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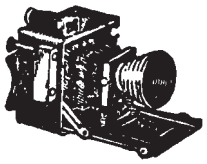

Review of the Scientific Basis for Friction Ridge Comparisons as a Means of Identification: Committee Findings and Recommendations

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I. Introduction

In response to the misidentification of a latent print, senior management of the FBI Laboratory tasked a three-member review committee to evaluate the fundamental basis for the science of friction ridge skin impression pattern analysis and to recommend research to be considered to test, where necessary, the hypotheses that form the bases of this discipline. The committee's evaluation followed a proactive approach, identifying areas where research and development might provide enhancements to current analytical capabilities in the field of friction ridge pattern analysis. This committee was not able to find a single peer-reviewed publication that definitively addressed all of the basic assumptions of friction ridge impression analysis, nor was that expected. Science is built on many studies, and one needs to review the totality of data. Thus this task was greater than the time and resources provided. For practical reasons, the committee was able to review only a small portion of the literature to define the current practices, scientific bases, and philosophies of the discipline. Further assessments were gained by interviewing experts in fingerprint analyses, forensics, statistics, and legal matters, as well as by relying on the experiences of the committee members to understand the fundamentals and to derive recommendations for documentary and validation studies. The findings and recommendations that follow are therefore not exhaustive, but instead focus on the primary foundations of the science of friction ridge skin impression pattern analysis.

II. Basic Assumptions

The committee reviewed the scientific basis for comparing a latent print found at a crime scene with a reference print obtained by a more controlled process (inking method, live scan, etc.) and the ability to render an interpretation of whether or not the two originate from the same source. There is indisputable evidence supporting that such practices can be carried out reliably and that the general process should not be rejected.

All forensic analyses have a subjective component, in which the analyst decides whether or not to interpret the evidence and the thresholds to institute during the evaluation. The latent print ACE-V (Analysis, Comparison, Evaluation-Verification) process has a greater component of subjectivity than, for example, chemical analyses or DNA typing. Yet this does not in itself call into question the reliability of the latent print analysis methodology. However, at some level, the examiner might be considered a "black box." The examiner makes an interpretation, and one may not know, understand, or appreciate the machinations that the examiner made to arrive at a conclusion. One also may not be able to codify the data used to make that interpretation. But reliable results have been obtained, and thus there can be confidence in the process. Alternatively, some suggest that more objective criteria would be useful to set minimum criteria across the field, provide greater confidence in the process, and provide better evaluation criteria to review cases critically. Both of these positions (i.e., the black box and objective criteria) have merit and should be considered to address the scientific underpinnings of friction ridge skin impression pattern analyses.

The *use of friction ridge* skin comparisons as a means of identification is based on the assumptions that the pattern of friction ridge skin is both unique and permanent. The assumption of uniqueness is grounded in the belief that the stresses, strains, and tensions that occur during ridge formation are infinite, random, and independent and that these forces yield tremendous variation in the population of fingerprint ridge formations produced. However, it is well accepted that wide variations in the amount of detail transferred during any given contact from the three-dimensional world of a finger to the two-dimensional realm of a fingerprint may not permit individualization. Thus, although the ridge pattern arrangement on friction ridge skin is unique, one may not be able to render an identification or an exclusion of a source from the limited amount of detail in certain latent prints. The second assumption, that friction ridge skin detail is permanent, is supported by basic biology (i.e., the structure of friction ridge skin) and by empirical observation. The patterns on friction ridge skin do not change over time, except that they become larger during growth to adulthood or may change as a result of a serious injury (which may produce scarring, for example) or some disfiguring disease. These two assumptions, uniqueness and permanence, are based to a lesser or greater degree on empirical research, probabilistic models, anecdotal evidence, and extrapolation.

II.A. Permanence of Friction Ridge Skin Features

Documentation seems sufficient to support the assumption of permanence. The structure and development of friction ridge skin is such that permanence is supported biologically. The committee found good evidence to support the belief that the features of a fingerprint pattern do not alter throughout a person's lifetime. However, most of the studies designed to evaluate permanence have focused on Level I and Level II detail. Because examiners also use Level III features (in those prints where such detail is visible), additional testing of the hypothesis of permanence of these features is warranted. Here, and in the remainder of the text, a feature is defined as any morphological detail that comprises the friction ridge skin arrangement at Level I, II, or III detail. The field also assumes that friction skin formation concepts apply to all volar skin, which extends beyond the finger to the lower joints, palms, and soles. While this extrapolation seems reasonable from a biological model, the vast majority of studies have been performed on the friction ridge skin comprising the first joint of the finger. Therefore, further testing of the hypothesis of permanence on the lower joints, soles, and palms could be considered.

