Texas Forensic Science Commission

Justice Through Science

FINAL REPORT ON COMPLAINT NO. 22.16, HARRIS COUNTY PUBLIC DEFENDER (RON SMITH & ASSOCIATES; LATENT PRINTS)

October 20, 2023

TABLE OF EXHIBITS

EXECUTIVE SUMMARY

In 2016, a Harris County jury convicted Joseph Webster of the 2001 murder of Josephine Herbert. At the crime scene, investigators recovered a single palm mark found in suspected blood on a curved metal pole near her body. The evidence was highly probative given the case circumstances. From 2009 to 2014, the Houston Police Department (HPD) outsourced its friction ridge analysis to Ron Smith & Associates (RS&A). At trial, a Project Manager for RS&A testified to results of comparisons made by various RS&A examiners, including herself. She opined that Webster's known palm print "matched" the mark recovered from the crime scene.

In 2010, RS&A compared Webster's known exemplar (along with many others) to the crime scene mark. At the time, RS&A reported a "non-identification." In 2013, HPD asked RS&A to re-compare the known exemplar of Webster and another man after receiving CODIS "hits" to the two men. The RS&A examiner requested a new, better-quality exemplar for Webster. After comparing the crime scene mark to the newly obtained exemplar from Webster, RS&A reported an "identification." The results were verified and technically reviewed.

The Harris County Public Defender's Office (HCPDO) represents Webster in post-conviction proceedings. HCPDO requested assistance from Dr. Henry Swofford, who submitted images of the crime scene mark and Webster's newer exemplar to Carrie Hall, an independent out-of-state examiner[1] and to the Houston Forensic Science Center for use in a blind examination of the images when submitted with no other information. Webster's known exemplar was submitted along with the known exemplars of the other individual whose DNA profile yielded the CODIS "hit". The results of the blind examination were reported as "inconclusive. Swofford also utilized LQMetric software to assist with evaluating the clarity of the friction ridge detail.

HCPDO filed a complaint with the Commission alleging the positive identification conclusion RS&A reached is not reproducible or reliable. The complaint also raised concerns regarding the potentially biasing impact of the CODIS hits to Webster and an alternate suspect.

When notified of the complaint, RS&A questioned the quality of the images utilized by the blind examiners. In response, the Commission requested assistance from HFSC in duplicating all images in the casefile. HFSC's diligent work in reproducing the record led the Commission to conclude that additional images existed beyond those provided to Dr. Swofford by the HCPDO, which had been provided the record by the Harris County District Attorney's Office (HCDAO). The crime scene palm mark had been photographed twice, once with a digital camera and once with a film camera. Because Dr. Swofford only received a portion of the digital images, he was only able to forward that subset for use in the blind examination.

The Commission retained Dr. Glenn Langenburg to assist in a review of the casefile and related testimony. Dr. Langenburg observed the quality of some of the images used in the blind examination were not the best reproductions available and the results of the blind examination may have been impacted by this limitation. For example, the known exemplar used in the blind examination was a lower quality photocopy of the original image. The examiners would have benefitted from utilizing all images available especially because the palm mark left in apparent blood was a challenging print to examine given the potential for distortion and artifacts.

[1] Both Dr. Swofford and Ms. Hall assisted the HCPDO *pro bono*. The Commission acknowledges the extensive work and collaboration of the HFSC, HCPDO (including Henry Swofford and Carrie Hall), HCDAO and RS&A during the investigation, drafting and editing of this report.

Dr. Langenburg examined the impression numerous times utilizing numerous images. He found variation in feature selection both among the images and between examinations he conducted on the same images over time. He concluded there was correspondence between the crime scene mark and the known exemplar of Webster, but that examiners may differ in their characterization of the correspondence. These observations highlight the importance of a linear sequential approach to the ACE-V process in which documentation of the features of the questioned mark are selected before comparing the exemplar print. This step is critical to establishing the foundation for the expert's opinion.

The report describes inflection points for the friction ridge discipline over recent decades and emphasizes key takeaways from published research. In applying historical lessons to the case under review, the Commission notes the mark in question would have benefited from blind verification due to its complexity, the potential contextual influence of the DNA hit to Webster, and the highly probative nature of this single questioned mark.

With respect to case documentation, the RS&A Project Manager is completely absent from the case record even though she was the only examiner who testified, and she confirmed during trial that she performed her own comparison and review. Under an agreement with the HCDAO, the Project Manager often testified on behalf of RS&A to maximize efficiencies because the RS&A examiners working on the HPD project were in different geographic locations throughout the country.

Effective documentation is a hallmark of transparency. Without it, lawyers and judges are simply unable to fulfill their duties. In a case where the palm mark is highly probative (such as this one) as well as challenging (such as this one), attorneys should raise questions about repeatability and reproducibility (and therefore reliability) of the proffered identification. This is especially true where the opinion changed from "no identification" to "identification" after new reference prints were obtained, there is potentially biasing information (such as the CODIS hit), and published research in similar cases shows variability in examiner decision-making the more difficult or complex a comparison is. Unless the case record indicates clearly and unambiguously what led an examiner to make the decisions he or she made during the analytical process, the lawyers may not even be aware when a comparison is challenging or complex. If the only document they review is a short report showing the defendant was "identified" as the source of the questioned mark, lawyers may not perceive the need to request an expert. And even if the lawyer asks, the court may not appreciate the need to appoint an expert given the opacity of the case record and the criminal justice system's historical tendency to perceive friction ridge evidence as nearly infallible.

With respect to testimony, the RS&A Project Manager used language common at the time such as "match" when describing the association between the crime scene mark and Webster's known exemplar. The community has since moved away from this language. The examiner also referenced her experience as an apparent measure of the accuracy of her conclusion. This type of testimony is no longer favored due to its potential to mislead the trier of fact.

Finally, the Commission outlines recommendations for friction ridge practitioners, many of which are based on current and proposed OSAC Registry Standards and/or Best Practice Recommendations. The Commission acknowledges implementation of these recommendations will take time and encourages the active engagement of the Texas Division of the International Association for Identification to assist agencies with gap analysis and implementation.

I. COMMISSION BACKGROUND

A. History and Composition of the Texas Forensic Science Commission

The Texas Forensic Science Commission (Commission) was created during the 79th Legislative Session in 2005 with the passage of HB-1068. The Act amended the Code of Criminal Procedure to add Article 38.01, which describes the composition and authority of the Commission.[1] During subsequent legislative sessions, the Legislature further amended the Code of Criminal Procedure to clarify and expand the Commission's jurisdictional responsibilities and authority.[2]

The Commission has nine members appointed by the Governor of Texas.[3] Seven of the nine commissioners are scientists or medical doctors and two are attorneys (one prosecutor nominated by the Texas District and County Attorney's Association and one criminal defense attorney nominated by the Texas Criminal Defense Lawyer's Association).[4] The Commission's Presiding Officer is Jeffrey Barnard, MD. Dr. Barnard is the Chief Medical Examiner of Dallas County and Director of the Southwestern Institute of Forensic Sciences in Dallas.

B. Investigative Jurisdiction

Texas law requires the Commission to "investigate in a timely manner, any allegation of professional negligence or professional misconduct that would substantially affect the integrity of the results of a forensic analysis conducted by a crime laboratory."[5] "Forensic analysis" is defined as a medical, chemical, toxicological, ballistic, or other examination or test performed on physical

[1] TEX. CODE CRIM. PROC. art. 38.01.
[2] Act of September 1, 2013, 83rd Leg., R.S., ch. 782, §§ 1-4 (S.B. 1238) (codified at TEX. CODE CRIM. PROC. art. 38.01); Act of September 1, 2015, 84th Leg., R.S., ch. 1276, §§ 1-7 (S.B. 1287) (codified at TEX. CODE CRIM. PROC. art. 38.01)
[3] TEX. CODE OF CRIM. PROC. art. 38.01 § 3.
[4] *Id.*
[5] *Id.* at art. 38.01 § 4(a)(3).

evidence, including DNA evidence, for the purpose of determining the connection of the evidence to a criminal action.[6] The statute excludes certain types of forensic examinations from the "forensic analysis" definition, such as latent print examination, a breath test specimen, and the portion of an autopsy conducted by a medical examiner or licensed physician.[7] "Crime laboratory" may include a public or private laboratory or other entity.[8]

For investigations involving a forensic examination or test not subject to the accreditation requirement contained in the Code of Criminal Procedure, the Commission's reports are limited to the following three subject areas:

- Observations regarding the integrity and reliability of the forensic analysis conducted.
- Best practices identified by the Commission during the investigation; and
- Other recommendations deemed relevant by the Commission.[9]

Because latent print examination is not subject to the accreditation requirement set forth in the Texas Code of Criminal Procedure, this report is limited to the above three items and does not assess professional negligence or misconduct.[10]

C. Limitations of this Report

The Commission's jurisdiction contains important statutory limitations. For example, no finding by the Commission constitutes a comment upon the guilt or innocence of any individual.[11] The Commission's written reports are not admissible in civil or criminal actions nor does the Commission have the authority to subpoena documents or testimony.[12] Information the

[6] TEX. CODE CRIM. PROC. art. 38.35(a)(4) and 38.01 § 2(4).
[7] For a complete list of statutory exclusions, *see*, TEX. CODE CRIM. PROC. art 38.35 (a)(4)(A)-(F) and (f).
[8] TEX. CODE CRIM. PROC. art 38.35(a)(1).
[9] TEX. CODE CRIM. PROC. art. 38.01 § (4)(a)(3)(B) and (C).
[10] Though not required for latent print analysis in Texas, RS&A is accredited by the ANSI National Accreditation Board (ANAB) to ISO 17025: 2017 and AR-3125 (forensic supplement).
[11] *Id*. at § 4(g).
[12] *Id*. at § 11.

Commission receives during any investigation is dependent upon the willingness of stakeholders to submit relevant documents and respond to questions. The information gathered in this report is not subject to the standards for admission of evidence in a courtroom. For example, no individual testified under oath or was limited by either the Texas or Federal Rules of Evidence (*e.g.,* against the admission of hearsay or was subject to cross-examination under a judge's supervision).

D. Use of Terminology

Forensic science terminology has evolved over time. In this report, the term "mark" (*i.e.*, palm mark) is preferred over "latent print" to designate an impression of unknown and uncertain origin deposited involuntarily outside of a controlled environment, such as at a crime scene. The term "print" (*i.e.*, palm print) refers here to an impression voluntarily deposited under controlled conditions where the source is known. In some instances, the term "latent print" is used where referenced by statute or administrative rule, or when used in a transcript or case record. Current standards, such as those developed by standards development organizations for publication to the National Institute for Standards and Technology (NIST), Organization of Scientific Area Committees for Forensic Science (OSAC) Registry of Standards use the term "friction ridge." The reader may also reference the terminology document provided at **Exhibit A**.

II. SUMMARY OF COMPLAINT

The Harris County Public Defender's Office (HCPDO) filed a complaint against Ron Smith & Associates (RS&A) on behalf of their client, Joseph Webster. (**Exhibit B**). The complaint concerns a partial palm mark ("L-1") recovered from a metal post at a 2001 murder scene. From

2009 to 2014, RS&A performed friction ridge examinations in Houston criminal investigations pursuant to a contract with the Houston Police Department (HPD).[13]

During the initial investigation following the murder, HPD examiners compared the palm mark from the post against the known exemplars of numerous suspects, including Webster, and reached "no-identification" conclusions. In 2011, RS&A examiners reworked the case and made comparisons of the recovered mark to the known exemplars of various suspects, including Webster, and likewise reached "no-identification" conclusions.

In 2013, HPD investigators obtained CODIS hits to Webster and another suspect.[14] The investigators asked RS&A to perform another comparison of the palm mark against the known exemplar of Webster and Lorenzo Jones, a second suspect. During Webster's 2016 murder trial, the RS&A Project Manager for HPD testified the comparison resulted in a "positive identification," and the palm mark found at the crime scene "belong[s] to the left palm print" of Webster.

The complaint makes the following allegations regarding the forensic analysis and related testimony by RS&A:

- The "positive identification" of Webster presented to the jury at the 2016 trial is not reproducible.
- The RS&A Project Manager expressed her conclusion in scientifically invalid language when she stated that the palm mark and known exemplar of Webster were from the "same source" or "matched."

[13] According to the RS&A Project Manager's testimony, RS&A was "in Houston for approximately five-and-a-half years. From about the beginning of 2009 to June 2014." Reporter's Record Vol. 4, p. 135: *State of Texas v. Joseph Webster*, Cause No. 1470226 (176th Dist. Ct. Harris County, Tex., February 17, 2016).

[14] CODIS is an acronym for Combined DNA Index System, a computer software program that operates local, state, and national databases of DNA profiles from convicted offenders, unsolved crime scene evidence, and missing persons. CODIS is commonly used to describe the Federal Bureau of Investigation's program of support for criminal justice DNA databases as well as the software used to run these databases.

- The RS&A Project Manager characterized the palm mark as a "bloody print" on direct examination but conceded on cross examination that she could not say for certain that the dried fluid from the post was blood.

- The quality of the evidence does not meet established criteria to support an "identification" as set forth by the OSAC Friction Ridge Subcommittee Proposed Best Practice Recommendation for Analysis of Friction Ridge Impressions and Best Practice Recommendation for Comparison and Evaluation of Friction Ridge Impressions.

