J2 Surface Roughness Measurement Techniques Using Pen Pressure Measurement in Signatures and Usability for Determination of Identity

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Learning Overview: After attending this presentation, attendees will have better understand the contributions of measuring pen pressure numerically with microscopes measuring surface roughness in determining signature identification.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by demonstrating the usage of pen pressure measurement, which has an important place in the field of writing and signature examination, and by providing a study on an important subject, the measurement with 3D microscopes.

One of the diagnostic methods used in forensic signature examination and determination of identity is the depth analysis of the stroke and the changes in that value of depth.[1,2.] Generally, the methods used to evaluate the depth and depth changes of the stroke do not yield numerical values but rather remain at the level of subjective evaluation.

In this study, the aim is to investigate the use of microscopes that are generally used in the field of engineering for surface roughness measurement and to determine whether the numerical values obtained can play a role in identifications in forensic signature investigations.

The Leica® DVM-6 3D microscope was used to measure the depth of the stroke in this study. Eleven participants were selected, and one was asked to sign their signature three times in three different conditions to create the questioned signatures. A clipboard was used as the first substrate under a blank paper. After that, one paper was placed on the same clipboard as a second condition. Finally, as the third condition, two papers were placed on the clipboard under the blank paper. Five female and five male subjects were asked to imitate the questioned signature three times by only looking at it—freehand simulation. This imitation was performed in all three conditions. Then, three dots were selected from the genuine signatures—those of the person who was imitated them. The maximum depth of the stroke was determined by measuring from these points. The maximum value of the stroke depths was determined for each subject separately by measuring at the same points in the imitation signatures. For each subject, it was investigated whether the values determined from the same points of the signature showed a statistically significant difference with the questioned signature. The data obtained were analyzed in *t*-test using SPSS 23 software. The calculations were performed within a 95% confidence interval.

In the three signatures of the first condition, statistically significant differences were found in six subjects compared to the questioned signature in measurements made from three points (total nine points). In the three signatures from the second condition, statistically significant differences were found in three subjects compared to the questioned signature in measurements made from three points (total nine points). In the three signatures from the third condition, statistically significant differences were found in four subjects compared to the questioned signature in measurements made from three points (total nine points). The mean of all three conditions (mean of 27 points in total) shows statistically significant differences in seven subjects compared to the questioned signature.

It is never possible to reach definitive conclusions in determining the identity of signatures. As matter of fact, when experts write the results, they never say that this signature is the product of a particular person's hand. One of the criteria used in this determination is the depth of the strokes that make up the signature. In addition, it is important to show this depth numerically with the changes created by depth. In practice, experts will never be able to decide on the identity of a signature with the values they achieve. However, they will have an important criterion in establishing an opinion. Herein, it is necessary to evaluate the values obtained, together with other findings, and to interpret them correctly.

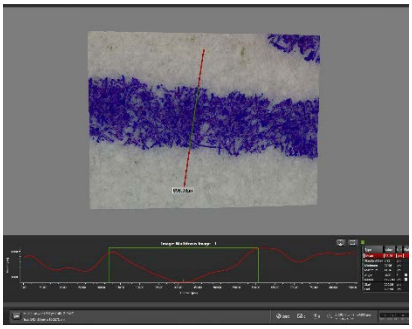

Figure 1: *Pen pressure depth analysis sample result that was used in study.*

Reference(s):

1. Giuseppe Schirripa Spagnolo. Potentiality of 3D laser profilometry to determine the sequence of homogenous crossing lines on questioned documents. *Forensic Science International* 164, no.2–3, (December 2006): 102-109.
2. Giuseppe Schirripa Spagnolo, Lorenzo Cozzella, and Carla Simonetti. Linear conoscopic holography as aid for forensic handwriting expert. *Optik* 124, (2013), 2155–2160.

Depth Analysis in Stroke, Pen Pressure, 3D Microscope

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