D23 Quantifiable Examination of Partial Fingerprints at Crime Scenes: A Digital Technique for Teaching and Field Examination

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After attending this presentation, attendees will learn the following information: (1) a new digital technique that can perform quantifiable measurements of partial fingerprints; (2) the scientific principles and methodology that support the examination; and, (3) an evaluation of the reliability and validity of the methodology of partial fingerprints for a potential field use.

This presentation will impact the forensic science community by introducing a new digital technique that can examine partial fingerprints with quantifiable measurements in an educational setting and a potential field examination at crime scenes.

Fingerprint examination has been a vital method for inclusion and exclusion of suspects for over a hundred years. However, the field is being challenged in recent years on three major fronts. First, the 2009 Natonal Academy of Sciences (NAS) Report, *Strengthening Forensic Science in the United States: A Path Forward,* challenges the current fingerprint examination to be non-scientific due to its nature of being a pattern- and minutia-based comparison, lacking a quantifiable measurement. Second, the Automated Fingerprint Identification System (AFIS) or the Integrated Automated Fingerprint Identification System (IAFIS), the software for law enforcement agencies in the U.S., is a station-based technology and can provide little support for a preliminary examination at crime scenes. Finally, AFIS or IAFIS requires a certain level of fingerprint quality to be developed at crime scenes. A partial fingermark is not eligible for an examination and comparison at all. In reality, a field technique for a preliminary examination or at least for a quick exclusion is a timely requirement for crime scene technicians and investigators. This presentation introduces a new digital technique that examines partial fingermarks for an educational setting and possibly for a preliminary examination at crime scenes.

It is argued that to echo the above-mentioned challenges, the 21st-century technology for fingerprint examination should be optical, digital, and portable. The optical technology can provide a non-destructive method and can be used either before or after the lifting of a fingermark for a safer development. The digital technology tends to be more reliable and valid, making possible a qualitative evaluation and quantitative measurement of full or partial fingerprints. Finally, a new application of digital technology can perform a rapid field examination, providing much-needed support for crime scene technicians and investigators.

This presentation is a preliminary report of a pilot study (N=60 in 30 pairs). The methodology is based on a target sampling approach due to being a pilot experiment. A partial fingermark can be in the form of a plastic, patent, or latent fingerprint. This study focuses on the latent fingermark that is made visual after a magnetic powder processing and lifted onto hinged fingerprint cards. The criteria for a partial fingerprint selection are threefold: (1) the fingerprint contains about 25% of the total area; (2) the partial fingerprint is visible by naked eye for an initial visual screening and is readable by a magnifier; and, (3) the partial fingerprint contains at least three minutiae or partial core structure for a triangulation analysis.

For the sake of simple selection of the partial fingerprints, two classifications can be observed and compared: a partial fingerprint with at least three minutiae and a partial with less than three minutiae. The comparison of the 30 pairs is divided into three situations: (1) a full fingerprint is compared with another full fingerprint (F with F); (2) a partial fingerprint with a full fingerprint (P with F); and, (3) a partial with another partial (P with P). The quantifiable examination consists of four types of measurement depending on the location and the type of minutia: linear; area; angle; and ridge-counting comparisons.

The preliminary results of 30 pairs indicate that the success rate is reachable at 95% for the F with F group, 70% for the P with F group, and 50% for the P with P group. It is concluded that the new digital technique is very promising in an educational setting and has a greater potential for partial fingerprint examination for exclusion at crime scenes. It is recommended that the comparison module and interactive graphic interface gives more accuracy, precision, and specificity on fingerprint examination. In order to compare partial fingerprints at crime scenes, a better dactyloscopy with the new digital technique can provide an interactive comparison module with various processing functionalities. In sum, this presentation should be considered as one big step forward to address the challenges from the NAS Report, *Strengthening Forensic Science in the United States: A Path Forward*, which was issued five year ago.

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Partial Fingerprints, Crime Scenes, Digital Technique

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