II.B. Uniqueness of Friction Ridge Patterns

Empirical studies can never prove absolutely the hypothesis of uniqueness. Doing so would require comparing the friction ridge arrangements on all fingers, palms, and soles of every person who has ever lived or, at a minimum, everyone who is currently alive. This is an impossible task and, in the committee's opinion, an unnecessary one. Many scientific theories and laws are not proven absolutely but are well accepted. The same holds true for fingerprints. Not all prints can be collected, and the technical power to carry out empirical comparisons on such a scale is beyond current capabilities. Instead, the assumption of uniqueness has been based on (1) anecdotal evidence comparing prints for more than 100 years and never observing two fingerprints with the same friction ridge skin arrangement; (2) controlled studies of genetically identical twins and never observing exactly the same pattern; and (3) the belief that the stresses, strains, and tensions across an area of friction ridge skin are random, infinite, and independent.

Although obviously complex forces and events impact friction ridge skin formation, they have not been defined and correlated. Thus it is easy to interpret an undefined, complex process as random and independent. There is a genetic component that shows some heritability, particularly for Level I features. Although unknown, it is possible that such genetic programmability may bias, to some degree, formation of Level II and Level III detail. Thus it is conceivable that the events are not random or completely independent. The forces themselves do not need to be addressed; however, the extrapolation that they produce random and independent features is a hypothesis that may be testable. Research studies may determine that some or all of the features are not independent. If so, it does not negate the precept that tremendous variation exists within all levels of detail. However, the findings of independence or lack thereof should be considered if attempting to establish a quantitative model for identification.

Although one can always find a few detractors, overwhelming evidence supports that an individual fingerprint pattern is unique. Because some Daubert (Daubert 1993) challenges have focused on the assumption of uniqueness of an entire print, several research studies within the last few years have attempted to test this hypothesis both empirically and through statistical modeling. Such effort is not a good use of resources because further testing of the hypothesis

of uniqueness of a whole print does not provide any gain in the fundamentals of the science of friction ridge examinations. It shifts resources away from addressing more pertinent questions. Latent print evidence can range from a complete fingerprint, including a palm print of high quality containing a lot of detail with visible Level III features, to a small, distorted portion of friction ridge skin of poor quality and a low number of features for comparison. The uniqueness issue of interest is not that a fingerprint in its entirety is unique, which is generally accepted by scientists, laypersons, and the legal community. The critical issue is the minimum number of objective features in a latent print necessary to render an identification with confidence (i.e., information content). Another factor associated with the issue of a minimum feature threshold, which may be more restrictive in defining a threshold, is that of practical limitations. In other words, the examiner may be bound more by the minimum number of features needed to locate the area for comparison on a reference sample than by a minimum feature criterion for identification. The minimum number (and arrangement) of features for uniqueness and the amount of detail necessary for evaluation in everyday friction skin ridge comparisons may not be the same.

Currently, the latent print community espouses that no scientific basis exists for requiring a minimum number of features to render an identification. This philosophy may be rooted in the inability of the discipline to quantify and categorize all features, particularly at the Level III detail. Various minimum point requirements have been promulgated over the history of the field. It is recognized that the point requirement standards that have been used by various agencies around the world pertain solely to the presence of points or minutiae (a subset of Level II detail), rather than including all features present in the latent print. In general, as the number of recognizable points decreases, the quality (or clarity) and/or quantity of surface area of the latent print will also tend to decrease, thereby reducing the likelihood of rendering an identification or an exclusion. This rationale may explain in part the current FBI Laboratory Latent Print Unit (LPU) protocol for requiring an additional review by a supervisor prior to accepting an interpretation of identification on fewer than 12 points (which will be discussed below).

Two approaches may be considered when assessing the scientific basis of identification using latent print evidence. They are (1) treating the examiner as a black box and rigorously testing his or her performance in a controlled manner or (2) developing more objective minimum criteria to establish a threshold for rendering an identification. A combination of these two approaches also may be considered.

II.B.1. Black-Box Approach

Assume for the moment that it is not possible to define minimum criteria for rendering an identification and that the latent print community's position of no scientific basis for a minimum criterion is correct. Some detractors might suggest that the lack of a definable, scientifically derived minimum threshold means that identifications should not be made; the process is too subjective. The committee does not support such a position because vast experience demonstrates that latent print and reference print analyses and comparisons can be performed, and identifications and exclusions can be properly effected. One can embrace the subjective approach and accept that the examiner is a black box. The examiner(s) can be tested with various inputs of a range of defined categories of prints. This approach would demonstrate whether or not it is possible to obtain a degree of accuracy (i.e., assess the performance of the black-box examiner for rendering an identification).