The complaint includes an affidavit by Dr. Henry Swofford, the current chair of the Physics/Pattern Scientific Area Committee of OSAC, which is responsible for developing minimum standards and best practice recommendations related to friction ridge impressions among other disciplines.[15] (**Exhibit C**). The HCPDO asked Swofford to review the Webster palm print evidence and related testimony to determine whether the reported conclusions conform to current standards in the field. The HCPDO also asked Swofford to assess the reliability of RS&A's palm print comparison and identification.[16]

Swofford did not perform a comparison himself because he recognized the contextual information he received from HCPDO may bias his assessment. Instead, he submitted images of the palm mark provided by the HCPDO, which they obtained from the Harris County District Attorney's Office (HCDAO), to other qualified examiners who had no information regarding the case history or facts surrounding the investigation.[17] Based on the results of the blind examinations, none of which produced an opinion of "identification," Swofford asserted that the comparative

[15] Swofford was chair of the friction ridge subcommittee from October 1, 2017, to September 30, 2023, at which time he was appointed to chair of the umbrella scientific area committee that encompasses the following five subcommittees: (1) friction ridge, (2) bloodstain pattern analysis, (3) forensic document examination, (4) firearms/toolmarks, and (5) footwear/tire.

[16] The answers to these questions may help inform the viability of filing a writ of habeas corpus under article 11.073 of the Code of Criminal Procedure. Article 11.073 provides relief when a field of scientific knowledge, an expert's scientific knowledge, or a scientific method on which the relevant scientific evidence is based *has changed since trial*, assuming certain other legal requirements are also met. TEX. CODE CRIM. PROC. art. 11.073.

[17] The blind examiners included: Carey Hall, an IAI certified examiner from Saint Paul, Minnesota, and two latent print examiners employed by the Houston Forensic Science Center. Swofford and Hall participated in the case review *pro bono*.

examination and identification made by RS&A and heard by the jury at trial are not reproducible and therefore not reliable.[18]

III. CRIMINAL OFFENSE AND RELATED INVESTIGATION

A. Crime Scene, Evidence Processing and Initial Investigation: 2001

In 2001, a woman was murdered, and her body found underneath a stairwell in an alleyway in downtown Houston. The cause of death was blunt force trauma to the head and neck. An HPD crime scene investigator observed suspected blood spatter and suspected bloody impact marks on the wall near the victim's head, suspected bloody fingerprints and palm prints on her legs, and a palm print in suspected blood on a metal post at the end of the alcove. An HPD latent print examiner, Debbie Benningfield, responded to the scene.[19]

Benningfield recovered a partial palm mark from the metal post using amido black, a staining dye that may enhance the visibility of suspected bloody prints. The amido black she applied to the post turned the mark a dark blue-black color. She instructed the crime scene unit to take various photographs and cut out the section of the post with the palm mark. She then took the cut-out post to the Drug Enforcement Agency (DEA) in Dallas where a DEA fingerprint examiner took digital photographs of the questioned impression and performed digital processing on some of the photographs.

During the investigation, HPD detectives learned that the murder victim was a prostitute and that she was seen the night of the murder with two males. After the initial investigation ruled

[18] Swofford also considered the extent to which examiners were consistent in their selection of features used for comparison, as well as the quality of ridge features using LQMetric which is an automated tool designed for measuring the image quality of latent fingerprints. *See*, Kalka, N., Beachler, M., Hicklin, R.A., *LQMetric: A Latent Fingerprint Quality Metric for Predicting AFIS Performance and Assessing the Value of Latent Fingerprints*, Journal of Forensic Identification 70(4) (2020).

[19] Benningfield served as a member of the Commission from 2006-2007. She was also a member of the Scientific Working Group for Friction Ridge Analysis Study and Technology (SWGFAST) from 2004-2014.

out several suspects, the case was eventually transferred to HPD's Cold Case Unit. Webster was not a suspect during the initial investigation.

B. DNA Analysis and CODIS Hits to Webster and Jones: 2006-2009

In 2006, Identigene, a private DNA laboratory headquartered in Utah, examined items recovered from autopsy for DNA analysis, including fingernail clippings, vaginal swabs, and t-shirt stains. The laboratory generated DNA profiles for each item. The DNA profile for the right-hand fingernail clippings consisted of a mixture with a major and a minor contributor. The DNA profiles generated for the other items were single-source profiles. In 2009, the profiles were searched against the state CODIS database. The minor component of the DNA mixture from the victim's right-hand fingernail clippings was consistent with Webster's profile in CODIS. A DNA profile from one of the t-shirt stains was consistent with the CODIS profile of a second suspect, Lorenzo Jones.

HPD investigators interviewed Webster and Jones. According to the appellate opinion affirming his conviction, Webster admitted that he frequented various prostitutes in the downtown Houston area and that he may have had sex with the victim. Webster denied that he killed the victim or that he had ever been in the alleyway where her body was found. Jones admitted that he once paid the victim for oral sex but denied killing her.

C. HPD Requests to RS&A for Additional Latent Print Comparison: 2010-2012

In 2010, an HPD cold case homicide detective asked the HPD crime laboratory to compare the questioned impression in suspected blood recovered from the metal post to the known exemplars of 51 individuals, including Webster and Jones. The HPD analysts did not identify any of the known individuals as the source of the questioned impression from the post. In 2010, RS&A, working under a contract with HPD, examined and compared the questioned impression to the

known exemplars of 51 individuals. Like the HPD examiners, the RS&A examiners did not identify any of the known exemplars as the source of the latent print from the metal post. RS&A issued a report in 2011 stating the palm mark was also searched through the Automated Fingerprint Identifications Systems (AFIS) of HPD and the Texas Department of Public Safety.

In 2012, an HPD homicide investigator reviewed the evidence again, including the 2009 CODIS hits to Webster and Jones. The investigator requested that RS&A reexamine the palm mark evidence. During this reexamination, a different RS&A examiner observed similarities between the latent print from the metal post and Webster's original known palm print exemplar ("Exemplar 1"). The RS&A examiner asked HPD to obtain a higher quality set of known palm print exemplars from Webster. HPD obtained a new set of prints and provided them to RS&A ("Exemplar 2"). Utilizing Exemplar 2, the RS&A examiner then identified Webster as the source of the palm mark in suspected blood obtained from the metal post at the crime scene.

D. Biology Screening on Metal Posts and Additional DNA Analysis: 2013-2015

In 2013, an HPD serologist processed two metal posts recovered from the crime scene for the presence of blood and DNA. The first post had red-brown staining, and the second had blue-black staining. The serologist identified the red-brown staining as potential blood and tested it. The results were negative. The serologist did not recognize the blue-black staining on the second post and did not identify it as potential blood. The serologist swabbed both posts for DNA, but no DNA was detected.

IV. TRIAL TESTIMONY

In 2016, Webster was tried and convicted of murder and sentenced to life in prison.[20]

[20] Webster's conviction was affirmed on direct appeal. *Webster v. State*, 2017 WL 2806786 (Tex. App.—Houston [1st Dist.] June 29, 2017, no pet. (mem. op.).

A. Debbie Benningfield (HPD) Testimony

At trial, Benningfield testified she believed the palm mark recovered from the crime scene had sufficient characteristics for comparison purposes. On cross-examination she testified that determining whether a mark has "sufficient characteristics" for an identification is subjective and there is no set number of characteristics deemed sufficient to make an identification finding. Benningfield testified an identification finding is based on the examiner's judgment and a combination of the clarity and quantity of the characteristics observed in the mark.

B. RS&A Project Manager's Testimony

The RS&A Project Manager testified she managed the HPD project from 2009-2014. She began her work in the latent print field in 1989 and was certified by the International Association for Identification (IAI) in 1993.

The RS&A Project Manager described the quality of the palm mark from the crime scene as having very limited amount of minutiae present. She testified that "bloody" marks are among the most difficult to identify because the slipperiness of the blood creates movement and distortion. She described the quality of Webster's original known exemplar (Exemplar 1) as fair, noting there were areas that appeared to be smudged or not correctly recorded to provide all the detailed information.

She testified that from reviewing the mark that was labeled "blood print on galvanized pipe" it appeared the mark was treated with amido black, a chemical used to enhance bloody marks by dying the protein in blood to a contrasting deep purple or dark blue color.

The RS&A Project Manager testified there were several factors that contributed to RS&A's inability to identify Webster as the source of the partial palm mark in 2010, including the quality of the mark, the quality of some areas of Webster's original known exemplar (Exemplar 1) and

possible examiner fatigue due to the large number of known exemplars initially submitted for comparison (exemplars of 51 individuals).

The RS&A Project Manager testified that at some point after the 2011 RS&A report stating they had made no identifications to the submitted known exemplars, RS&A was asked to focus on certain suspects because there were CODIS hits in the case. The RS&A Project Manager testified that the examiner who was assigned the re-examination of the mark[21] was unaware of the CODIS hits because the RS&A Project Manager would have been responsible for providing that information to him, and she wanted him to base his analysis solely on the evidence. She also testified that there was no indication in the case file of the CODIS hits to Webster and Jones. However, on cross-examination, she conceded the examiner's direct supervisor (also a verifier in the case) was aware of the CODIS hits. The RS&A Project Manager's assertion that the examiner was shielded from the CODIS hits was based upon her assumption that the supervisor withheld the information as she had.

The RS&A Project Manager testified that the examiner assigned to the comparison saw enough information in Webster's original known exemplar (Exemplar 1) to ask HPD for an additional set of known exemplars. The RS&A Project Manager testified that the second set of Webster's knowns (Exemplar 2) was much better quality than the original known exemplars. The area of interest—the "hypothenar" or outer edge of the left palm—was clearer in Exemplar 2. Once Exemplar 2 was provided, the assigned examiner made an identification. The RS&A Project Manager testified that the examiner's identification of Webster underwent two levels of verifying review. In addition, the RS&A Project Manager compared the known left palm print of Webster with the partial palm mark from the metal post and determined the appropriate opinion conclusion

[21] RS&A Examiner 4, who was assigned the re-examination of the mark, and originally identified Webster, was not named during the trial.

was an identification. The RS&A Project Manager testified that she verified the identification again before trial.

When asked what degree of confidence or certainty she could give to her conclusions, she responded: "I've compared hundreds of thousands of prints and in my opinion, they came from the same source."[22]

On cross-examination, the RS&A Project Manager acknowledged that the 2011 RS&A report revealed several instances where the examiner requested additional prints for comparison purposes, but Webster was not one of those requested. She also conceded that amido black is not specific to blood and may react to other substances. She clarified that she did not know whether the substance containing the palm mark was blood. She acknowledged the RS&A report reference to the "blood print on a galvanized pole" was a description obtained from the back of the photograph of the mark submitted by law enforcement, but the substance was not independently confirmed as human blood.

V. COMMISSION INVESTIGATIVE PROCESS

A. Notice and Initial Response from RS&A

On April 7, 2022, Commission staff notified RS&A of the HCPDO complaint. On April 12, 2022, Ron Smith submitted a letter response indicating he had discussed the matter with the RS&A Project Manager, and because she was a contract employee with RS&A, the letter served as their joint response. RS&A expressed a threshold concern regarding whether all parties were working with the same quality of images. The response also stated RS&A's belief that the finding of "identification" for the left palm print of Joseph Webster was correct as reported in 2013 and testified to by the RS&A Project Manager in 2016. The response further indicated that Ron Smith

[22] Reporter's Record Vol.4, p. 157: S*tate of Texas v. Joseph Webster*, Cause No. 1470226 (176th Dist. Ct. Harris County, Tex., February 17, 2016).

personally conducted his own re-examination of the palm mark and compared it with the known print of Webster (Exemplar 2) and that he could arrive at "only one conclusion and that is identification." Smith opined that the amount of friction ridge detail information in correspondence is more than what would be required by "any competent examiner."

At its April 22, 2022, quarterly meeting, the Commission accepted the complaint for investigation and formed an investigative panel consisting of Commissioners Patrick Buzzini, Ph.D., Michael Coble, Ph.D., and Mark Daniel, Esq. The Commission subsequently retained the services of Dr. Glenn Langenburg, a certified latent print examiner with 23 years of experience in friction ridge analysis and extensive publications in the field, to assist staff with the investigation and this report. (**Exhibit D**, Langenburg CV).

B. Concerns Regarding the Quality of Images Utilized in the Blind Examinations

On April 13, 2022, Commission staff notified the HCPDO of RS&A's concerns regarding the quality of images sent to the blind examiners and requested information regarding the images provided. On April 21, 2022, the HCPDO responded that "Swofford had access to digitally scanned copies of printed photographs with RS&A markings on them" and that they were scanned at 1000 ppi, which is industry standard for "examination quality" digital photographs. HCPDO was unable to confirm whether RS&A had better quality images because the only action HCPDO took was to obtain the record from the HCDAO and forward it to Swofford.

On June 9, 2022, RS&A supplied the Commission with an image of the palm mark and the known Webster exemplar utilized in RS&A's palm print comparison. After telephone discussions with RS&A, Commission staff requested Swofford supply RS&A with the images used by the analysts during the blind examinations for purposes of determining whether all parties had access to the same quality of images. The Commission requested access to the original images on

September 5, 2022, and Swofford provided them on September 6, 2022. On October 18, 2022, Swofford also provided RS&A the materials that the blind examiners utilized (unmarked images of the crime scene impression as well as the known exemplars of three individuals, including Webster).

On October 20, 2022, RS&A submitted a supplemental response to the complaint that contained additional questions regarding the quality of the images Swofford supplied to the blind examiners. According to the RS&A response, while the images were scanned at 1,000 pixels per inch, consistent with published recommendations on industry standards for a latent print, the actual resolution of the images Swofford received were at 384 pixels per inch. In other words, the images were high-resolution scans of a low-resolution printed image. RS&A also questioned the quality of the known exemplar of Webster supplied to the blind examiners as a "poor quality reproduction" of the original.

RS&A requested the Commission's assistance in gaining access to the original materials contained in the files of HPD or that may have been introduced into evidence at Webster's trial. According to the request, representatives from RS&A traveled to Houston and inventoried the evidence available to RS&A examiners during their examination.

