



Factors associated with latent fingerprint exclusion determinations



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ABSTRACT

Exclusion is the determination by a latent print examiner that two friction ridge impressions did not originate from the same source. The concept and terminology of exclusion vary among agencies. Much of the literature on latent print examination focuses on individualization, and much less attention has been paid to exclusion. This experimental study assesses the associations between a variety of factors and exclusion determinations. Although erroneous exclusions are more likely to occur on some images and for some examiners, they were widely distributed among images and examiners. Measurable factors found to be associated with exclusion rates include the quality of the latent, value determinations, analysis minutia count, comparison difficulty, and the presence of cores or deltas. An understanding of these associations will help explain the circumstances under which errors are more likely to occur and when determinations are less likely to be reproduced by other examiners; the results should also lead to improved effectiveness and efficiency of training and casework quality assurance. This research is intended to assist examiners in improving the examination process and provide information to the broader community regarding the accuracy, reliability, and implications of exclusion decisions.

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1. Introduction

Historically, the latent print¹ [1–9] examination process was primarily focused on identifying (or individualizing) the person (subject) who left a latent print. Only in special circumstances did examiners need to make the distinction between not identifying the source of a latent print (“non-identification”) and determining that a specific finger or palm from a subject was not the source of a latent print (exclusion). “Non-identification” is inherently ambiguous, as it does not differentiate between exclusions and inconclusive determinations: exclusions explicitly indicate that a

subject was not the source of a latent, whereas inconclusives indicate that the examiner could not determine whether or not a subject was the source of a latent. This ambiguity came under criticism in the late 1990s and early 2000s as part of the accreditation of latent print units and crime laboratories. In response, the Scientific Working Group on Friction Ridge Analysis, Study and Technology (SWGFAST) guidelines were changed between 1997 and 2002, dropping non-identification as a determination, and adding inconclusive and exclusion determinations. Although SWGFAST guidelines changed, some laboratories and individual examiners continue to use the older non-identification determination [10]. The changing role of exclusion determinations in standard practice presents a new challenge for the latent print community, which is still adjusting to these changes.

SWGFAST defines the term “exclusion” to mean “the determination by an examiner that there is sufficient quality and quantity of detail in disagreement to conclude that two areas of friction ridge impressions did not originate from the same source” [11]. An examiner can exclude a specific anatomical area (such as a specific finger from a specific person), or a person (“if all relevant

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¹ Regarding the use of terminology – “latent print” is the preferred term in North America for a friction ridge impression from an unknown source, and “print” is used to refer generically to known or unknown impressions. We recognize that outside of North America, the preferred term for an impression from an unknown source is “mark” or “trace,” and that “print” is used to refer only to known impressions. We are using the North American standard terminology to maintain consistency with our previous and future papers in this series [1–9]. See Glossary, Appendix SI-1.

comparable anatomical areas are represented and legible in the known exemplars”) [12].²

The term “exclusion” is not used consistently throughout the latent print community. In 2009, the latent print examiners who participated in our Black Box study [2] were asked to specify how they use the term “exclusion” as a conclusion in their standard operating procedures: examiners differed on whether exclusion means that the latent did not come from any friction ridge skin for that subject (51%), from any finger from the subject (10%), or from a specific exemplar (e.g., a specific finger) (11%) — 4% said that any comparison that is not an individualization is an exclusion, and 23% said they do not use the term. However, most survey respondents (84%) said that they often conclude that a latent and the exemplars provided definitively did not come from the same source; only 3% never make such a conclusion ([2], summarized in Appendix SI-2.4).

This shift in standards for reporting conclusions has given rise to a new type of error: erroneous exclusions. Under the identification vs. non-identification approach, an examiner could err by making a “missed ID,” failing to individualize two fingerprints that other examiners individualize. Missed IDs include not only erroneous exclusions, but also inconclusives and no value determinations on comparisons on which other examiners made individualization determinations. Using SWGFAST terminology, an erroneous exclusion is an error, because it can be shown to be demonstrably wrong; a missed ID is a non-consensus decision in which examiners disagree regarding whether there is sufficient support for an individualization decision.

Explicitly dividing the old non-identification determination into inconclusive and exclusion determinations reduces ambiguity, but in operational casework the distinction is often not important. Occasionally, the distinction between an inconclusive and an exclusion may be important for exculpatory evidence, if the latent is of high probative value (e.g., on the handle of a knife), or if the latent indicates that another person was present at a crime scene. However, the probative value of an exclusion is usually minimal because excluding a person does not mean that the person did not touch an object. In most casework, an exclusion has the same operational implications as an inconclusive, and an erroneous exclusion usually has the same operational implications as a missed ID.