Under the black-box approach, there is a subjective component to varying degrees in all phases of the ACE-V process. To reduce examiner bias, a blind technical review comprising the ACE portion of the ACE-V process should be carried out by another qualified examiner during routine casework. This review should include all aspects of the ACE portion but is particularly important for the Analysis step, during which quality is assessed and ultimately results in an "of value" or "no value" decision. To be truly blind, the second examiner should have no knowledge of the interpretation by the first examiner (to include not seeing notes or reports). Such a technical review is absolutely necessary under the black-box scenario. A blind verification process will have a significant impact on resources; therefore, a study should be carried out to determine the best and most cost-effective approach to accomplish the objective.

II.B.2. Quantitative Approach

Attempting to develop a quantifiable minimum threshold based on objective criteria could test the hypothesis of having no scientific basis for a minimum number of features. Some probabilistic models have attempted to address the rarity of features in Level II and Level III detail. Many of these have not been rigorously tested, or the algorithms and existing data are not readily available for review because this information is proprietary or not well collated. If a minimum threshold for an identification can be developed, it should be tested employing a selected panel of the best latent print examiners. It is important to know how the examiner performs compared with an institutionalized or policy based threshold. It is entirely possible that some current identifications could no longer be made because the threshold sets the bar higher. Alternatively, the threshold may set the bar lower than what the practitioner currently considers sufficient detail and features for an identification. Any minimum threshold must consider both the clarity (quality) and quantity of features and include all levels of detail, not simply points or minutiae.

In discussions with examiners, the committee discovered that although there is no official minimum threshold, some examiners would not proceed with an analysis (i.e., send a latent print to be photographed for further review) unless the pattern contained seven detectable points. First, one needs to determine if this unwritten approach is being practiced generally in the FBI LPUs (or in the greater field). If so, there may be some basis to accept the seven points as an interim operational minimum threshold.

Interviewing examiners in the LPUs is one approach to determine actual practices. But caution should be exercised in accepting a consensus by this method alone. The practice of using seven points may be pervasive in the LPUs because most examiners were taught by the same few people; the criteria were not derived independently. Thus there may be a bias in ascertainment for a seven point guideline. Yet seven points may be a good first-level approximation. Second, the minimum threshold hypothesis based on seven points can be tested both by statistical models and by black-box testing. A minimum of seven points does not necessarily connote identity; it conveys only that the print should be photographed and then analyzed more intensely. It is possible that two prints may share seven or more points in common and not be from the same source. Relying solely on points for an identification would be improper. It is the entire arrangement and the ridges and features in sequence that should be analyzed and compared when rendering an identification.

In considering the minimum number of features required to render an identification, the fingerprint community generally accepts the concept of uniqueness of a single ridge. The view is that a number of identifiable features define the morphology of even a single ridge. A single ridge unit is composed of a sweat pore and the surrounding ridge. If every single ridge unit is unique in its morphology, then it is inconceivable that any ridge could be duplicated exactly in two different areas from the same person or among all people. Given the current technological capability, the observance of a single ridge in itself would be impossible to orient and locate in relation to a reference sample(s). Therefore, it is doubtful that any identification has ever been made based solely on a single friction ridge. In short, the morphology of a single ridge may be unique, but using only a single ridge for comparison is impractical.

III. Quality

It is compelling to focus on a quantifiable threshold; however, quality/clarity, i.e., distortion and degradation of prints, is the fundamental issue that needs to be addressed. Variability is inherent in the production of any two prints from the same source, due to a number of factors (surface, environmental factors, size, etc.). Latent prints in particular are not produced in a controlled manner and are subjected to various development processes that may add to the variation between the latent print and the source fingerprint. One has to accept a certain amount of explainable variation in the representation of a print; otherwise, everything would be excluded and no effective print comparisons could be made.

The human eye is quite good at correcting for distortion and degradation, much better than current computer systems. Although the human expert may be better at identifying and accounting for distortion, this process is somewhat subjective and dependent on the individual examiner. Some distortion also is tolerated for minutiae searching by an automated fingerprint identification system (AFIS). A certain amount of distortion is tolerated in the relationship of features between a reference print and a latent print. In fact, a "wider net" is cast when searching and identifying candidates in order to reduce the number of false exclusions in the candidate list. Automated matching algorithms account well for a degree of distortion, and these algorithms can be subjected to rigorous testing. Perhaps some validation studies have been carried out on the degree of distortion (at Level II detail) that can be tolerated before a true mate falls from the top position of the candidate list. If such studies have not been carried out, they could be considered. The concern is that automated encoding algorithms generate false-positive and false-negative minutiae. Thus the detected minutiae pattern may have to be artificially generated or require intensive manual encoding.