Commission staff contacted HFSC and requested assistance in obtaining quality reproductions of all versions of the mark from the crime scene and known exemplars of Webster available or utilized during the examinations performed by RS&A. In response, HFSC located and produced high-resolution reproductions of the HPD case file regarding the criminal case, including all the crime scene images of the palm mark as originally documented by Benningfield, the additional images produced by the DEA at Benningfield's request, and Webster's known

exemplars (Exemplars 1 and 2) (the known exemplars were introduced at trial). These reproductions were subsequently shared with the HCPDO (including Swofford) and RS&A.

C. Investigation

Commission staff (assisted by Dr. Langenburg) reviewed documentation provided by the parties as well as relevant standards, guidelines, and published literature in the discipline.

In addition to written communications between Commission staff, RS&A, and the HCPDO, the Commission reviewed Swofford's affidavit with him, and discussed various questions regarding image quality with RS&A. On June 9, 2023, staff hosted a two-hour virtual meeting between RS&A personnel, HCPDO staff, HCDAO staff, Carey Hall (who participated in the blind examination at the request of Swofford), representatives from HFSC, Dr. Langenburg, and Commissioner Patrick Buzzini. On September 8, 2023, staff hosted a several hours-long virtual meeting between RS&A personnel, Dr. Langenburg, and Commissioner Patrick Buzzini to discuss various aspects of the report.

VI. METHODOLOGY, RESEARCH AND EVOLVING STANDARDS IN THE FIELD

A. Analysis, Comparison, Evaluation and Verification (ACE-V)

Formalized in the 1980s by David R. Ashbaugh, the conventional protocol for conducting methodical comparative examinations of friction ridge skin involves four phases known as Analysis, Comparison, Evaluation, and Verification (ACE-V). In broad strokes, a friction ridge examination using ACE-V proceeds as follows:

- *Analysis* refers to an initial data-gathering phase during which the examiner studies the unknown origin mark to assess the quality and quantity of discriminating detail present. The examiner considers information such as substrate, development method, various levels of ridge detail, and pressure distortions with the aim of determining whether the mark is suitable for comparison. A separate analysis then occurs with the exemplar print.

- *Comparison* is the side-by-side observations of the friction ridge detail in the two prints to determine the agreement or disagreement in the details.

- *Evaluation* is the phase during which the examiner assesses the value of the agreement or disagreement of the observed features during the Analysis and Comparison and forms a conclusion regarding the source of the unknown mark.

- *Verification* involves subsequent examiners applying the ACE protocol to either confirm or raise questions about the findings of the initial examiner. Some agencies review an examiner's conclusions with knowledge of them, while others have a second examiner who is unaware of the outcome of the first examination.[23]

B. 1995-1998: TWGFAST and SWGFAST

National professional guidelines were first introduced for the field of friction ridge examination in 1995, under what was known as TWGFAST, the Technical Working Group for Friction Ridge Analysis, Study, and Technology. This group was funded by the Department of Justice and hosted by the Federal Bureau of Investigation (FBI). Other forensic disciplines developed similar technical working groups during this period.

In 1998, TWGFAST became SWGFAST, replacing the word "Technical" with "Scientific." The group was comprised of friction ridge practitioners from local, state, and federal organizations. They met regularly to develop guidelines for best practices. A common debate among SWGFAST members during this period was whether SWG documents should be titled "guidelines" or "standards," considering the fundamental nature of the information contained in the documents and the fact that there was no national regulatory oversight body to ensure consistent method application across the discipline. However, the practical reality was (and still is) that even for members who believed the information articulated in SWG documents was

[23] *See*, Kaye, David H, et. al., The Report of the Expert Working Group on Human Factors in Latent Print Analysis-- *Latent Print Examination and Human Factors: Improving the Practice through a Systems Approach* (2012) pps. 1-2. https://dx.doi.org/10.2139/ssrn.2050067

foundational for ensuring sound scientific practice, SWGFAST had no enforcement power. Participation in SWGFAST and adoption of SWGFAST documents was entirely voluntary. Whether a particular forensic science service provider (FSSP) chose to follow SWGFAST guidance was fair grounds for cross-examination, but discussion of the subject was entirely dependent on the quality of the lawyering in a particular case which may be variable. Indeed, even in jurisdictions where lawyers asked about compliance with SWGFAST guidelines an FSSP could simply point to them as recommendations, not requirements.[24]

C. 2004: FBI's Misidentification of Brandon Mayfield and Its Impact

In March 2004, Al-Qaeda launched a series of bombings against the Madrid commuter train system, killing 193 people. In the wake of the attack, a coordinated international law enforcement investigation was launched during which the FBI erroneously identified Brandon Mayfield, an attorney in Portland, Oregon as being the source of a fingermark detected on a plastic bag containing detonators recovered at the crime scene. Mr. Mayfield was ultimately released but only after the Spanish National Police (SNP) identified the FBI's mistake. In March 2006, the Department of Justice's Office of Inspector General issued a lengthy report identifying several factors that contributed to the FBI's misidentification of the fingermark.[25]

The OIG report explained that Mayfield's fingerprints had been retrieved, along with others, as a potential "match" to the recovered fingermark (LFP 17) based on a computerized search by the FBI's Integrated Automated Fingerprint Identification System (IAFIS) which had generated a list of 20 proposed candidate prints. An FBI examiner then conducted side-by-side

[24] *See*, SWGFAST Standards and other documents: https://www.nist.gov/organization-scientific-area-committees-forensic-science/friction-ridge-subcommittee.
[25] A Review of the Handling of the Brandon Mayfield Case, U.S. Department of Justice Office of Inspector General (2006): https://oig.justice.gov/sites/default/files/archive/special/s0601/final.pdf.

comparisons of LFP 17 and the candidates, one of which was Mayfield's fingerprint. Following a detailed comparison of LFP 17 with Mayfield's known fingerprints, the examiner concluded that Mayfield was the source of LFP 17. This conclusion was verified by two other examiners at the FBI. In May of 2004, an independent expert appointed by the court to review the fingerprint evidence concurred with the FBI's identification of LFP 17 to Mayfield.

The OIG found several causes for the erroneous identifications. One was the unusual similarity of the fingerprints of Mayfield and the true source of the fingermark, an Algerian national, Ouhnane Daoud. Ten (10) features in LFP 17 formed a constellation of points of comparison (*i.e.,* level 2 detail such as minutiae) that was generally in agreement with the constellation of points of comparison in the known fingerprints of both individuals.[26] The OIG found no systemic study of the rarity of such an event, but rather anecdotal reports suggesting that such a degree of similarity between prints of two different people is "rare." The OIG further observed that while they were similar, the fingerprints of Mayfield and Daoud were *not* identical.

Another significant cause of the misidentification was that the examiner's interpretation of some of the features in LFP 17 were adjusted or influenced by reasoning "backward" from features that were visible in the known prints of Mayfield. Having found as many as 10 points of unusual similarity, the examiners began to "find" additional features in LP 17 that were not there, but rather suggested to the examiners by features in the Mayfield known prints. Murky or ambiguous details in LFP 17 were erroneously identified as points of similarity with Mayfield's prints.

[26] Close non-matches have recently been studied in connection with error-rate determinations. *See*, Koehler JJ, Liu S. *Fingerprint error rate on close non-matches*. J Forensic Sci. 2021 Jan;66(1):129-134. doi: 10.1111/1556-4029.14580. Epub 2020 Sep 29. PMID: 32990979.

The OIG identified some possible additional causes including the fact that the verifying examiners were aware that an identification had already been made by previous examiners at the time they were asked to conduct the verification.

Ultimately, the FBI acknowledged the error and made changes to policy and procedures based on the OIG findings.[27] "Chief among these was the adoption of procedures to require more detailed documentation of all steps of the examination process, including documentation of any discrepancies." A review panel organized by the FBI[28] also recommended implementation of several changes to the FBI's verification procedures, including blind verification (*i.e.*, previous conclusions unknown to the verifier) and second verifications in designated cases."[29] The report also recommended: (1) institution of blind verification into casework; (2) documentation of the features assessed in a latent print prior to observing the known print; (3) recognition of risk of working 'backwards' from the known print and making significant changes to feature annotations during the Comparison phase; and (4) undertaking research to develop more objective criteria for conducting latent print examinations.

The OIG issued a second report in 2011. The report updated the progress of the FBI after instituting these changes for five years.[30] Changes adopted by the FBI because of the Mayfield case continue in practice today.

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[27] Initially, the FBI cited low image quality as one reason for their error; however, following the review, it was determined that such explanation was not supported by the evidence. Office of the Inspector General 2006 Report at 183-185.

[28] The FBI Laboratory recruited five latent fingerprint examiners to serve on the International Panel including: Alan McRoberts (Chairman of SWGFAST); C. Lee Fraser (Royal Canadian Mounted Police); Ron Smith (Ron Smith and Associates); Bruce Grant (New Scotland Yard); and Gregoire Michaud (Michigan State Police). In addition, the laboratory requested that the International Association for Identification (IAI) and the American Society of Crime Laboratory Directors (ASCLD) nominate two other panelists. The IAI selected Ken Smith (U.S. Postal Inspection Service) and ASCLD selected Frank Fitzpatrick (Orange County Sheriff, Coroner Laboratory). *See*, Mayfield report, supra n.25 at p. 127).

[29] *See*, Mayfield report, supra n. 25 at 128.

[30] Office of the Inspector General (OIG). A Review of the FBI's Progress in Responding to the Recommendations in the Office of the Inspector General Report on the Fingerprint Misidentification in the Brandon Mayfield Case. June 1, 2011, Washington D.C.

D. 2009: National Academy of Sciences Report

In 2009, the National Research Council, National Academy of Sciences (NAS) released a report titled *Strengthening Forensic Science in the United States: A Path Forward* after a multi-year congressionally mandated study. The report was critical of weaknesses in the scientific underpinnings of several forensic disciplines routinely utilized in the criminal justice system, including friction ridge analysis.[31]

The NAS report noted the analysis of marks obtained from a crime scene is based largely on subjective human interpretation.[32] Historically, the threshold for making a source identification has been kept subjective (*i.e.*, without prescribed quantitative cut-offs) so the examiner may consider both the quantity and quality of comparable details. Because the comparison process is subjective, the outcome of a friction ridge analysis is not always repeatable or reproducible.[33]

The NAS report found the reliability of the ACE-V process would be improved if specific measurement criteria were defined.[34] The report also emphasized that defined measurement criteria become increasingly important when an examiner compares fingermarks that are smudged or incomplete, or when comparing impressions from two individuals whose prints are similar.[35] Because crime scene samples are typically not pristine, examiners often face requests for comparison where the mark is partial or of low quality.

The NAS report observed the ACE-V framework is not specific enough to qualify as a "validated method" for conducting friction ridge analysis. ACE-V does not guard against bias; is too broad to ensure repeatability and transparency; and does not guarantee that two analysts

[31] National Research Council of the National Academies, *Strengthening Forensic Science in the United States: A Path Forward*, (2009).
[32] *Id*. at 139.
[33] *Id*.
[34] *Id*. at 140.
[35] *Id*.

following it will obtain the same result.[36] The NAS report also found that merely following the steps of ACE-V does not imply that one is proceeding in a scientific manner or producing reliable results.[37] Moreover, claims made by examiners in testimony that latent print analysis has a "zero" error rate are not scientifically supportable.[38] Finally, the NAS report found that better documentation was needed at each step of the ACE-V process.[39]

The NAS report also noted that SWG documents "lack the level of specificity" to ensure consistency and rigor in practice. They issued this assessment:

> Often there are no standard protocols governing forensic practice in each discipline. And, even when protocols are in place (*e.g.,* SWG standards), they often are vague and not enforced in any meaningful way.[40]

At the 2009 Spring meeting of SWGFAST, the group decided to change the way its documents were written and titled in response to the NAS report critique. Most documents issued in 2009 or later were written and titled as "Standards." The level of specificity for practice became more granular. By 2011, notable standards such as the "Standard for Documentation of ACE-V" (ver 1, 2009), "Standard for Examining Friction Ridge Impressions and Resulting Conclusions" (ver 1, 2011), and "Standard for the Application of Blind Verification in Friction Ridge Examinations" (ver 1, 2011) were valued as best practice in the field and were highlighted in admissibility hearings in support of arguments that friction ridge comparison should be admitted under *Daubert* or *Frye*.

Because friction ridge FSSPs vary significantly with respect to size, geographic location, and resources, not all providers implemented SWGFAST standards. Because there is no national

[36] *Id*. at p.142.
[37] *Id*.
[38] *Id*.
[39] *Id*. at 143.
[40] *Id*. at 6.

forensic science oversight agency, there also is no centralized repository or tracking mechanism to identify which FSSPs implemented SWGFAST standards, and which did not. While changing the document titles to "standards" did not give SWGFAST any regulatory authority or the ability to force implementation, the stronger language at least in theory provided a basis for closer examination of analytical practice by stakeholders in the legal system.

E. 2014: NIST Organization of Scientific Area Committees for Forensic Science

In 2014, SWGFAST was officially disbanded with the creation of OSAC. Unlike the SWGs which were comprised almost exclusively of practitioners, OSAC subcommittee members—in addition to practitioners—include attorneys, statisticians, human factors experts, quality assurance experts, and other researchers both in and outside the friction ridge discipline.

The OSAC Registry is a repository for standards in various disciplines of forensic science, including friction ridge analysis. The OSAC Registry includes two types of standards:

1. **Published Standards**: These are fully developed standards that have been published by a standard developing organization (SDO) such as the Academy Standards Board (ASB).

2. **OSAC Proposed Standards:** These are new or revised standards that have been drafted by OSAC and sent to an SDO to be further developed and published. To help fill the gap during the time it takes for an SDO to complete the standards development process, OSAC encourages the forensic community to implement OSAC proposed standards.