A substantial part of the decision process is the extraction of information from the fingerprints. The decision whether to exclude relies on a series of assessments and subsidiary decisions made by the examiner during analysis and comparison: assessing whether there are areas in the latent and exemplar that can be used to effect a meaningful comparison; assessing the presence and absence of features; assessing whether similarities should be considered correspondences; assessing whether dissimilarities should be considered discrepancies. Each of these assessments must account for uncertainty: the examiner must consider the level of confidence in each assessment. Deciding whether or not to exclude can be straightforward if the prints being compared are high quality and there are notable differences in the pattern classes or overall ridge flow. However, deciding whether or not to exclude may be more challenging if either the latent or exemplar is unclear, distorted, or incomplete: features and ridge flow can be misinterpreted in unclear prints; distortion can lead to extreme dissimilarity in mated prints (from the same person) [12,13];

incomplete or partial prints are susceptible to being erroneously excluded as the result of incorrect anchoring or localization (comparing the wrong areas).

Deciding whether to exclude requires assessing whether dissimilarities are in fact due to true discrepancies. The distinction between these terms is important: a dissimilarity is a difference in appearance between two friction ridge impressions, but a discrepancy is an examiner’s assessment that a dissimilarity originates in the skin itself and cannot be explained as an artifact or distortion. In the “one discrepancy rule” [12,14], any discrepancy is sufficient to exclude; over-eager application of this rule may lead to errors [13,15,16]. SWGFAST states that “The term discrepancy is only used as a description of incompatibility between two impressions that has resulted in a conclusion of exclusion,” [12] and therefore per that definition the examiner’s decision whether dissimilarities should be considered discrepancies is directly tied to the decision whether the comparison should be an exclusion.

Examiners can make exclusions based on differences in pattern classes or overall ridge flow (level 1 features), or minutiae and paths of individual ridges (level 2). Although exclusions can be based solely on differences in level-1 information, when there is significant distortion, differences in both level-1 and level-2 features are required; ridge edges and pores (level 3 details) cannot be the sole factor in exclusion determinations [12]. After recent research studies reported a surprisingly high rate of erroneous exclusions [2,17,18], there has been more discussion of erroneous exclusions, often with examples of how distortion or other factors could make mated prints appear very different [e.g., Ref. 13]. Some agencies have begun to change the criteria for an exclusion. For example, three agencies in Arizona now require an anchor point (e.g., a core or delta) in both prints and discrepancies in both level-1 and level-2 details to render an exclusion: “Only after noting distinct differences in two or more target groups in their relation to the first-level anchor point does the examiner have sufficient disagreement to exclude.” [16]

In making an exclusion decision, the examiner considers his/her assessment of similarities and dissimilarities, along with his/her level of uncertainty in this assessment, and then determines if the information is sufficient to render an exclusion. The sufficiency threshold is based on an implicit utility function [19,20], in which the examiner considers the relative benefits of making a correct exclusion versus the costs of making a mistake. Errors and disagreements among examiners may be due in part to lack of guidance on the relative costs and benefits of each decision, or systematic pressures encouraging some decisions more than others. These pressures will vary by agency or among cases, and examiners’ responses to these pressures will vary. For example, given a print of marginal suitability, an examiner must decide whether to compare or not. Approximately half of the Black Box survey respondents reported that they are either not permitted to make (32%) or discouraged from making (19%) an inconclusive determination if the latent and exemplar are both of value and include a large potentially corresponding area [2]. The rate of erroneous exclusions may be explained in part by environments in which some examiners felt discouraged from making inconclusive determinations and knew that exclusions would not be subjected to verification.

In light of the high erroneous exclusion rate reported on Black Box and other studies [17,18], and the recent interest in exclusions [13,16], we have conducted additional analyses of data from the Black Box and White Box studies to understand the associations between a variety of factors and exclusion determinations, particularly factors associated with erroneous exclusions. To the extent that these associations are causal, they may help to shed light on how decisions are made; however, non-causal associations may also be informative toward understanding the circumstances

² Note that there are additional unrelated uses for the term “exclusion” occasionally used in forensic contexts: the positive identification of a latent to an elimination print (e.g., officer, family member, victim), and the inadmissibility of evidence in court. The term “elimination” is sometimes used as a synonym of exclusion.

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