To determine if a print can be used for comparison, an assessment of the clarity and quantity of information is made (i.e., the Analysis step in the ACEV method). This is a sliding heuristic practice: as quality declines, a greater quantity of features is needed for the print to be considered "of value" for identification. There is/are no defined quality metric(s). Quality metrics are difficult concepts to define and convey. Perhaps some quality metrics could be (1) a demonstrable and recognizable feature, (2) general clarity/blurriness, (3) grayscale requirement, and (4) defined ridge/valley. Perhaps guidelines for the Comparison and Evaluation phases should be developed for distinguishing the number of explainable dissimilarities versus unexplainable features.

A set of guidelines describing quality metric features should be established. There is some attempt by the FBI LPUs to address quality by invoking a minimum 12-point guideline for requiring a supervisor's approval for a rendered identification because quality may be low. This 12-point system should be tested to determine if a correlation exists between the number of points and clarity. If so, the number of appropriate points to invoke additional review could be codified.

It may be difficult to prescribe quality metrics for every case, but some guidelines could be developed. If not, a minimum quantity threshold (if possible) with a requirement of recognizable and identifiable features might suffice. It is important to stress that under the minimum quantity threshold approach, tabulation of features occurs at two stages. The first is during the analysis of a latent print, and the second is a refinement after comparison with a reference print. At first glance, the refinement may be considered a biased practice to be avoided. The committee disagrees, provided that the analysis stage is carried out independently and, when possible, prior to that of the reference print.

An analogy with DNA is provided for clarification. When assessing a DNA evidence profile as being a single-source or mixed sample, the number of alleles per marker is counted. A single-source sample should display only one or two alleles per marker. Suppose only one of the 13 CODIS (Combined DNA Index System) markers in an evidence profile displays three alleles (call it marker TPOX) and all other markers display one or two alleles (excluding identical twins, a 13-marker profile from a single-source sample is typically considered sufficient

for source identification). Because the phenomenon of three alleles has been observed (although not frequently), the examiner may not rule out the hypothesis that the evidence is from a single source. At the same time, the possibility of a mixed sample, although less likely, might be entertained. A suspect is identified and his or her reference DNA profile matches at all 13 CODIS markers and displays three alleles at marker TPOX. Certainly, such results would be consistent with the interpretation that the sample is not a mixture and would provide stronger weight toward source attribution. There is no distinction for latent print examinations, and more documentation of meaningful scenarios would be useful.

IV. Image Capture and Quality

Early on, the committee assumed that some studies have assessed the accuracy of representation of the friction ridge detail on the finger using the image-capture systems that record reference prints (rolled inked prints, live scan, flat inked prints, etc.). However, there apparently are little or no published data addressing this assumption. Some image-capture systems, such as live scans, may not accurately capture the features and their arrangements on a finger. If such low-quality images are being accepted into the fingerprint repository, it could hamper the identification process, particularly for partial prints. Most discussions of the issue of the ability to effect an identification from a partial latent print have considered only the clarity and quantity of features in the latent print. However, it is important to consider image quality, accuracy of recorded detail, and information content in the known source or file prints as well, in particular when performing an AFIS search. This gap needs to be rectified.

V. Generating Data Sets

In order to carry out effectively some of the studies suggested herein, populations of latent and reference print data need to be available. Attempts have been made to collect such data, and images can be purchased. But the committee could not find any well-defined protocol(s) describing the process for recording, collating, evaluating, and editing such research materials. For example, for a minimum quantity threshold study, it is suggested that high quality data be used first. To extract the feature data, it would be desirable to hold distortion and degradation to a minimum. It would then be possible to degrade the data in a controlled manner to explore the effects of poor quality on the threshold value.

VI. Simultaneous Impressions

There is a practice of using simultaneous impressions to make an identification. Simply stated, simultaneous impressions are two or more friction ridge impressions from the fingers and/or palm of one hand that are determined to have been deposited at the same time. Considerable variation in the definition of simultaneous prints as well as the practices for interpreting such evidence was found within the FBI LPUs. This makes it difficult to effectively address the subject and to critique the practice. Therefore, and foremost, an explicit definition and protocol need to be written. In the meantime, the committee focused on the simple model of two latent prints from two fingers that may have originated from one hand of a single person and could have been placed on an object contemporaneously. Two assumptions are made: (1) the two impressions are related contemporaneously; and (2) even though there are not sufficient quantity and clarity in any one impression, the weight of the combination of features from two or more impressions is equal to or greater than an equivalent amount of data from a suitable identification that could be made if all of the features were located in a single impression. In other words, the features and relationships are not restricted to a small region of friction ridge skin.

Assuming hypothetically that an examiner requires a minimum of seven points in any configuration sufficient for effecting an identification, in simultaneous prints, the seven points could be apportioned between the two fingers. In assessing the independence of features or lack thereof (as described above), one also should consider the independence (or relationship) of features across fingerprints and lower joints on the same hand, not only those in the same fingerprint, if simultaneous impression interpretations are to be used. To justify extracting partial information from two or more impressions and then combining them requires testing that the combination (of less-than-threshold features per impression) is equal to or greater than some threshold requirement.