The Friction Ridge Subcommittee of OSAC has written several proposed standards and best practice recommendations. While these documents are at various stages of review and acceptance, they expand upon the work of SWGFAST. Documents produced by the OSAC Friction Ridge Subcommittee are completed work products of the committee, even if they have not yet made it through the SDO process to publication by ASB.

F. 2016: President's Council of Advisors on Science and Technology

In 2016, the President's Council of Advisors on Science and Technology (PCAST) issued a report titled "*Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature Comparison Methods*."[41] The report focused on the scientific validity of several feature comparison methods by examining their foundational validity and their validity as applied.[42]

PCAST commended the FBI for the design and publication of a major black box study while citing the need for additional research and identifying areas for continued attention, including but not limited to:[43]

1) *Confirmation bias*. Examiners often alter the features they initially mark in a latent print based on comparison with an apparently matching exemplar. This circular reasoning introduces a serious risk of confirmation bias.

2) *Contextual bias.* Examiners' judgment can be influenced by task-irrelevant information about the facts of the case.

3) *Proficiency Testing.* Essential for assessing an examiner's capability and performance in making accurate judgments, PCAST recommended improvements by making the tests more rigorous, by incorporating testing systematically within the flow of casework (*i.e.,* blind proficiency testing), and by disclosing tests for evaluation by the scientific community. [44]

PCAST also made a specific recommendation to promote universal adoption of rules requiring a linear Analysis, Comparison, and Evaluation process whereby examiners must

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[41] President's Council of Advisors on Science and Technology, *Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods* (2016)

[42] PCAST defined "foundational validity" as the *scientific* standard corresponding to the legal standard of evidence being based on "reliable principles and methods." "Validity as applied" means the *scientific* standard corresponding to the legal standard of an expert having "reliably applied the principles and methods." *Forensic Science in Criminal Courts: Ensuring Scientific Validity of Feature-Comparison Methods* (2016) p. 43. (Emphasis original).

[43] *Id*. at p. 102.

[44] The Houston Forensic Science Center and the Harris County Institute for Forensic Science have implemented blind proficiency testing in various disciplines. *See*, *e.g.*, Gardner, B., Neuman, M., *Perceptions of blind proficiency testing among latent print examiners*, Science and Justice 63 (2003) 200-205, https://doi.org/10.1016/j.scijus.2022.12.005; Gardner, B., Neuman, M., Kelley, S., *Latent print quality in blind proficiency testing*, Forensic Science International 324 (2021) 110823, https://doi.org/10.1016/j.forsciint.2021.110823; Pierce, M., *Development and Implementation of an Effective Blind Proficiency Testing Program*, Journal Forensic Science 65(3), 809-814, (2020), https://doi.org/10.1111/1556-4029.14269 .

complete and document their analysis of a fingermark *before* looking at any known fingerprint and should separately document any additional data used during Comparison and Evaluation. The FBI adopted this approach after Mayfield and PCAST observed that it merits universal adoption by all FSSPs.

G. Empirical Research in the Field: Key Takeaways

Fingerprint comparison has long been considered a potentially helpful tool for assisting the factfinder in determining innocence or guilt in crimes where the identity of the person who committed the crime is in question. Based in part on the perception that "no two people have the same fingerprint," comparison opinions were presented to jurors as infallible.[45] However, with DNA exonerations came the realization that assertions of infallibility did not match reality. Even with increased public awareness of the possibility for human error, understanding the nuances of when the evidence may be accurately and reliably interpreted within the bounds of a particular criminal case is a challenging task to this day.

Reports like the NAS Report (2009) and PCAST (2016) were unified in their call for empirical research to support or refute the claim that examiners can accurately associate unknown impressions from a crime scene back to their source, and under what circumstances. In black box studies, analysts volunteer to participate, and researchers create testing material intended to mimic real-life casework. Researchers provide analysts with many independent comparison problems involving questioned and known samples. Some problems are more challenging than others. Researchers then determine how often the analysts who participate in the study reach conclusions

[45] The PCAST Report cites a longstanding claim by DOJ that fingerprint comparison is "infallible" (www.justice.gov/olp/file/861906/download); testimony by a former head of the FBI's fingerprint unit testified that the FBI had "an error rate of one per every 11 million cases" (see p. 53); and a study finding that mock jurors estimated that the false positive rate for latent fingerprint analysis is 1 in 5.5 million (see p. 45). Koehler, J.J. "Intuitive error rate estimates for the forensic sciences." (August 2, 2016). Available at: papers.ssrn.com/sol3/papers.cfm/abstract_id=2817443.

that align with the ground truth information researchers have about whether the known and the questioned marks are attributable to the same person.

1. FBI/Noblis Black Box Study

As of this writing, there have been a few large-scale black box studies attempting to establish a discipline-wide error rate estimate for friction ridge comparisons. The first is a highly regarded study commonly referred to as the FBI/Noblis Black Box Study.[46] It was focused on fingerprints (not palms). In that study, authors provided 744 known-latent comparisons, consisting of 520 items where the person whose reference sample was provided left the mark and 224 where the person did not leave the mark. To mimic real-life scenarios where investigators might identify a suspect by searching the AFIS database, researchers selected the known prints by searching the questioned marks against the 58 million prints in AFIS and selecting the closest non-matching prints. The 169 examiners who participated in the study were shown 100 pairs and asked to assess their suitability for comparison and classify those deemed suitable as either "identification," "exclusion," or "inconclusive."

The study reported 6 incorrect identifications of 3,628 total, translating to a false positive rate of 0.17 percent. One takeaway from the study is that false identifications were observed 1 time in every 604, though the upper bound established by the researchers indicates the rate could be as high as 1 false identification in 306 cases. The study also reported a false negative rate of 7.5%.[47]

[46] Bradford T. Ulery et al., *Accuracy and Reliability of Forensic Latent Fingerprint Decisions*, PNAS 108 (19) 7733-7738, (2011).

[47] Well-designed "black box" studies are championed by scientists (including but not limited to PCAST) as the best method for evaluating accuracy, reproducibility, and repeatability of decision-making by friction ridge examiners (and others engaged in pattern recognition/feature comparison disciplines). However, all studies have limitations. For example, in the FBI/Noblis study, participants were aware they were being tested, and there are differences of opinion about the possible impact of that knowledge on performance. Did they work harder to get the answer right knowing they were being tested? Or did they treat the study less seriously because it was not active casework (where pressure to bring backlogs down is intense) and participation was anonymous? Additionally, participants were drawn from either accredited laboratories or agencies that participate in professional organizations such as the

A second notable takeaway from the FBI/Noblis Black Box study is the observed variability in examiner opinions of inconclusive.[48]

"Mated Pair" Results. Participants first decided whether the prints they were given were "of value" for comparison. Of 5,969 prints deemed "of value for identification" where researchers knew the questioned mark originated from the same person as the known print, participants issued the following opinions:

- 61.4% Correct Identification
- 31.1% Inconclusive
- 7.5% Erroneous Exclusion[49]

"Non-Mated Pair" Results. Researchers reported 4,083 prints that study participants deemed "of value for identification" where researchers knew the questioned mark did *not* originate from the same person as the known print. For these comparison conclusions, study participants issued the following opinions:

- 0.15% Erroneous Identification[50]
- 11.1% Inconclusive
- 88.7% Correct Exclusion[51]

International Association for Identification. Because there are so many agencies that perform friction ridge examination across the United States, it is difficult to extrapolate what the results of the study would have been had the authors been able to include a wider range of practitioners, especially those from unaccredited, small agencies with limited access to resources for training and quality assurance. Additionally, many "black box" studies do not test the verification component of casework, which is a fundamental aspect of effective quality assurance. In actual casework, the verification step may have flagged some of the incorrect calls before they were reported.

[48] On page 13 of the Appendix, Table S5 breaks down data for examiner decisions against ground truth.

[49] When the data are expanded to include all 8,189 mated pairs that examiners considered of value for either identification or exclusion, participants issued the following opinions: 45.2% correct identification; 47.3% inconclusive; 7.5% erroneous exclusion.

[50] The difference between this percentage and the 0.17 percentage referenced on the preceding page is that in the calculation of the 0.17 percentage the denominator of the calculation excluded "inconclusive" comparisons. In this calculation, it includes inconclusive results.

[51] When the data are expanded to include all 4,985 non-mated pairs that examiners considered of value for either identification or exclusion, participants issued the following opinions: 0.12% erroneous identification; 20.7% inconclusive; and 79.2% correct exclusion.

2. Noblis Repeatability/Reproducibility Study

As a follow up to the FBI/Noblis Black Box Study, the authors did another study where they gave the same prints back to the same examiners.[52] Examiners repeated their own conclusions 90.1% of the time (10% of the time, they disagreed with their own prior conclusion when presented with the same impressions they previously compared). When prints were given to other examiners, the same conclusion between examiners was supported 85.9% of the time.[53]

3. Palm Black Box Study

In 2020, researchers published a black-box study testing the accuracy and reliability of palmar friction ridge (Palm Black Box Study).[54]

"Mated Pair" Results. Participants first evaluated whether the exemplars they were given were of value for comparison. Of 6,683 exemplars deemed "of value for identification" where researchers knew the questioned mark originated from the same person as the known print, participants issued the following opinions:

- 78.5% Correct Identification
- 13.8% Inconclusive
- 7.7% Erroneous Exclusion.[55]

[52] Bradford T. Ulery et al., *Repeatability and Reproducibility of Decisions by Latent Fingerprint Examiners*, 7 PLOS ONE (2012).
[53] *See*, *infra* n.53.
[54] H. Eldridge, M. De Donno, C. Champod, *Testing the accuracy and reliability of palmar friction ridge comparisons-a black box study*, Forensic Sci Intl. 318 (2021), 110457, https:/doi.org/10.1016/j.forscint.2020.110457; H. Eldridge, M. De Donno, C. Champod, *Mind-set – how bias leads to errors in friction ridge comparisons*, Forensic Sci. Int. 318 (2021), 110545, https://doi. org/10.1016/j.forsciint.2020.110545.
[55] When the data are expanded to include all 6,900 mated pairs that examiners considered of value for either identification or exclusion, participants issued the following opinions: 76.6% correct identification; 15.4% inconclusive; 8.0% erroneous exclusion.

"Non-Mated Pair" Results. Researchers reported 2,470 prints that study participants deemed "of value for identification" where researchers knew the questioned mark did *not* originate from the same person as the known print. For these comparisons, study participants issued the following opinions:

- 0.4% Erroneous Identification
- 29.7% Inconclusive
- 69.9% Exclusion[56]

4. Upcoming FBI/Noblis Black Box Study

In 2022-2023, the FBI and Noblis conducted a new black-box study to measure accuracy and reproducibility of analyst decisions when comparing marks to known prints acquired by searching a new database system—the FBI Nex Generation Identification (NGI) system. Results of this study are expected to be published in late 2023 or early 2024.

5. NIJ/Miami-Dade Black Box Study

A second black box study (NIJ/Miami-Dade) included palmar comparisons but did not isolate error rates for them.[57] It also contained no close non-match distractors as provided in the FBI study, and to date has not been published in any peer-reviewed journal.

[56] When the data are expanded to include all 2,560 non-mated pairs that examiners considered of value for either identification or exclusion, participants issued the following opinions: 0.5% erroneous identification; 30.3% inconclusive; and 69.3% correct exclusion.

[57] Igor Pacheco et al., *Miami-Dade Research Study for the Reliability of the ACE-V Process: Accuracy & Precision in Latent Fingerprint Examinations* (2014)

6. Other Important Research and Takeaways

In addition to "black box" studies, FBI/Noblis have published other research (referred to as "white box" studies)[58] designed to understand the factors that affect examiner decision-making. These studies are all important contributions to understanding the state of the friction ridge discipline. A key takeaway from every study referenced in PCAST and published in the seven years since is that repeatability and reproducibility of decisions made by friction ridge examiners vary when tested.[59] Much depends on the individual decisions made by examiners during each phase of the Analysis, Comparison, and Evaluation process. Repeatability and reproducibility were lower for comparisons assessed by the examiners as "difficult" than for "easy" or "moderate" comparisons, indicating that examiner's assessments of difficulty may be useful for assigning quality assurance tools to mitigate risk.

When it comes to inconclusive decisions, the authors of the Palm Black Box note the challenge with judging the appropriateness of an inconclusive decision even when researchers have ground truth. Sometimes, a lack of visible minutiae *should* lead the examiner to choose "inconclusive," because choosing a more definitive conclusion (identification or exclusion) is simply not supported given the information ascertainable from the images presented. For comparisons that are considered challenging, it can be difficult to say what the "correct" response

[58] *See*, Hicklin, R.A., Buscaglia, J., Roberts, M.A., Meagher, S.B., Fellner, W., Burge, M.J., Monaco, M., Vera, D., Pantzer, L.R., Yeung, C.C., and N. Unnikumaran. "*Latent fingerprint quality: a survey of examiners.*" Journal of Forensic Identification. Vol. 61, No. 4 (2011): 385-419 ; Hicklin, R.A., Buscaglia, J., and M.A. Roberts. "*Assessing the clarity of friction ridge impressions.*" Forensic Science International, Vol. 226, No. 1 (2013): 106-17 ; Ulery, B.T., Hicklin, R.A., Kiebuzinski, G.I., Roberts, M.A., and J. Buscaglia. "*Understanding the sufficiency of information for latent fingerprint value determinations*." Forensic Science International, Vol. 230, No. 1-3 (2013): 99-106 ; Ulery, B.T., Hicklin, R.A., and J. Buscaglia. "*Repeatability and reproducibility of decisions by latent fingerprint examiners.*" PLoS ONE, (2012) ; and Ulery, B.T., Hicklin, R.A., Roberts, M.A., and J. Buscaglia. "*Changes in latent fingerprint examiners' markup between analysis and comparison.*" Forensic Science International, Vol. 247 (2015): 54-61.

