Practitioner's Commentary: The Outstanding Fingerprints Papers

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Introduction

I read with great interest the three Outstanding papers. A mathematical model to assess the requested probability, that the thumbprint of every human who has ever lived is different, is beneficial to the science of identification from fingerprints.

I offer a viewpoint from the forensic discipline of friction ridge identification. As an A.F.I.S. (Automated Fingerprint Identification System) Technician, I examine more than 125,000 fingerprints each year. On a daily basis, I determine if "friction ridge skin impressions" (also known as *latent prints* or *latent marks*) collected at crime scenes came from the same source as a known "rolled" inked fingerprint (also known as an *exemplar*). Mathematical models, such as those suggested by the Outstanding teams, could help resolve the hypothesis that a "small distorted fragment" of a friction ridge skin impression came from the same source as a known "rolled" inked fingerprint.

Uniqueness of Fingerprints

Over 100 years of research in embryology, genetics, biology, and anatomy have documented the extensive genetic, biological, and random environmental occurrences that take place during fetal growth; all this work supports the

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premise that friction skin is unique, as does statistical research. Despite the oversimplification in each model from unrealistic assumptions such as

- minutiae occur at uniform rates along a particular ridge,
- only two types of minutiae exist,
- all fingerprints are perfect rolled prints, and
- ridge widths are consistent, so that pores and edge shapes are not significant,

each of the teams' conclusions support fingerprint uniqueness. Given the time constraint in the contest, oversimplification was likely unavoidable.

Most legal professionals, scholars and scientists support the view that "nature never repeats itself," and most do not dispute fingerprint uniqueness.

Challenges of Fingerprint Identification

Why is it, then, that the scientific reliability of friction ridge identification is frequently challenged in the courtroom? In 1993, a U.S. Supreme Court, in a ruling for the civil case *Daubert v. Merrell Dow Pharmaceuticals, Inc.*, 509 U.S. 579 (1993), outlined specific "Daubert" criteria to be used by trial judges in assessing the admissibility of scientific evidence. While the Court's ruling is not necessarily binding on the individual states, many states have adopted the "Daubert" standard or the federal rules on which it was based. In 1999, the Assistant Federal Defender for the State of Pennsylvania was the first to challenge the admissibility of fingerprint evidence based on his own interpretation of the Court's ruling and the five "Daubert" criteria. Robert Epstein, defense counsel for Byron Mitchell on trial for armed robbery, posed the question:

> Is there a scientific basis for a fingerprint examiner to make an identification, of absolute certainty, from a small distorted latent fingerprint fragment, revealing only a small number of basic ridge characteristics such as nine characteristics identified by the FBI examiner at Mr. Mitchell's first trial?

Friction ridge identifications usually involve smaller, frequently distorted friction ridge skin impressions that are compared to a usually larger rolled inked impression collected under a controlled environment. Therefore, it is necessary for the friction ridge identification specialist to analyze the latent print and assess if sufficient quantity and quality of unique friction ridge features can be observed. If sufficient information exists, the latent print is deemed to be "identifiable." Dr. Christophe Champod, co-author of a new book on fingerprint science [Champod et al. 2004] states that, "The number of studies devoted to *partial* marks, taking into account realistic features and effects such as *pressure distortion* and *clarity* is very limited. There is huge room for improvement here."

A probability model, based on a statistical analysis of the frequency or rarity of all types of friction ridge features and modified to account for different types of distortion, may possibly be used to quantify the apparent "sufficient observed uniqueness" in a latent print and hence help support a conclusion of a positive fingerprint identification or "individualization." However, given our knowledge of the morphology of friction ridge skin, statistical analysis may never encompass all of the significant friction ridge features that can be observed in the latent print by the friction ridge identification specialist and applied to the identification process. Nevertheless, it is certainly an endeavour worthy of considerable attention by the scientific community.

Certainty

A key phrase in Robert Epstein's statement is "of absolute certainty." How can Friction Ridge Identification Specialists do what they say they can do with absolute certainty? Dr. Champod argues that the opinion of positive identification made by the friction ridge identification specialist "is based on inductive reasoning" and, therefore, "must be probabilistic" [Champod et al. 2004]. However, others suggest that the probability is so small that it can be disregarded and hence the latent print examiner's conclusion of 100% certainty is acceptable. Even Dr. Champod supports the view that individualization cannot be achieved through statistics, "But statistics can do no more than provide a probability. It is for others to decide on whether that probability is small enough to conclude identity of source" [Champod et al. 2004].

Dr. Champod further suggests that

> ... the benefits from statistics applied to the fingerprint identification field will include a way to assess the statistical value of marks declared insufficient for identification. A model should allow probabilities to be assigned to partial marks, e.g., assessing the chance of finding another finger showing a limited number of matching features.

Unfortunately, there are inherent risks in bringing a probability model out of academia and into a courtroom. In one DNA "match" case that he discusses, Andre Moenssens [2000] states, "The odds of the arrestee's DNA being wrongly matched against that of the crime scene were said to be one in 37 million." Moenssens believes that it is a common misunderstanding among lawyers, judges, lay persons and police that when a DNA "match" is reported with odds of one in 37 million that a like match in the DNA pattern exists once in 37 million people. This is clearly a misunderstanding of the statistics used by the experts. Monenssens continues by adding, "According to DNA scientist Keith Inman... it should be understood that the calculated frequency is an estimate, and can be off by an order of magnitude in either direction."

Crucial Considerations

Correct interpretation of friction ridge features is critical to the friction ridge identification process. Whether or not these features are recognized, ignored, or given any significance can be seriously affected by any distortion present in the fingerprint. Another factor that should be considered is that the majority of crime scene fingerprints contain only 20% of the information found in a rolled inked fingerprint. Therefore, the inability to accurately recognize friction ridge features or interpret them correctly may be detrimental to the reliability of the probability model. Unless the probability model accurately accounts for the effects of distortion in a crime scene print, the application of such a model could be detrimental to the judge or jury's assessment of the value of the fingerprint evidence.

In my opinion, the conclusions of the Outstanding papers support the underlying premise that fingerprints are unique. Time constraints may have prevented a more detailed examination of comparing the probability of a fingerprint misidentification to a misidentification by DNA evidence. Unfortunately, the assumptions used in the models preclude the significance of distortion and lack of clarity in the crime scene print. Other factors, such as the subjective nature of latent print analysis by specialists with varying levels of training, knowledge, and experience, also need to be examined in assessing the odds of a fingerprint misidentification.

Conclusion

I agree with Dr. Champod that "Statistical data, even gathered through myopic models, can only help the discipline work toward more reliable and transparent methods of assessing evidential value." I highly recommend that anyone interested in pursuing further the application of statistical analysis and probability models to friction ridge identification read his book [Champod et al. 2004].

I applaud the efforts of all this year's modeling teams in considering the important problems involved in the complex statistical analysis of friction ridge features and the advancement of the science of friction ridge identification.

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About the Author

Mary Beeton was first introduced to the applied science of friction ridge identification through her training and education as an Automated Fingerprint Identification System Technician with the Durham Regional Police Service in Ontario, Canada. Her Website "Ridges and Furrows" is the culmination of many hours spent researching topics relating to the forensic discipline of friction ridge identification. Ms. Beeton frequently gives presentations on A.F.I.S., the history of friction skin identification, fingerprint patterns, and digit determination to police officers as part of their advanced training. Ms. Beeton is currently President of the Canadian Identification Society (C.I.S.), an organization with approximately 900 members from Canada, the United States, and other countries worldwide. The C.I.S. encourages forensic identification specialists to share their knowledge and experience and supports continuing research in all areas of forensic science.

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