The assumption that two nearby impressions are from the same individual and have been deposited contemporaneously can be addressed only on a case-by-case basis. Some might say that for some scenarios two prints found together may have been deposited at different times and thus may not be from the same source. Alternatively, if an item could only be held in a certain manner, then the only way of explaining the evidence is that the multiple prints are from a single person. In some cases, identifying simultaneous prints may infer, for example, the manner in which a knife was held. It may be better to define simultaneous prints as “cluster impressions or prints” so as not to infer the timing of the deposition of the multiple prints. However, before proceeding, more explicit guidelines on when it is appropriate to assume that prints are simultaneously deposited need to be created, and it should be required that any assumptions made be stated in the examiner’s report.

VII. Exclusions

The general practice in the field of latent prints is that of “making an identification.” Simply because no latent print of sufficient quality and quantity was found with features similar to the suspect does not mean that the suspect did not handle the evidence. Someone can handle an object and leave no latent print(s); therefore, practitioners espouse that no one can ever be excluded as having touched the evidence. In keeping with this philosophy, a latent print examiner tends to approach the comparison to “make an ident,” rather than to attempt

to exclude. This concept is similar to any other forensic analysis in that a lack of evidence does not necessarily exclude a suspect. However, it contrasts slightly with the doctrine of other forensic science disciplines. In forensic science examinations, regardless of the discipline, a pattern or profile (or some other data) is generated from the evidence, and it is compared with that obtained from a reference sample(s) in an attempt to exclude the two samples as having originated from the same source. When an examiner fails to exclude, then some significance is placed on that observation or finding. The more powerful or resolving the analysis, the more likely it is that wrongly associated samples will be excluded. The tremendous variability observed in friction ridge skin makes analysis of latent prints one of the most powerful exculpatory tools available to the forensic scientist. In fairness, an examiner does look for discrepancies in ridge detail that would result in an interpretation of exclusion. However, this approach is implemented only for prints deemed suitable for comparison.

In the first step of ACE-V, the examiner analyzes a latent print to determine if it is suitable for comparison. However, some prints may not meet this criterion, but they may provide exculpatory information. This can depend on how one frames the focus for exclusion. As stated above, no one can ever be excluded as handling the evidence because a person can touch an object and not leave a latent print. Alternatively, a defendant may desire to know if there are latent prints on the object demonstrating that someone else did handle the object.

An example may illustrate the point. Consider the recovery of a latent print on a glass found at a crime scene. The print is degraded such that the quality of Level II and Level III features is too poor to proceed to the comparison phase of the examination. The print is therefore declared "of no value" and discarded. No further work will be performed on this print. In this scenario, the Level I features clearly present the pattern of a whorl. Now assume that a suspect is apprehended and his or her fingerprints (and possibly other areas of friction ridge skin) have no whorls. In this case, even though it lacked sufficient quality or detail for an identification, the pattern would have excluded the suspect as the source of any prints found on the evidence. The defense and prosecution may want to know if the evidence revealed that someone other than the defendant handled the evidence. Exclusions are a very useful investigative tool and are currently underutilized.

The issue of exculpatory power of evidence is complex but needs further investigation. Some interviewees suggested to the committee that patterns insufficient for an identification could be artifactual. Thus false-positive and false-negative results could be obtained. This needs to be further studied and documented. It would not be wise to recommend a procedure that may have an inherently high error rate. There also is a tremendous resource consideration. If it were deemed reliable to proceed with the exculpatory model, then a substantially larger workforce (and concomitant resources) would be needed, case backlogs would increase, and more storage facilities would be required.

VIII. IAFIS Searches

An examiner encodes the minutiae on a latent print and then enters the data into the Integrated Automated Fingerprint Identification System (IAFIS) to search for possible matches. When an examiner uses IAFIS, false-positive and false-negative (missed) minutiae from reference prints may be encoded. In addition, IAFIS is not as good as the examiner for interpreting distorted patterns and uses only partial detail. Thus the list of matches constitutes candidates, not absolute identity. Based on FBI LPU experience, about 82 percent of the time that the true matching reference pattern (i.e., mate) is on the list, it is in the top candidate position. The other 18 percent of the time, approximately one-third of the true matching reference patterns reside at position number 2 (Table 1). It would be desirable to improve the functionality so that the true mate is the top candidate significantly more than 82 percent of the time (and raise the ranking of those farther down the list). Some interviewees also suggested that if a second examiner encoded the same print, he or she may not select the same minutiae. Thus the pattern used by the second examiner for searching in IAFIS is different than that used by the first examiner. In turn, the candidate list could be different to some degree. Perhaps if two examiners independently encoded minutiae on the latent print, the results of each of their searches combined may increase the success rate of identifying the true mate, provided, of course, that the mate is in the database. A study should be considered to test the effects of two examiners' encoding a print and launching a search on IAFIS. A cost benefit analysis should be considered here as well.

