J9 Thermal Imaging of Obliterated Writing

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After attending this presentation, attendees will understand the use of thermal imaging to view obliterated writing evidence.

This presentation will impact the forensic science community by increasing understanding in the visualization of obliterated writings.

The use of thermal imaging techniques for the non-destructive examination of obliterated writings could be of significant value for questioned document analyses. The commonly used Video Spectral Comparator (VSC) is able to decipher many questioned writings, but has been found to have limitations, most notably in its inability to visualize "true black" inks. A "true black" ink is non-fluorescent and non- reflective and has traditionally posed a challenge for questioned document examiners. Additionally, the VSC is limited to deciphering obliterations in which the inks have significantly different spectral properties. As a possible alternative method, research has been performed to determine the feasibility of visible/near infrared hyperspectral imaging in reading obliterations[1]. This technique has been found to be very effective, but has some limitations as well. In some cases, pencil/pen obliterations were not able to be read, due to the lack of a significant spectral signature of the pencil writings.

Thermal imaging is an alternative tool that can aid in the visualization of obliterated writings. Infrared thermography utilizes the amount of infrared light emitted by objects and chemicals to determine their approximate temperature and provide contrast based on the differences. When heated, the unique emissivities of inks cause different amounts of radiation to be emitted, enabling the image to be based on temperature and chemical differences rather than wavelengths. The early results of this proof-of-concept study indicated that several operating parameters can be adjusted to yield optimum results. Therefore, all of the samples that were collected for the initial study have been reanalyzed. To ensure the reproducibility of the results, two identical cameras were used to collect the thermal images.

To validate the technique, multiple blind samples of obliterated writings were analyzed. All samples were written in #1, 2, or 3 pencil, black pen ink, true black ink, black gel pen ink, or were typed on paper. The implements used to obliterate the writing were black ink, true black ink, black gel pen ink, marker, crayon, and white out. The obliterated writing samples included printing in all capital letters, cursive writings, a combination of print and cursive writings as well as the type written samples. Most samples were heated so that the emissivities of the inks could induce a thermal contrast. This technique enables the user to visually decipher between the inks present, allowing the original writing to be read. A few samples could be discerned without heating but the vast majority did require heating. Several heat sources were used but the most commonly used source was a standard 120W light bulb. Many writing implement combinations are easily and quickly visualized; including any pencil, gel pen, or printer ink writings obliterated by various other implements. These results indicate that thermal imaging is a valuable tool in the analysis of obliterated writings, especially when used in conjunction with hyperspectral imaging.

Reference:

1. Ayub, H., Williams, D.K., "The Role of Hyperspectral Imaging in the Visualization of Obliterated Writings", American Physical Society, Baltimore, Maryland, March 2006, abstract no. R9.6

Obliterated Writing, Thermal Imaging, Ink Analysis

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