[59] Ulery BT, Hicklin RA, Buscaglia J, Roberts MA (2012) *Repeatability and Reproducibility of Decisions by Latent Fingerprint Examiners.* PLoS ONE 7(3): e32800. doi: 10.1371/journal.pone.0032800

should have been. The difference between an identification and inconclusive opinion may be attributable to the risk tolerance of the analyst or other human factors.

VII. OBSERVATIONS IN WEBSTER CASE

To assist the reader in understanding the progression of friction ridge analysis in the criminal case that is the subject of this complaint, the following table shows the series of examinations conducted from 2010 to present. Variation in opinions is observed, some of which may be explained by the quality of the images available to examiners.[60]

Because the palm mark was obtained from a crime scene and ground truth is unknown, the Commission makes no assessment of what the "right" (*i.e.,* accurate) answer is. With respect to reliability (repeatability and reproducibility), we observe an evolution of conclusion opinions throughout the history of the case and focus on transparency in documentation as the cornerstone without which lawyers, judges, and jurors are simply unable to fulfill their respective duties. For example, in a case where the palm mark is highly probative as well as challenging (such as in this case), attorneys should raise questions about the repeatability and reproducibility (and therefore reliability) of the proffered identification. This is especially true given the potentially biasing information (the CODIS hit), the fact that the conclusion opinion changed from "no identification" to "identification" after new reference prints were obtained, and the fact that published research shows variability in examiner decision-making the more difficult or complex a comparison is. Unless the case record clearly indicates what led the examiner to make the decisions he or she made during the analytical process, the lawyers may not even understand when a comparison is challenging or complex. If the only document they review is a two-line report showing their client's print was "identified" as the source of the questioned mark, they may not perceive a need

[60] The extent to which image quality of the crime scene palm mark impacted examiner opinion is unclear because even when examiners had all images available, some of the images deemed "lower quality" were still used.

to request an expert. And even if the lawyer asks, the court may not appreciate the need to expend limited resources given the opacity of the case record and the criminal justice system's historical tendency to rely on a reported friction ridge "identification" as infallible (or close to it). When lawyers and judges do not appreciate the significance and limitations of forensic analysis, jurors may also not be able to properly carry out their mission as fact finders to determine truth and deliver justice to victims and the accused. Attempting to remedy a lack of information or understanding of forensic science through a writ of habeas corpus is an inefficient and costly way for the criminal justice system to address issues that could have been evaluated at the outset.

The following table shows the progression of examinations and related conclusions in the *Webster* case over time:

Examiner	**Type Exam**	**Images Available**	**Conclusion**	**Reported Conclusion**	**Notes**
2001-2010 HPD Examiners	ACE	All	Non-ID	None	
2010 RSA Examiner 1	ACE	All	Non-ID	Non-ID	Poor Quality Known
2010 RSA Examiner 2	V	All	Non-ID	Non-ID	Poor Quality Known
2010 RSA Examiner 3	Tech Review	All	Non-ID	Non-ID	Poor Quality Known
2013 RSA Examiner 4	ACE	All	ID	ID	Utilizing New Known
2013 RSA Examiner 5	V	All	ID	ID	Utilizing New Known
2013 RSA Examiner 6	Tech Review	All	ID	ID	Utilizing New Known
2013 RSA Examiner 7	V	All	ID	ID	Utilizing New Known
2016 RSA Project Manager (Testifying)	Unclear from Case Record	Assumed All	No Written Report	ID in Testimony Only	No Records: ID Expressed in Testimony Only

2021 First Blind Exam Independent Examiner	ACE	Subset	INC.	INC.	Poor Quality Known
2021 First Blind Exam HFSC Examiner 1	ACE	Subset	INC.	INC.	Poor Quality Known
2021 First Blind Exam HFSC Examiner 2	ACE	Subset	INC.	INC.	Poor Quality Known
2023 Second Blind Exam HFSC Examiner 3	ACE	All	INC.	ID	ID after consultation with HFSC Examiner 4; cited features from a single image that were different than Examiner 4's features
2023 Second Blind Exam HFSC Examiner 4	ACE	All	ID	ID	Used combined features from two images: different than Examiner 3's features

Note: "V" and "Tech Review" are often checks of another examiner's work and not necessarily independent re-examinations.

In evaluating the complaint, the Commission acknowledges the remarkable collaboration between HCPDO, HCDAO, RS&A and HFSC. The Commission especially commends HFSC's efforts to respond to valid concerns raised by RS&A regarding the quality of images provided to Swofford and engaging in the time-consuming task of retrieving the files from court and re-submitting the evidence through its system using blinded procedures. HFSC did this despite the risk that blind re-examination may expose inconsistencies and weaknesses in any forensic discipline. The actions of Texas stakeholders during this investigation demonstrate the best of what transparency and collaboration yield when the common cause is justice for victims of crime as well as those accused.

A. "Reliability" and "Validity" in Science

When evaluating expert scientific opinion, it is important for stakeholders to understand what is meant by "reliability" and "validity," as the terms are used in scientific settings.[61] Reliability refers to consistency of a method, and it consists of two main sub-components:

[61] *See*, Stern, H., Cuellar, M., Kaye, D., *Reliability and Validity of Forensic Science*, Significance, 16: 21-24, https://rss.onlinelibrary.wiley.com/doi/10.1111/j.1740-9713.2019.01250.x.

repeatability and reproducibility. Validity refers to the accuracy (or correctness) of a method and how the scientific methodology used appropriately addresses the question of interest. A helpful discussion of the concepts by Stern, et al. is as follows:

> In scientific and statistical discourse, a *reliable* process for making measurements or drawing conclusions produces largely consistent results when properly applied.
>
> *Repeatability* refers to the reliability of measurements or conclusions by a single examiner under the same conditions: does the same examiner give the same answer using the same instrumentation or approach if provided the "same" (within the accepted uncertainty or tolerance) materials a second time?
>
> *Reproducibility* refers to whether different analysts obtain the same measurement or reach the same conclusion as each other when analyzing the same materials.
>
> The *validity* of a measurement or methodology is more directly concerned with accuracy. A *valid* measurement process accurately measures what it is intended to measure. Like *reliability*, *validity* comes in degrees, and it is best assessed by examining reported results in representative (or more challenging) cases where the researcher knows the correct answer.[62]

B. Additional Challenges with Interpreting Latent Prints Deposited in Liquid

As the RS&A Project Manager acknowledged during her testimony, impressions made with liquid blood (or other liquids) that subsequently dry can be more complex and pose particular challenges.[63] For example, blood is known to form unusual artifacts, resulting from pooling and cohesion which can complicate the interpretation of diagnostic features in the impression.[64] It can also cause a very "noisy" background making it difficult to identify which features were produced from "ridge" detail and which features were produced from "furrow" detail (the spaces between

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[62] *Id.* at 22-23.

[63] *See* Glenn Langenburg, *Deposition of Bloody Fingermarks*, J. Forensic Identification, May 2008, at 355-389; Praska N., Langenburg, G. *Reactions of latent prints exposed to blood*, Forensic Science Int. 224 (1-3) 51-58 (2013) https://doi.org/10.1016/j.forsciint.2012.10.027.

[64] See, David R. Ashbaugh, Quantitative-Qualitative Friction Ridge Analysis, (1999); Glenn Langenburg, *Deposition of Bloody Fingermarks*, J. Forensic Identification, May 2008, at 355-389.

the ridges).[65] Furthermore, practitioners do not always have access to training and assessment of distortion effects that mimic real casework because many training exercises are performed on smooth, flat, non-porous surfaces using typical finger secretion residue, which tends to be waxy and highly viscous.[66] Thus, some of the distortion interpretation rules examiners are trained to observe may not apply to impressions made in liquid.[67]

The impression in the present case—though not confirmed through testing to be blood—appeared to be in a liquid state during deposition, as heavy pooling, cohesion, and liquid artifacts are visible in the impression. As a result, numerous features observed in the crime scene impression (L-1) bear a higher degree of uncertainty since the observed feature may be a true feature or it may be an artifact. Because some characteristics in the crime scene impression may not be reliable, it is critical that the impression be analyzed (and features selected and assessed) before comparing to the known print.

VIII. EXAMINATIONS CONDUCTED BY RS&A (2010-2013)

A. 2010 L-1 Examination

On November 20, 2010, RS&A Examiner 1 declared the palm impression crime scene print "of value" on a "Latent Print Analysis Worksheet." He noted it was a left palmar impression from the hypothenar and the orientation of the mark. The conclusions were verified by RS&A Examiner 2 on November 29, 2010, and technically reviewed by RS&A Examiner 3 on July 29, 2011. Additionally, Examiner 1 annotated a "target group" of minutiae that consisted of three features.

[65] See, Boris Geller, Amihud Leifer, et. al, *Fingermarks in Blood: Mechanical Models and the Color of Ridges*, Forensic Sci. Int'l., May 2018, at 141-147.
[66] Residue may be comprised of "eccrine" (sweat) material, "sebaceous" (fatty, oily) material, or a mixture of both, and may also include other contaminants (*e.g.*, food, grease, dirt, biological secretions, etc.)
[67] For example, when blood dries on the hand, it becomes sticky and tacky and will behave in a manner similar to regular 'residue'. *See*, Maceo, A. *Qualitative Assessment of Skin Deformation: A Pilot Study*. J For Ident 2009; 59(4):390-440.

(IMG 415).[68] Examiner 1 believes he conducted an Analysis of the questioned impression, but he only documented a "target group" of features at the time.

On November 20, 2010, RS&A Examiner 1 reported the comparison of exemplars from approximately 50 known individuals to L-1. The reported result for the comparison of the palm mark to the known exemplar of Webster at that time was "non-identification." RS&A Examiner 1 requested additional known exemplars for four individuals to whom he compared L-1, but he did not request an additional exemplar for Webster at that time. RS&A Examiner 1 used the submitted 2003 Webster exemplar (Exemplar 1) during his comparison.

RS&A Examiner 1 also requested L-1 to be searched in the AFIS databases. In 2010, there were local and state databases for palm prints in Texas, but not a federal database. L-1 was searched and re-checked by several RS&A contractors (not RS&A Examiner 1) on or about December 2010 (local HPD AFIS) and July 2011 (Texas DPS database). No potential hits were reported.

B. 2013 Examination

Following a CODIS "hit," HPD asked RS&A to perform another round of comparisons specifically to both Webster and Jones. The file reflects another exemplar from Webster was requested by the examiner who was assigned to the case at this time (RS&A Examiner 4). Law enforcement supplied a known exemplar from Webster taken in 2001 (Exemplar 2).

When compared side-by-side in the hypothenar region, the 2001 exemplar is clearer, less distorted, and displays more definition in the ridge characteristics compared to the 2003 exemplar.

[68] A "target group" is defined as "[a] distinctive group of ridge features (and their relationship) that can be recognized." *See* **Exhibit A**.

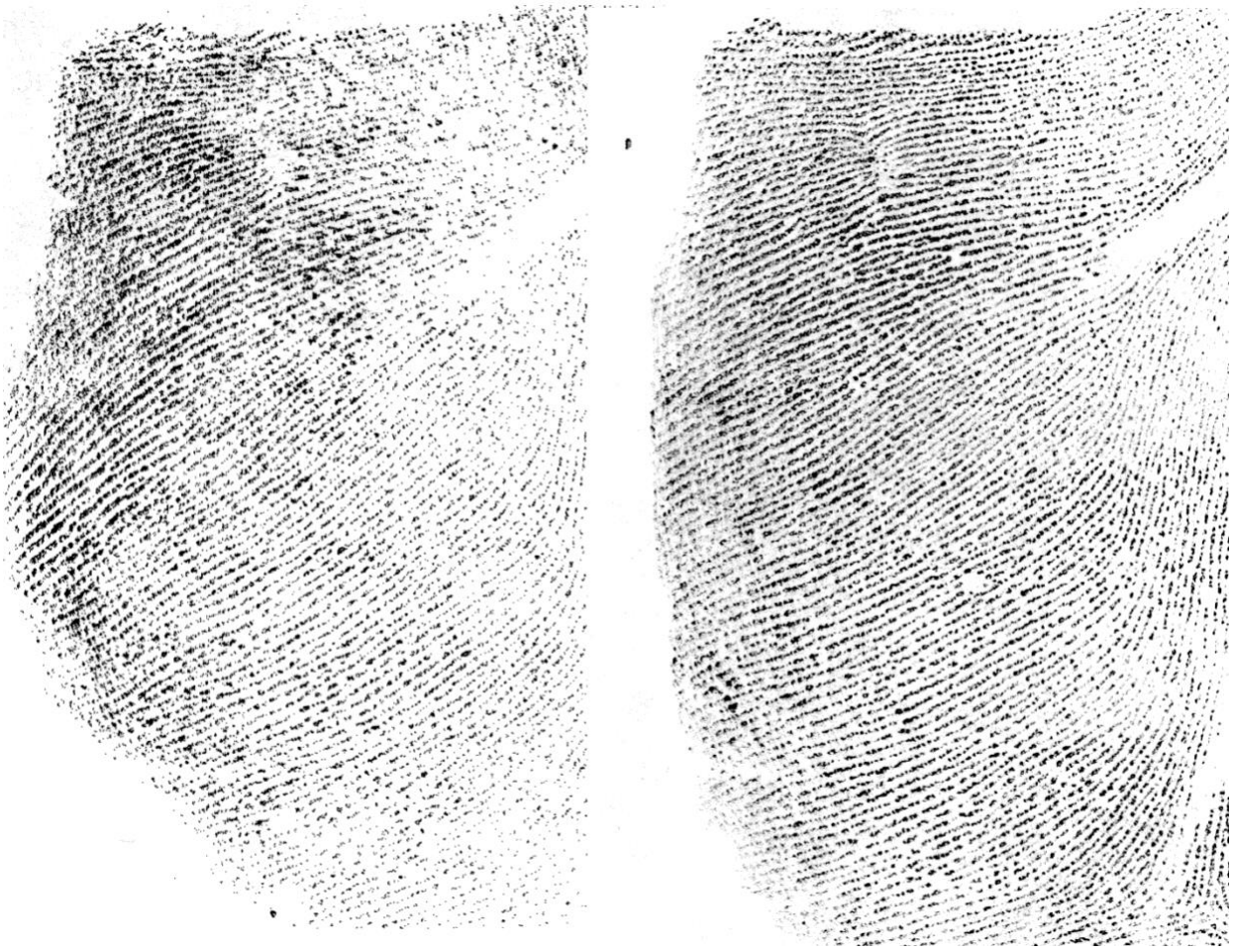


Figure B: The left image is a copy of Webster's left palm taken in 2003 and used in the 2010 examinations (where it was reported as "Non-Ident") (Exemplar 1). The right image is a copy of Webster's left palm taken in 2001 and used in the 2013 examinations (where a different RS&A examiner reported "Identification") (Exemplar 2).