Table 1: Position of the True Mate on an IAFIS Candidate List (Data from IAFIS Searches Conducted at the FBI Laboratory Through October 2004)

Position	Number of Identifications	Percent of Identifications
1	973	82.18
2	74	6.25
3	22	1.86
4	20	1.69
5	21	1.77
6	14	1.18
7	12	1.01
8	12	1.01
9	13	1.10
10	5	0.42
11	2	0.17
12	3	0.25
13	1	0.08
14	1	0.08
15	3	0.25
16	1	0.08
17	0	0.00
18	3	0.25
19	2	0.17
20	2	0.17
Total	1184	100.00

IX. Sourcebook

In the course of this review, the committee found that papers, studies, and other data were not all collated to facilitate an analysis or to be useful for training. The existence of a sourcebook would have facilitated this review. Furthermore, the committee may have found that some of its recommendations had been addressed to a greater degree than was apparent. Thus the committee recommends the development of a sourcebook and formalization of a notebook of the data collected operationally by the FBI LPUs. The sourcebook should be coordinated with members of the Scientific Working Group on Friction Ridge Analysis, Study and Technology (SWGFAST), which also recommends the development of a sourcebook.

X. Conclusions

This committee's review found overwhelming evidence that latent print examinations can be carried out and that reliable identifications can be made. However, there are scientific areas where improvements in the practice can be made, particularly regarding validation, more objective criteria for certain aspects of the ACE-V process, and data collection. The main benefit would be to better ensure the consistency of interpretation practices across the field. The recommended projects are summarized in Table 2 and are divided into two categories (High Priority and Priority).

Table 2: List of Recommendations Sorted into High-Priority and Priority Categories

Note: No ranking of priority is made within each category.

I. High-Priority Projects

A. Quality

1. Develop guidelines for describing quality metric features.
2. Test whether 12-point system is correlated with total number of points and clarity.

B. Quantity

1. Test hypothesis of independence of features.
2. Test hypothesis that there is no scientific basis for minimum point threshold.
3. Establish a quantitative model for identification.
4. Survey Latent Print Units (and community) to determine if unwritten minimum threshold of seven detectable points is applied routinely.
5. If seven-point minimum threshold (or whatever is used by majority) is generally accepted, test with statistical models and by black-box approach.

C. Performance

1. Establish minimum number of features that can be evaluated pragmatically in friction skin ridge casework comparisons.
2. Test performance of examiner as a black box rigorously in a controlled manner.
3. If a minimum threshold for an identification can be developed, test a selected panel of latent print examiners.

D. Exclusions

1. Review value and reliability of exculpatory power of evidence.

II. Priority Projects

A. Permanence Test

1. Test hypothesis of permanence of Level III features.
2. Test hypothesis of permanence of features on the lower joints, soles, and palms.

B. Data Collection

1. Test existing algorithms and collect existing data for review.
2. Develop well-defined protocol(s) describing the process for recording, collating, evaluating, and editing research materials.
3. Develop a sourcebook and collate existing data within the Latent Print Units (and with members of the Scientific Working Group on Friction Ridge Analysis, Study and Technology).

C. Cluster (Formerly Simultaneous) Impressions

1. Develop more explicit definitions on cluster prints and guidelines on when it is appropriate to assume that cluster prints are deposited simultaneously.
2. Test hypothesis of independence of features across fingerprints and lower joints on the same hand (simultaneous impression interpretations).

D. Additional Validation Studies

1. For quality testing, develop method to artificially generate patterns and test degree of variation at which incorrect matches are made.
2. Assess accuracy of representation of the friction ridge detail on the finger when using the image-capture systems that record reference prints.
3. Test impact of two examiners' independently encoding a print and launching a search on the Integrated Automated Fingerprint Identification System.

In the committee's opinion, all of the recommendations in Table 2 are considered priorities for research efforts. Projects within each category are listed in no particular order. Additionally, several of these proposed efforts are best performed via a hierarchical, rather than a parallel, approach. That is, the results of one project will assist in the research design and methodology for subsequent projects. Because performing all of the proposed research projects and implementing the recommendations require substantial monetary and personnel resources, final decisions regarding prioritization of projects will need to be made. The committee concluded that although the use of friction ridge skin impression pattern analysis is fundamentally sound, additional studies could improve confidence in the results obtained, provide guidelines for more consistent practices throughout the latent print community, and provide metrics for assessing performance.

