ABSTRACTS

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Kinematic Models of Subjective Complexity in Handwritten Signatures

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This research seeks to develop a model using kinematic features that best explains variability in Forensic Document Examiner's (FDE's) perception of complexity. One hundred and twenty-three individuals provided five genuine signatures each. All signatures were collected on a tablet running MovAlyzeR® software, which recorded the kinematic data while the subject was signing. Scanned copies of the signatures were sent to five FDEs who were asked to rate the complexity on a five-point scale. For the purpose of this study, complexity was defined as how difficult it would be to simulate the signature without detection by an FDE. The effects of signature style on stroke kinematics were statistically significant for several variables, so separate models were developed for the three signature styles. Kinematic models ranging from three to eight parameters explained 71%, 76%, and 79% of the variation in complexity judgment for text-based, stylized, and mixed-style signatures, respectively. Our results confirm those from previous work that the number of strokes (or the number of turning points) in a signature is a strong predictor of FDE complexity assessment, adding that other kinematic variables such as stroke velocity, slant, horizontal stroke length, and total length of all segments of the signature, together with number of strokes, account for a greater portion of variability in complexity perception. These results underscore the importance of sensitive kinematic analyses of temporal and spatial features in understanding signature complexity.

Dating Water-Based Inks on Documents—Rollerball Pen Inks Containing Pyrrolidone

Valery N. Aginsky, PhD.

The ink aging methodology that is based on measuring a gradual loss (due to evaporation and diffusion into paper) of high boiling solvents from ink on paper has been extensively published and its capabilities, limitations, and scope of applicability discussed in scientific literature. This paper describes an application of this ink aging methodology to the dating of the rollerball inks that contain the high boiling solvent 2-pyrrolidone (2-PD). This work is a continuation of multiple published works that studied natural aging on paper of both oil/glycol-based inks (conventional ballpoint inks) and water-based inks (rollerball and gel ballpoint pen, felt tip pen, stamp pad, and inkjet inks). The goal of this work was to study the natural aging of rollerball inks on paper by monitoring a gradual loss of 2-PD—a high boiling solvent that is used, along with water, for manufacturing Pilot® rollerball pen and other water-based inks. The results of this work show that, at normal environmental conditions, the rate of the loss of the solvent 2-PD from inks after their placement on paper, as well as from paper in close proximity (immediately next) to the inks' strokes, may correlate with the age of the inks during up to 12 months following the application of the inks to paper (the natural aging curves "Content of 2-PD—Age of Ink" obtained for the inks tested in this study leveled off within less than 6 months, when single ink lines were tested, and within less than 12 months, when 'thick' layers of ink on paper, such as the areas of retracing and intersection of two ink lines were tested). It is important to note that the ink-aging analysis of the ink in the areas of retracing and intersection of two ink lines is only applicable for certain types of water-based inks, such as rollerball inks, that produce ink strokes homogeneously filled with ink within the confines of ink lines. Thus, a monitoring of the gradual loss (with age) of 2-PD both from 'thick' lines of inks on paper and from paper in close proximity to the inks' lines allows one to distinguish between fresh (less than 12 months old) and old (significantly older than one year) entries written with rollerball inks.

Utilizing Data From Write-On™ 2.0 To Provide A Stronger Scientific Basis For Handwriting Examinations

Chris Anderson, Anna Agius and Gary Storey

Forensic document examination can fall prey to criticism regarding the lack of a proper statistical basis in handwriting examinations. The development of Write-On™ as a tool to aid forensic document examiners (FDE's) in the analysis of handwriting has helped to address this situation. One facet Write-On™ provides is a wealth of statistical data, however it seems to be largely under-utilized. The authors have developed methods to better exploit the statistical data produced by Write-On™, which gives the examination a stronger scientific footing. This research explores how to extract the data produced by Write-On™, export it into Microsoft Excel® (Excel) and use the data to demonstrate whether there is a sufficient quality and quantity of handwriting to conduct a proper and adequate comparison. Conveying this information in a report provides an improved scientific basis for the opinion expressed.

A preliminary study of 3D depth measurement of the grooves generated by three different pens for handwriting

Francesco Dellavalle and Sergio Frontini

In order to produce a handwritten graphic trace, contact between the tip of the writing instrument and the writing medium is required. The pressure of the pen tip on the paper is necessary to ensure that there is a transfer of ink on paper, depending upon the writing instrument, the paper, the writing surface, and the author's habit, more or less pressure will be exerted when this contact is made.
In the field of forensics, the effort exerted by the writing hand is evaluated by the intensity perceived in the color and amplitude of the graphic pattern, over the depth of the groove visible on the back of the sheet.
The inking of the stroke might not be directly correlated with the degree of indentation in the paper.
For example, it may happen that the inking of the stroke is not directly correlated with the level of depth of the groove in the paper, therefore could be due to defects of the graphic medium dispensing, or by the speed of the movement of the hand of the writer.
The measure of the depth of a writing groove and the measure of the relative pressure variation along a graphic pattern may constitute an important fact for the forensic examination of documents.
The subject of this article is therefore a first metrological approach that aims to quantitatively define for any given "writing means" (i.e., pens) and "writing medium" (inks):

1. **the differences in degree of indentation for the same individual;**
2. **the differences in degree of indentation, if any, for different individuals;**
3. **the absolute limits that the degree of indentation can vary continuously.**