Another image that documented an Analysis before viewing the known exemplar of Webster is a photograph bearing red annotations indicating minutiae on a single printed DEA photograph (img 414/top/bottom).

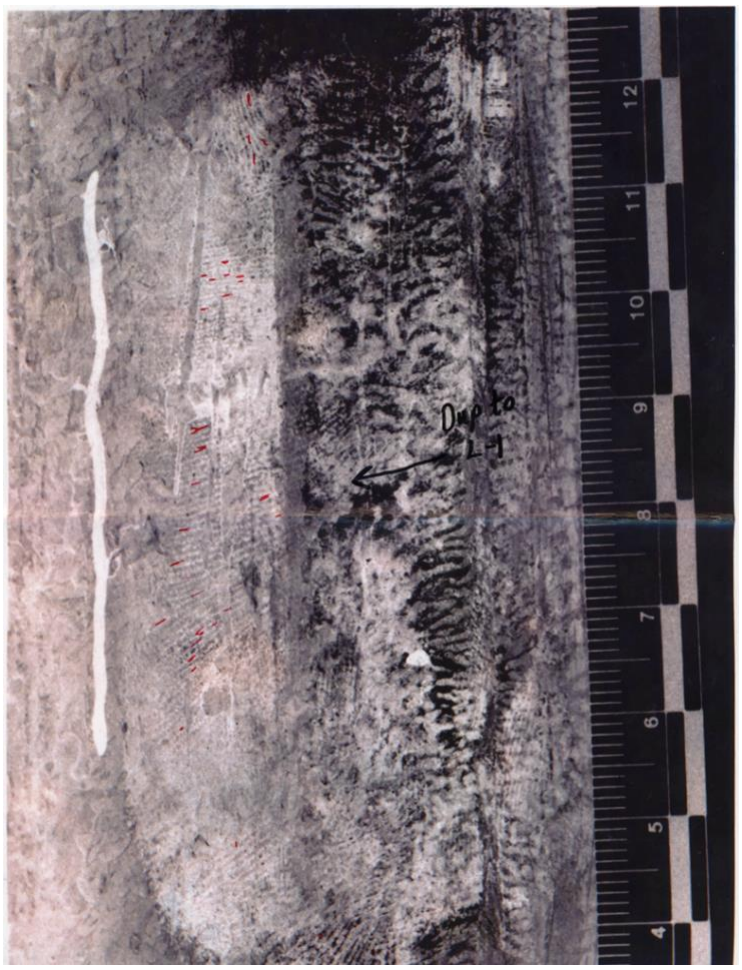


Figure C: "img414" Analysis marking of potential minutiae in red. This is one of the DEA photographs.

The back side is stamped and initialed by RS&A Examiner 1 and dated November 20, 2010. In discussions with Commission staff, Examiner 1 expressed confidence that the annotations on img 414 were not his annotations. RS&A asserts that, based on their practices and the workflow of the case, these were most likely the annotations of RS&A Examiner 4. However, the image does not contain the date of Analysis by Examiner 4, or the initials of Examiner 4, and thus it is not possible to confirm the assertion based on the documentation alone.

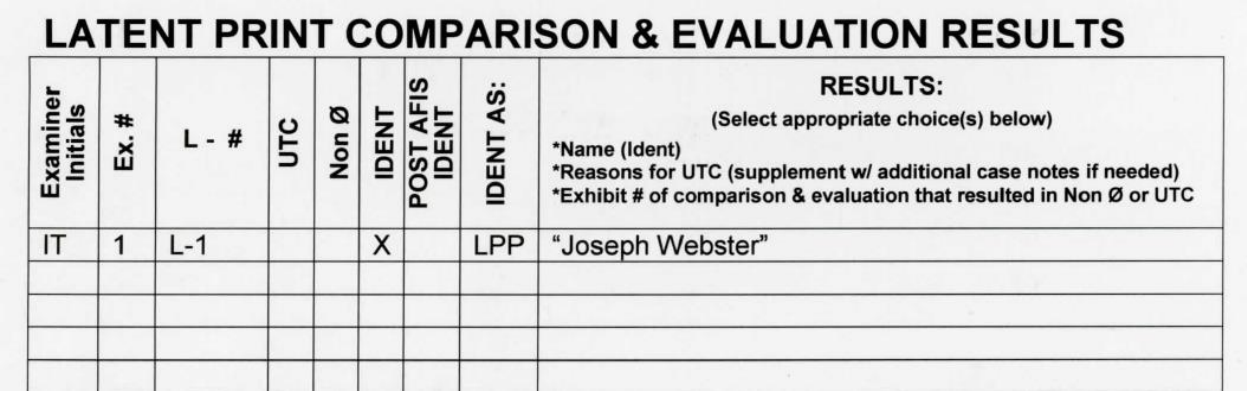
On October 22, 2013, using the new exemplar, RS&A Examiner 4 reported the identification of L-1 to Webster's left palm. RS&A Examiner 5 verified the identification on October 23, 2013. On November 5, 2013, RS&A Examiner 6 performed a technical review.

RS&A issued a formal report on December 6, 2013, declaring an identification to L-1. As was company practice, Ron Smith signed the report in his capacity as owner. The documentation does not include any indication that Smith performed an Analysis or Comparison himself at the time. No other examiner names were listed in the report. The report does not describe why L-1 was not identified when compared to Webster in 2010 but refers to L-1 as "previously unidentified."

The RS&A examiners annotated the features on photographs utilized. RS&A Examiner 4 annotated features selected before the Comparison to known exemplars in a photograph from 2010 (*See* **Figure C**). RS&A Examiner 1 also annotated features before Comparison, but the annotation was limited to a "target group" of three features.

In 2013, when L-1 was identified, there were several RS&A examiners who documented the identification of L-1 to the left palm of Webster. RS&A incorporated multiple examiner verification as a form of quality assurance, though the verifiers were not "blinded" to the conclusions reached by their colleagues.

The casefile contains a Comparison and Evaluation worksheet signed by RS&A Examiner 4, RS&A Examiner 5, and RS&A Examiner 6. This documented the date that the identification, verification, and technical review occurred. There is no other salient information regarding the examination on the worksheet. For example, the worksheet does not discuss the complexity of L-1, the distortion of L-1, the issue of the multiple photographs, or any consideration of the substrate, matrix, pressure, etc. (*See* **Figure D** below.)



LATENT PRINT COMPARISON & EVALUATION RESULTS

Examiner Initials	Ex. #	L - #	UTC	Non Ø	IDENT	POST AFIS IDENT	IDENT AS:	RESULTS: (Select appropriate choice(s) below) *Name (Ident) *Reasons for UTC (supplement w/ additional case notes if needed) *Exhibit # of comparison & evaluation that resulted in Non Ø or UTC
IT	1	L-1			X		LPP	"Joseph Webster"

Figure D: Comparison and Evaluation Worksheet

There is a file (Comparison Charts) that shows multiple chartings, side-by-side of L-1 and the left palm of Webster.

The first page shows a chart by RS&A Examiner 7 (dated 11/4/13). He noted the source of the photograph ("a scan of photo from Item 53"). He does not indicate which photograph, but all the photographs in Exhibit 53 are DEA photographs. The photographs in Exhibit 53 also have his initials and the same date on the back sides.

The second page shows another charting with a set of initials from RS&A Examiner 6 dated either 10/3/2013 or 11/3/2013 (the handwriting is difficult to read). RS&A Examiner 6 did not indicate which photograph he used for L-1.

Page three is a side-by-side charting of L-1 made by RS&A Examiner 4 dated 10/22/2013.

Figure E: A portion of the charting made by the original examiner, RS&A Examiner 4, who identified L-1 to the left palm of Webster on 10/22/2013.

Page four displays another chart with two sets of markings in two different colors and two sets of initials: one set for RS&A Examiner 4 (the initial examiner who made the identification to Webster) and one set for RS&A Examiner 5 (who verified the identification). In the case records reproduced by HFSC, the charting by the analyst who made the identification and the analyst who performed the verification is contained in a PDF file. During this investigation, RS&A provided the Commission another type of file (TIFF) not contained in the official case record documenting the work of these two analysts in "layers." The verifying analyst could turn off the layer that showed the markings of the original analyst. A review of the layers indicates that the two analysts differed in the features they annotated.

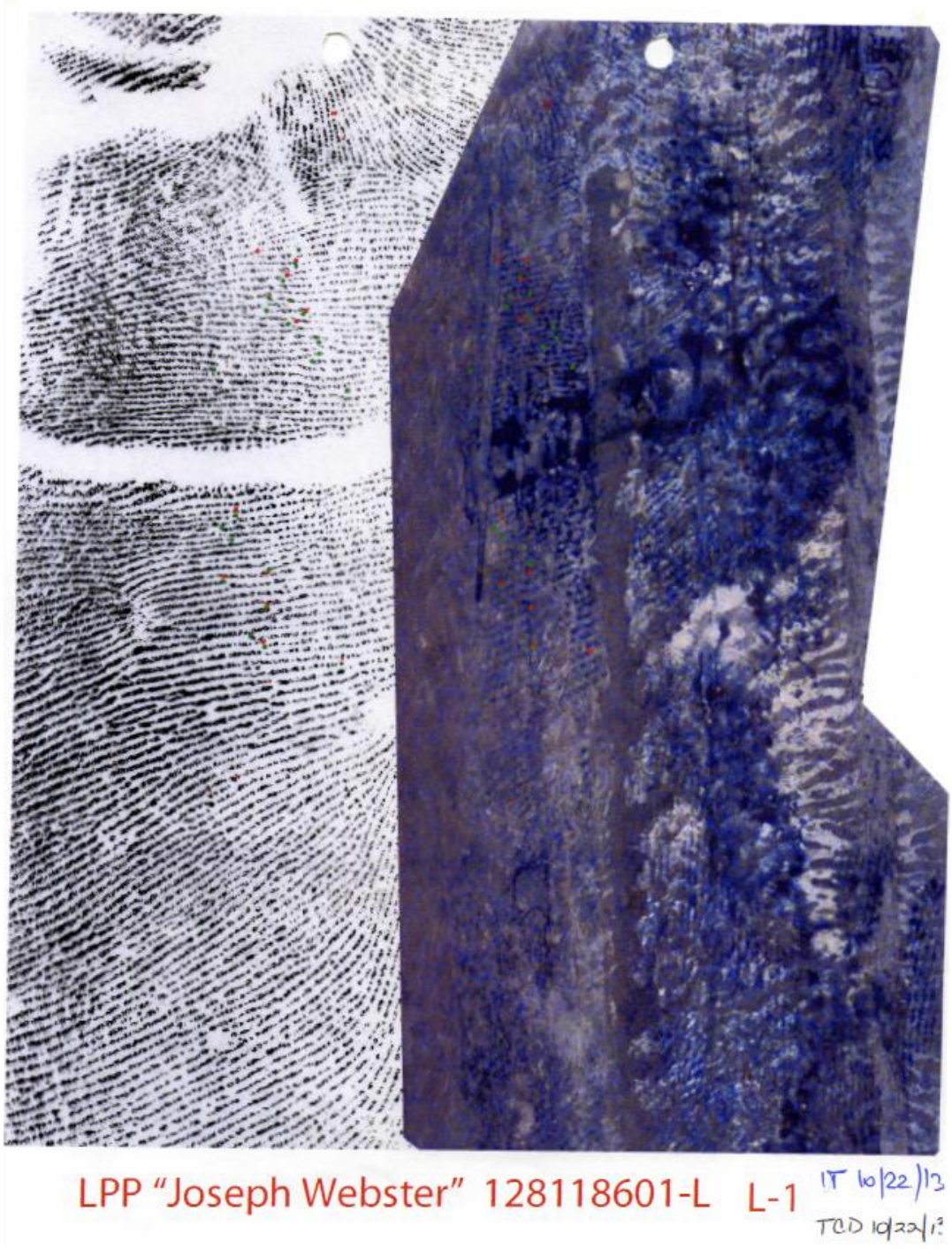


Figure F: Chart showing identification and verification.

As previously mentioned, the RS&A Project Manager for HPD testified at Webster's trial in lieu of the examiners involved in the identification and reporting decisions made by RS&A in 2013. RS&A recalls this arrangement was made by the contracting parties due to the high volume of cases RS&A managed under the HPD contract and the fact that many RS&A examiners were not physically located in Texas. While the Commission acknowledges certain cost-saving benefits of the arrangement (*e.g.*, increased efficiency and expediency, decreased travel, etc.), a consequence is that the case record includes no documentation of the RS&A Project Manager ever having worked on the case. Indeed, were it not for the trial transcript, one could not discern that the RS&A Project Manager performed an examination or verification herself.