Acknowledgments

In the course of this review, the following experts outside the FBI were interviewed: Mr. Rockne Harmon (Deputy District Attorney, Oakland, California); Dr. David Kaye (Professor, Arizona State University College of Law); Ms. Susan Narveson (Chief, Investigative and Forensic Sciences Division, National Institute of Justice, Washington, D.C.), Mr. Barry Scheck (Professor, Yeshiva University, Benjamin N. Cardozo School of Law, New York, New York); and Dr. David Stoney (Chief Scientist, Stoney Forensic, Inc., Clifton, Virginia). The committee greatly appreciates their candor, advice, and time. The committee also thanks the members of the FBI Laboratory Division Latent Print Units for their time and willingness to honestly answer probing questions about their work practices and the history of their profession.

The opinions expressed are those of the authors and may not necessarily be ascribed to any of the individuals who were interviewed.

This is publication number 05-12 of the Laboratory Division of the Federal Bureau of Investigation. Names of commercial manufacturers are provided for identification only, and inclusion does not imply endorsement by the FBI.

Suggested Readings

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Presidents Message

Greetings Fellow SCAFO Members,

I am honored to be this organizations 69th President and also extremely honored to be the 4th female President.

For those of you who don't know me I would like to give you a brief background of my experience in our profession and as a SCAFO member. I have worked for the Los Angeles County Sheriff's Department Identification Unit for 16 years as a Forensic Identification Specialist and have completed IAI Certification as a Latent Print Examiner. I have been involved in comparison work, crime scene investigation, training and currently work as the lead person in the Chemical Processing Section. I am a member of IAI and the Finger Print Society of Great Britain as well as numerous other organizations in related fields of our profession.

I have been an active member of SCAFO since 1992 and have held the offices of Director, Secretary, Vice President and now President. During the years that I have been involved with SCAFO I have realized that this organization like any other will only succeed with active participation and input from its members. We are constantly looking for interesting speakers related to our field as well as venues where we can have meetings and training seminars.

I would like to encourage all SCAFO members to get involved and contribute ideas for improvements of the organization as well as bringing new Active members into the organization. Many of our members can contribute by sharing their unique cases and experiences during our meetings and training seminars. I also would like to hear feedback from the membership on topics and speakers that you would like to see or hear at the training Seminar or at the regular meetings.

I am looking forward to helping SCAFO maintain it's reputation for being a leader in the Fingerprint community. With the help of the Board of Directors, SCAFO hopes to present several training opportunities in addition to our yearly training seminar. I will attempt to keep you updated on the activities of the organization for 2006 in upcoming editions of The Print as well as our dinner meetings.

"On behalf of SCAFO and it's members we would like to extend our condolences to Jim and Janet Lawson on the loss of Jim's mother".

Thank You for Your Support,

Letter from the Editor

I am pleased to be the new editor of "The Print". I have been a SCAFO member since 1993. Through the years, I have held the positions of Director, Secretary, Sergeant of Arms, Vice President, and SCAFO President in 2002. I have been a Deputy Sheriff, for the Los Angeles County Sheriff's Department, for 27 years. Currently, I work as a latent print examiner and crime scene investigator.

The Print has been a first rate publication, read by members of the Latent Print Community in California, across the United States, Europe and China. It is my goal to continue publishing an informational and professional publication. As your new editor, I welcome any new and/or original articles that you would like to submit for publication. What makes "The Print" stand out from other publications are the fine articles that have been submitted by its members through out the years. If you do any type of search on the internet for Fingerprint articles, you will surely find that one or more have been published in The Print and posted on SCAFO's web site.

At this time, on behalf of all SCAFO members, I would like to thank Alan McRoberts, for all his years of service, dedication, and professionalism he has given to "The Print".

Steve Tillmann
Editor

Upcoming SCAFO Meeting

April 8, 2006

Past Presidents Meeting

Grandma's Hilltop Hideaway Cafe

539 Vista Bella
Oceanside, CA

Registration 4:30PM Dinner 5:30PM
Cost $20.00
RSVP: uyeda@scafo.org

MINUTES OF DECEMBER MEETING

DATE: December 4, 2005

LOCATION: La Palapa Del-Mar, Long Beach

HOST: Susan Garcia

SECRETARY: Mari Johnson

PROGRAM: CSI making friends with the enemy
David Miranda, Pasadena Police Dept.

CALL TO ORDER: Meeting called to order by President Dennis Uyeda.

ATTENDANCE:

PAST PRESIDENTS: Dell Freeman (1973), Clark Fogg (1994), Robert Goss (2001), Steve Tillmann (2002).

EXECUTIVE BOARD: Dennis Uyeda, Mari Johnson, Susan Garcia, Lisa DiMeo, Clark Fogg, Sarah Watson, Craig Johnson, Sue Baker, Gena Russell-Durgan and Marvin Spreyne, (Absent: Alan McRoberts, Bill Leo, and Chuck Russell.).

