners with additional objective, statistical information for reliability and measurement validity and to provide courts with additional foundational and supporting data.

This study produced an initial set of 32 handwritten numeral features that were subsequently reduced to 25 characteristics (78%) that passed an Attribute Agreement Analysis (AAA) and were utilized in this study. By passing an AAA, these characteristics are shown to be unambiguously identified by forensic document examiners. Handwriting specimens from 1,197 participants were collected based on the parameters set forth by Johnson et al.[1] Meeting the prescribed population representation through paring led to the selection of 849 numeral specimen forms that closely approximate the demographic proportions represented in the United States. The analysis of these specimens yielded 25 specific frequency occurrence proportions. This study relied on the same protocols applied by Johnson.[1]

There are several studies relative to numeral characteristics.[5-7] Ahola delved into frequency of occurrence in Canada but used a modest, non-stratified sampling number and concentrated on styles of numerals as opposed to specific design structures referenced herein.[5]

Forensic document examination, along with its sister disciplines within the forensic sciences, is undergoing exponential changes in the basic fiber of its foundation. One such change is the recognition that objective, pre-determined frequency of occurrence proportions is the most objective form of weighing the significance of characteristics noted in an examination. In recognition of this, much time has been spent in establishing estimates and this work must continue.

The product of this study is data. Forensic document examination must now collectively decide the best ways in which to utilize this data. Johnson provided several suggestions and ideas, but ultimately it will require a discipline-wide consensus as to the best way to move forward. Frequency occurrence issues are now appearing in reports and in court testimony, so the need for some levels of standardization is becoming increasingly important.

This study is the second in what is anticipated to be a series of studies. The purpose of this study is to fill a gap from the original study in which none of the numeral characteristics passed the AAA. It is anticipated that the next study will further fill gaps from the first two studies. Subsequent to that, it is imperative that these studies be maintained and expanded. By the collection of additional specimens and the identification of additional characteristics that pass AAA, forensic document examination will have an ever-increasingly valuable tool for use in casework and in presenting to courts the foundational research that provides the basis from which we operate.

Reference(s):

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