IX. REVIEW USING BLIND EXAMINATIONS

A. First Round of Blind Examinations Facilitated by Swofford

The images of the palm mark in the case file can be divided into the original crime scene images photographed under the direction of Deborah Benningfield (crime scene images) and the images later created by the DEA (DEA Images). The two sets can be distinguished by the appearance of different rulers observed in the photographs. The crime scene images depict a ruler displaying the 19 cm to 29 cm mark approximately. The DEA Images depict a ruler displaying the 3 cm to 12 cm mark approximately. Both rulers are white and photographs depicting a black ruler are color-reversed negatives or prints.

The Benningfield crime scene images were originally captured on film negative. The officer under Benningfield's direction who took the photographs used an entire roll of film to photograph the mark under different conditions, lighting, exposure, distances, etc. Benningfield waited to clear the scene while the photo lab processed the film. She directed an officer to remove the section of the post with the palm mark. Once the cut section of the post was received at HPD,

Benningfield then transported it to the DEA facility in Dallas. The DEA had digital technology with processing and enhancement techniques not available for photographic film in 2001. However, in 2001 digital photography was in its infancy and the latent print field had not established minimum requirements for resolution of latent print evidential photographs. The DEA images were originally captured at a resolution of 384 ppi.

The first group of blind examiners in this case received a limited set of DEA photographs originally stored on a CD.[69] It is important to note that the technical record was provided by the HCDAO to the HCPDO which in turn gave the images to Swofford. While all parties were acting in good faith by providing what they perceived to be the complete case file, the blind examiners did not have access to any of the Benningfield crime scene images. They would have benefitted from having access to, and utilizing, multiple photographs from the case file. The mark was found in a dried substance (suspected blood) left on a curved metal post which was difficult to photograph. As a result, some of the images are out of focus, not correctly lit, or do not have the proper depth of field. The photographs of L-1 varied in quality, completeness, contrast, visual content, focus, resolution, and reliable ridge detail.[70] In addition, the known exemplar provided to the blind examiners was a lower quality reproduction of the image. (*See* **Figure A.**)

On June 9, 2023, Commission staff held a virtual meeting with stakeholders to discuss the image quality concerns raised by RS&A. The conclusion was that the blind examiners should be provided with all image reproductions because it was not possible to discern based on case

[69] The original Analysis worksheet from RS&A Examiner 1 in 2010 references a CD with "7 digital images". RS&A Examiner 1 does not specify the source of these images. There are, however, 7 TIFF images in Exhibit 1 folder labeled "Photo of metal fence post CD". These 7 images are all DEA photographs.

[70] Image quality is a well-known cause of disagreement between experts. *See, e.g.,* Andy Bécue, Christophe Champod, *Interpol Review of Fingermarks and Other Body Impressions* (2019–2022), Forensic Science International: Synergy, Volume 6, (2023), (researchers have identified the following factors as potential causes of disagreement between fingerprint experts: the quality of the image (mark and print), operating on borderline decisions using categorical conclusion scales, and the granularity of the conclusion scales.

documentation alone which specific images RS&A examiners utilized in forming their identification opinion. RS&A has asserted numerous times that their examiners would have used all available images in conducting their examination. The Commission accepts this description of RS&A's general practices, but the technical record does not specify which subset of images formed the basis for the conclusions reached by each examiner.

While the Benningfield crime scene images of L-1 are high resolution reproductions of film negatives, the DEA images were initially captured at a lower resolution. Nonetheless, the DEA images have certain advantages. In some instances, the DEA images revealed other areas of L-1 not clearly visible in the scene photographs. Digital enhancements of a DEA image can also be performed by the examiner to assist in adding clarity to features. Stakeholders also agreed that subsequent blind examination would include the best reproduction of the known left hand palm exemplar of Webster. The key criminal justice partners (HCDAO and HCPDO) agreed during the call that it would be helpful for HFSC to run the prints through their system again (blind), and HFSC accepted this request.

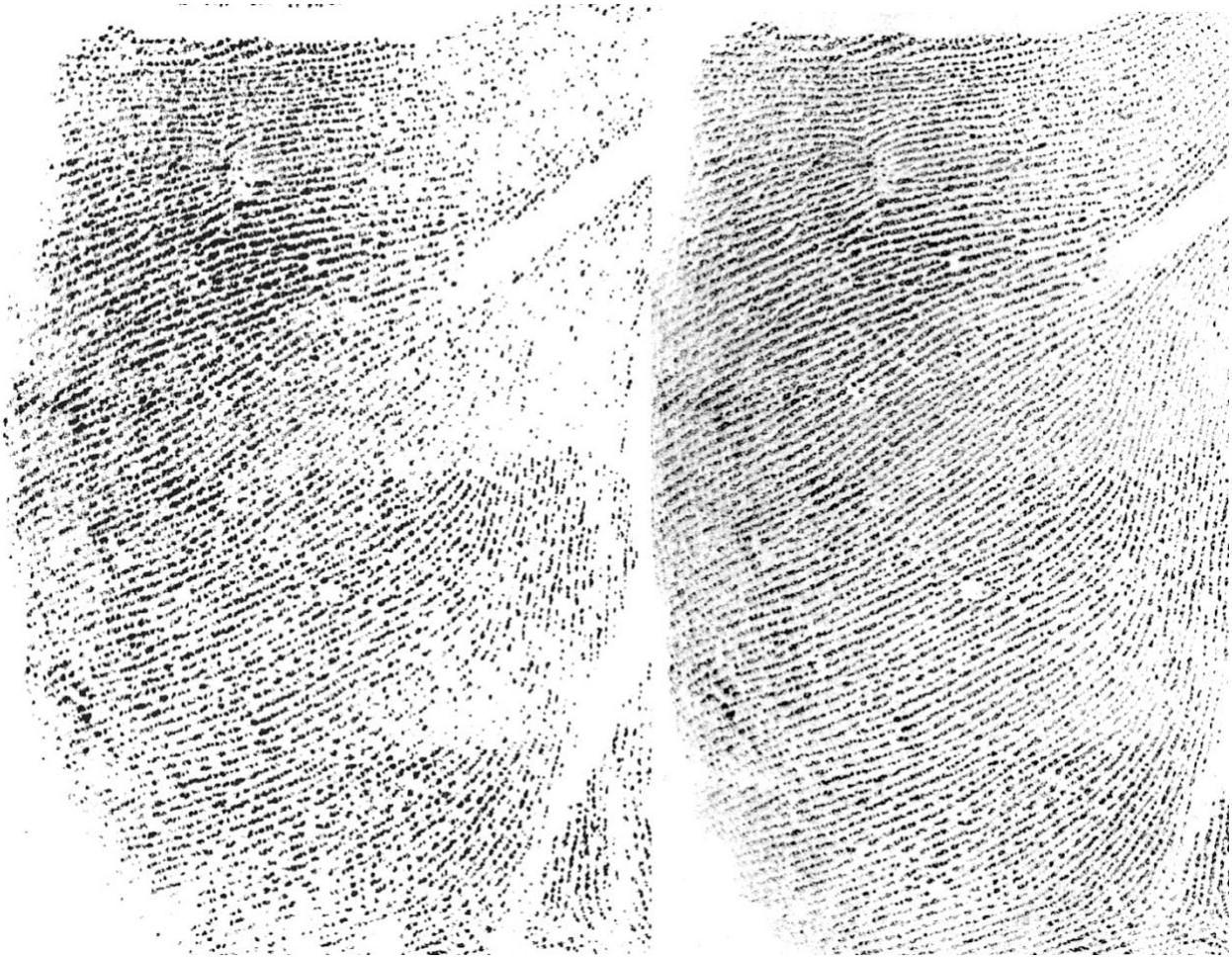


Figure G: Left image is the known left palm of Webster received by the original blind examiners. The right image is the original high resolution scanned image in the case file used by RS&A in 2013 (Exemplar 2). The differences in quality are presumed to be caused by photocopy or printing limitations. The case record includes the entire left palm of Webster; what is shown in this figure is a cropped specific region of the palm (the hypothenar) to illustrate the difference between the quality of the image in the case record and the quality of image received by Swofford from HCPDO (which it in turn received from HCDAO).

B. Second Round of Blind Examinations by HFSC (July 2023)

Two HFSC examiners with no knowledge of the case or context for previous conclusions received all available crime scene images and independently reviewed the images of L-1. They also received the best quality exemplar prints from Webster and two other suspects from the initial investigation. HFSC's friction ridge reporting procedure includes three reporting options for

conclusions after conducting the Comparison and Evaluation phase: Identification, Inconclusive, or Exclusion.

The first HFSC examiner to whom the case was assigned (HFSC Examiner 3) reached an "inconclusive" finding after comparison of the palm mark from the crime scene to all three reference prints (Webster and the two other defendants). HFSC Examiner 3 attributed the inconclusive to the limited quantity and quality of information in the image of the mark from the scene.

A second HFSC examiner (HFSC Examiner 4) reached an "identification" conclusion after comparing the palm mark from the scene to the left palm print of Webster. HFSC Examiner 4 made alterations to selected features during the comparison phase (adding, adjusting, or ignoring selected features post-Analysis). Because there were conflicting conclusions between the two examiners, HFSC's procedure permitted a "consultation" between them.

After consultation, HFSC Examiner 3 performed an additional Analysis, made alterations to the annotations and features, and then declared an "identification" to Webster's left palm print and excluded the other two proposed candidates. HFSC Examiner 3 and HFSC Examiner 4 utilized a combination of different images, features, and portions of the mark to support their respective opinions.

X. REVIEW BY COMMISSION'S RETAINED SUBJECT-MATTER EXPERT

On February 20, 2023, Dr. Langenburg began an examination at the Commission's request. He was aware of the issues in the case, both those raised by Swofford and the responses by RS&A. It is important to note that this scenario (awareness of background information) is *not* what the Commission recommends for criminal casework (*i.e.*, examiners should be shielded from task-irrelevant information). However, given the Commission's mission and the fact that the

Commission's reports are inadmissible in civil or criminal actions, Langenburg's knowledge of the complaint and the parties' responses were necessary for him to advise the Commission effectively.

Until this point, Langenburg avoided viewing the crime scene mark and the exemplar prints side-by-side and performing a Comparison. He used a linear process, starting with annotations and analysis of the unknown print (L-1), a suspected blood palm mark on a curved, metal post. The mark had been previously treated with amido black; a protein stain used for suspected blood prints.[71]

When Langenburg performed the ACE steps, he started with an analysis of L-1. It was apparent that multiple photographs would aid in the examination because the clarity and reliability of the ridge detail varied depending on which image was used. For example, Langenburg used img415, img422, img744, img745, and DEA photo L-1(1) for his annotations. He documented the observed features in L-1 before comparing them to the known impressions.

Langenburg used a method of documentation known as GYRO (an acronym for Green, Yellow, Red, and Orange).[72] This method assigns confidence to the existence of known features. Using GYRO, green colored features represent the highest level of certainty in the existence of a feature in the opinion of the examiner. Yellow and red colored features represent moderate and low levels of confidence respectively. The method is intended to transparently

[71] While the impact of amido black on the ability of a laboratory to extract DNA from an evidentiary sample is not a core issue in this report, the Commission points the reader to research demonstrating that when one treats a presumed bloody questioned print with amido black, it effectively cuts the blood DNA from the victim in half, thereby yielding greater peak heights from the minor contributor (in this case the suspect). It follows a questioned print treated with amido black where the presumed blood is from the victim may, if anything, help recover a better profile from the print of the suspect where there is a minor contributor. Harush-Brosh, Yinon, et. al, *Back to Amido Black: Uncovering Touch DNA in Blood-Contaminated Fingermarks*, Journal Forensic Science 66(5), 1697-1703 (2021), https://doi.org/10.1111/1556-4029.14783.

[72] Langenburg, G; Champod, C. *The GYRO system-a recommended approach to more transparent documentation*. J Forensic Identification. 2011;61(4):373–384.

communicate to other examiners which features the expert opined were true, accurate and diagnostic features for an examination, and which were less diagnostic, but might be useful to the examination.

Figure G below depicts multiple photographs of L-1 annotated by Langenburg using GYRO. It is important to note the variability in each of the annotations. While there are certain robust features that appear annotated with confidence (green) in each of the four images in Figure G, there are features that do not robustly appear and are marked with lower confidence, or not at all. Furthermore, Langenburg performed a second, and in some cases, a third analysis on subsequent days. Each analysis showed variation.