Members and guests present: 55

OLD BUSINESS:

Second Readings:

Mark Waldo
Terence Holden
Mary Ellen Gorski
Stefanie Camarillo
Motion to accept: Craig Johnson
Second: Theresa Bennett

Swear Ins by Past President Clark Fogg:

Georgine Scott, Monterey Sheriffs Dept.
Margaret Adams, San Bernardino Police Dept.

NEW BUSINESS:

Emily Schum, Glendale Police Dept.
Recommended by: Debbie Stivers
Barbara Maestas, Riverside District Attorneys Office
Recommended by: Yolanda Pina-Perez.
Recommended by Anne Wenceslao

ANNOUNCEMENTS:

Dennis Uyeda turned over the gavel to the new President, Susan Garcia. Dennis, was thanked for his term in office and was presented his 2005 gavel.

The 2006 Executive Board was sworn in by Past President Bob Goss. So let me introduce to you your 2006 Board: Susan Garcia (President), Gena Russell-Durgin (Vice President), Craig Johnson (2nd Vice President), Sarah Watson (Sgt. of Arms), Mari Johnson (Secretary), Lisa DiMeo (Treasure), Sue Baker (Director), Marvin Spreyne (Director), Debbie Stivers (Director), Amy Hines (Director), Clark Fogg (Parliamentarian), Dennis Uyeda (Chairman of the Board) and Steve Tillmann (Editor). (Absent: Bill Leo, Historian)

At the October Seminar Chuck Russell was voted in as Director for 2006. Due to personal conflicts, he felt he would not be able to adequately serve on the 2006 SCAFO board. The two year Directors seat was filled by Amy Hines, of Riverside County DA office.

On behalf of SCAFO I would like to thank Teresa Falicon, the wife of Dale Falicon a long time member, for donating the holiday table favors filled with chocolates that all in attendance received.

Also for those that donated the door prizes with an extra big THANK YOU to Dick Rogers of Armor Holdings. Dick is a long time supporter of SCAFO, as long as I have been a member, has never missed a SCAFO seminar with all his goodies. Dick donated a very generous cash gift for door prizes along with some door prizes. .

ATTENDANCE DRAWING $25.00:

Marvin Spreyne.

DOOR PRIZES:

Dick Rogers, Sarah Watson, Mari Johnson, Susan & Don Garcia (DJ Designs), and SCAFO.

MOTION TO ADJOURN:
Marvin Spreyne
Second: Bob Goss

MEETING ADJOURNED: 1430 hours

"Every man owes a part of his time and money to the business or industry in which he is engaged. No man has a moral right to withhold his support from an organization that is striving to improve conditions within his sphere."

- President Theodore Roosevelt, 1908

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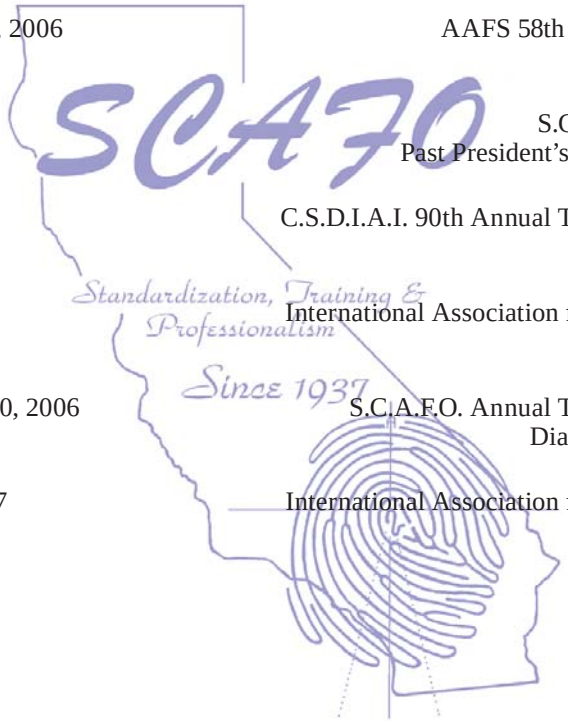
See instructions on the website's email page.

-- Upcoming Events/Schools/Seminars--

February 20 - 25, 2006	AAFS 58th Annual Meeting Seattle, WA
April - 8, 2006	S.C.A.F.O. Meeting Past President's Dinner Meeting
May 7 - 11, 2006	C.S.D.I.A.I. 90th Annual Training Seminar Ontario, CA
July 2 - 8, 2006	International Association for Identification Boston, MA
September 29 - 30, 2006	S.C.A.F.O. Annual Training Seminar Diamond Bar, Calif.
July 22 - 27, 2007	International Association for Identification San Diego, CA



Southern California Association of Fingerprint Officers
An Association for Scientific Investigation and Identification Since 1937