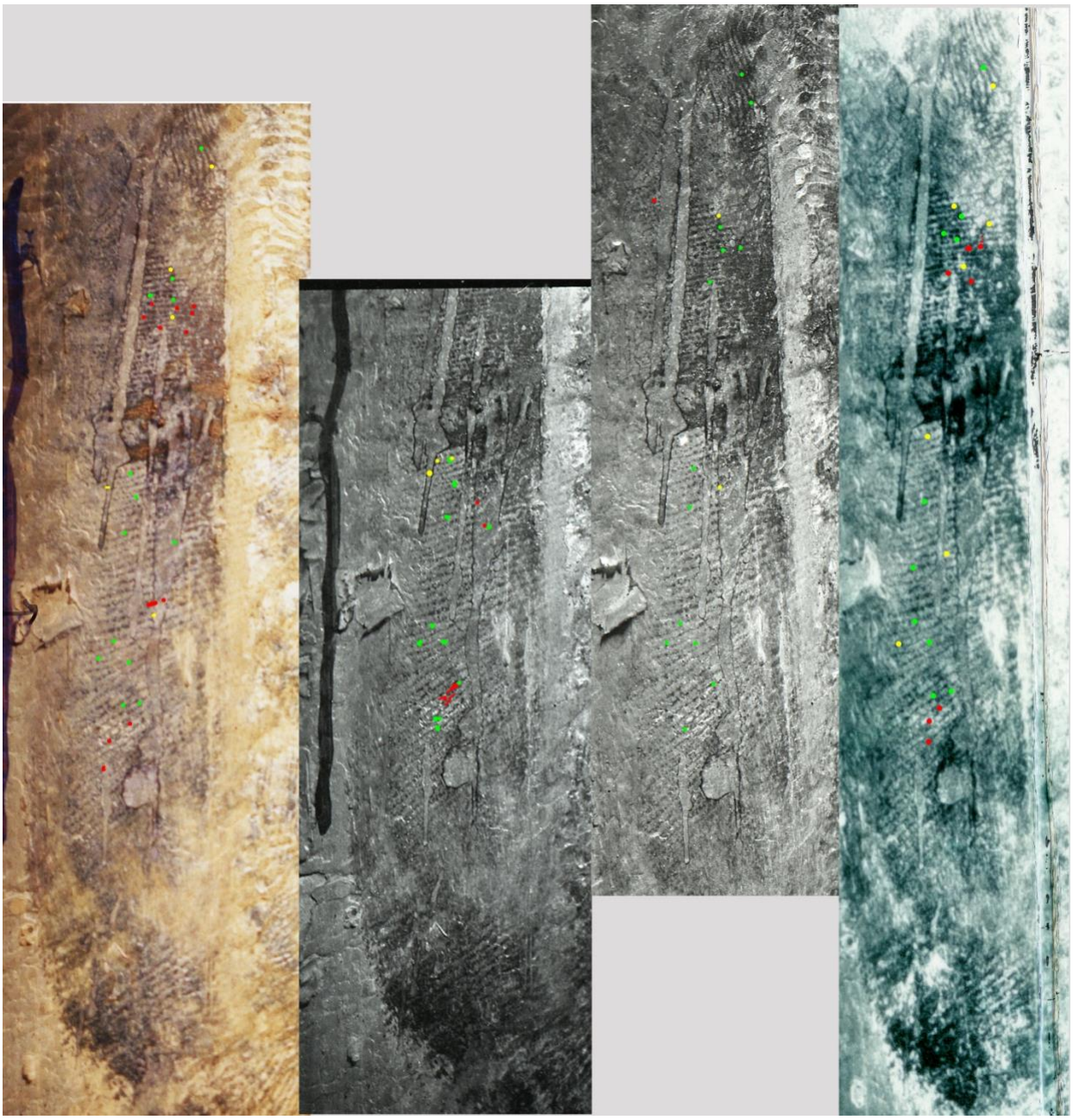


Figure G: These are four of the images used by Langenburg. Because the photographs varied in (1) focus, (2) light, (3) how much of the impression filled the frame, (4) digital enhancements, (5) printing on photographic paper versus original negative, the details varied in appearance throughout the analysis. The image on the left is a printed color photograph from the scene photographs. The two middle images are negatives but show different portions of L-1 in focus/different lighting. The right image is a DEA digital photograph. All the GYRO annotations are by the same examiner, prior to comparing to a known impression.

Langenburg concluded this is a challenging impression that merits extensive documentation and quality assurance measures. The specific images produced different feature sets and Langenburg's confidence level in his selection of specific features varied from analysis to analysis. Feature selection is critical to establishing the foundation for a conclusion. While a handful of features appeared in all analyses conducted, many did not.

Depending on which features were selected and which were found to be in correspondence, Langenburg observed the weight of the observed features may vary between examiners. Contrary to RS&A's assertion that any competent examiner could reach no conclusion other than identification, Langenburg opined that while some examiners may observe correspondence between L-1 and the left palm print of Webster sufficient for them to feel confident to issue an opinion of identification, it is not certain that all competent examiners would. Other degrees of support may be viable and would depend on which features an examiner chooses. Degrees of support would also depend on the type of conclusion scale utilized by the examiner (*e.g.*, the traditional three-category scale vs. an expanded scale).[73]

XI. OBSERVATIONS RE: NEED FOR TRANSPARENCY

A. Important Legal Distinctions

As a threshold matter, the Commission distinguishes between two critical points: the criteria defendants must satisfy to obtain relief pursuant to article 11.073 of the Code of Criminal Procedure and the Commission's expectations regarding the historical conduct of forensic examiners and forensic disciplines generally. Under Texas law, a defendant *may* obtain relief on

[73] The traditional 3-category scale includes the following options: Identification; Inconclusive; or Exclusion. Some FSSP's have shifted toward an expanded scale to reflect the range of data observed in casework exemplars, including the following categories: Identification; Support for Same Source; Inconclusive/Lacking Support; Support for Different Sources; Exclusion. *See*, OSAC Proposed Standard for Friction Ridge Examination Conclusions (2018).

proper application of a writ of habeas corpus when a field of scientific knowledge, an expert's scientific knowledge, or a scientific method on which the relevant scientific evidence is based has changed since trial, assuming certain additional criteria are met.[74] The ultimate evaluation of this question falls within the sole province of the Texas Court of Criminal Appeals.

The Commission does not expect any forensic scientist, including the examiners involved in this case, to have met standards developed and published *after* the forensic analysis was performed. However, one of the Commission's core duties is to highlight evolution in forensic science, including improvements that have been made by a particular field in response to published research (even when the research may be critical of the discipline) and historical inflection points (even when they involve painful errors like in the Mayfield case) for purposes of identifying needs and guiding future improvements. Indeed, the friction ridge community has long been viewed as a leader in embracing the need for foundational research and making associated changes. This leadership is reflected in the diligent work of researchers in the field, SWGFAST, and (more recently) the Friction Ridge Subcommittee of OSAC and ASB.

B. Absence of Case Record Documentation for Testifying Project Manager

The RS&A Project Manager who testified at trial does not appear by name or initial on a single document, photograph, or report in this technical record. There is no documentation of the features she used or her application of ACE(V). None of the original examiners testified at trial. RS&A explained that due to the high-volume nature of their contract with HPD, the RS&A Project Manager was allowed to testify in friction ridge cases where she was not the original examiner or verifier.[75]

[74] TEX. CODE CRIM. PROC. art. 11.073.

[75] As the RS&A Project Manager was describing the re-examination of the evidence by "the analyst that was assigned", the defense attorney requested a sidebar conference with the court and stated '[t]he answers she just gave indicate

At trial, Webster's defense attorney objected to the RS&A Project Manager's testimony on the grounds that she herself did not conduct an Analysis, Comparison, Evaluation, or Verification. The State responded, and the RS&A Project Manager testified, that she "personally verified" her own findings in the case "twice, once at the time that the report was completed in 2013, and again just before this trial."[76] The Commission accepts that RS&A's description of the environment in Houston at the time may be accurate. However, regardless of what agreements were reached with legal stakeholders with respect to the RS&A Project Manager's testimony, the absence of documentation regarding the RS&A Project Manager's work makes it difficult for a qualified independent examiner or legal end-user to evaluate the rationale for the identification conclusion reached by the only friction ridge expert who testified for the State in this case.

C. Certain Comparisons Merit More Extensive Documentation

The examination of L-1 was undeniably challenging.[77] Not only did it require examiners to use multiple images, but the overall low quality of the mark, variability in the feature selection process, and the nature of the palm mark in suspected blood (or other liquid matrix) also contributed to the complexity of the comparison. As a challenging mark, the case record would

somebody else made these examinations". The prosecutor then informed the court that "she has done the comparison herself three times". The defense responded, "I guess we'll find out" and did not raise any further objection to the Project Manager testifying to the results of the re-examination by the assigned analyst. Reporter's Record Vol. 4, p.148: *State of Texas v. Joseph Webster*, Cause No. 1470226 (176th Dist. Ct. Harris County, Tex., February 17, 2016).

[76] Reporter's Record Vol. 4, p. 156: *State of Texas v. Joseph Webster*, Cause No. 1470226 (176th Dist. Ct. Harris County, Tex., February 17, 2016).

[77] The RS&A Project Manager testified that, in general, "blood prints are very difficult to identify because of the slipperiness of the blood present as it's being transferred, the movement, the distortion." In discussions with RS&A they agreed the crime scene mark in this case would be considered "challenging" by many examiners, though there were differences of opinion between the Commission's expert, HFSC, Swofford, on one hand and RS&A on the other regarding whether the mark would be properly classified as "complex" under current OSAC standards. Regardless, RS&A explained their examiners had access to and likely used digital image enhancement techniques to assist them, and that the enhancements may be viewed by comparing original images to enhanced images. However, there are no metadata in the case file itself demonstrating that RS&A employed digital processing techniques. During the investigation, RS&A provided the Commission with additional TIFF files which may allow a qualified examiner to better understand the enhancements, but the metadata were not included in the criminal case record.

have benefitted from thorough documentation and quality assurance measures, especially considering the initial "non-identification" opinion reported by RS&A in 2010.

Documentation of features selected, before comparing the exemplar print, is critical to establishing the foundation of the expert's opinion. For the adversarial system to work properly (and to mitigate extensive post-conviction habeas litigation) attorneys must be provided with enough information to understand and challenge the basis for an expert's opinion at the outset. An attorney should be able to ask which features the examiner observed before looking at the known, and which became apparent only after.[78] If the friction ridge community asserts that features not previously selected may be identified *after* comparison to the known, then case documentation must provide legal end-users enough information to understand and ask questions about this process.

In addition to ample and compelling published research demonstrating inter-examiner (and intra-examiner) variability with complex and/or challenging marks,[79] the fact that Langenburg did not consistently select features in L-1 suggests that some features in L-1 are ambiguous, distorted, and unreliable (inconsistent as a signal stimulus). This is further highlighted by the variability in feature selection and role of consultation during the second set of HFSC blind examinations.

The Commission calls attention to certain questions highlighted in the Palm Black Box Study that should be considered by every attorney when evaluating challenging forensic comparisons. For example, in the context of the study and considering the impact of inconclusive opinions, the authors ask the following:

> "If the majority of examiners reach an inconclusive decision, but some examiners reach a definitive decision (identification or exclusion) were those definitive examiners "super-examiners," (*i.e.,* especially competent) or were they simply

[78] Indeed, in DNA mixture interpretation, the Commission has cautioned laboratories to avoid suspect-driven analysis, where data from the evidentiary DNA profile is interpreted to "fit" the known suspect's profile.
[79] See **Exhibit E**.

> more risk-tolerant and making decisions that were not sufficiently supported by the available data? Conversely, if an examiner reports inconclusive when the majority reached the correct definitive conclusion (*i.e.,* the conclusion that matches ground truth which is known in a research study), was the inconclusive examiner the lone voice of reason to exhibit caution, or were they being too risk-averse?"

This line of inquiry applies in many criminal cases given that inconclusive opinions are common in forensic analysis due in part to the less-than-pristine nature of crime scene evidence. In all cases, but especially in cases involving consultation or differing perspectives between examiners, attorneys should obtain the case record (not just the report) and understand what precipitated the consultation or difference of opinion. For example, did an examiner simply overlook something? After the consultation, how consistent were image choices between examiners? How consistent were feature choices? Did the examiners agree about which aspects of the mark were sufficient to establish an identification? If so, why? If not, why not? These are all fair and appropriate questions for attorneys to ask in the context of the any case where the highly probative nature of the palm mark is uncontested by the parties. However, lawyers can only ask the questions if the forensic case record is sufficiently clear to provide a basis for the inquiry.

1. SWGFAST on Documentation

In 2009, SWGFAST published a standard titled "Standard for the Documentation of ACE-V" which provided that complex marks require a more granular level of documentation. The document was updated in 2012 to include even more specific requirements:

> "7.1 Complex latent print examinations require extensive documentation by the examiner during the analysis and subsequent comparison phase of the examination process to establish a foundation for conclusions. Analysis of a complex latent print may be documented using images, in conjunction with annotations, notations on a worksheet, or narrative description. Analytical factors provide the basis for interpretation of distortion and understanding of variation in appearance.

"7.3 Extensive documentation is required and may include one or more of the following: area mapping, ridge tracing, minutiae marking, and detailed level 3 shape marking".[80]

Another 2011 SWGFAST document titled "Standard for Examining Friction Ridge Impressions and Resulting Conclusions," gave clear instructions for the assignment of complexity to a mark. Once it was deemed to be "complex," additional documentation and quality controls were triggered.

Documentation [4] and verification procedures [5]	
Non-complex	Limited documentation of the relevant features used as a basis for a conclusion. Standard verification.
Complex	Extensive documentation of the relevant features used as a basis for a conclusion. Should consider the possibility of an enhanced verification and review procedure (e.g., a blind verification and multiple verifiers).

Table 2: Documentation and verification procedures.

2. Expert Working Group Report on Human Factors and Latent Print Examination

SWGFAST's view on documentation was further buttressed by the 2012 National Institute of Standards and Technology Report titled "Latent Print Examination and Human Factors: Improving the Practice through a Systems Approach," (Human Factors Report). The report was written by friction ridge subject matter experts and other criminal justice partners (attorneys, cognitive psychologists, quality assurance experts, etc.).[81]

[80] http://clpex.com/swgfast/documents/documentation/121124_Standard-Documentation-ACE-V_2.0.pdf

[81] National Institute of Standards and Technology, *Latent Print Examination and Human Factors: Improving the Practice through a Systems Approach* (2012)

The report noted the following regarding the value of documentation:

> "Documentation is not itself an interpretive practice, but rather a practice for capturing an examiner's interpretive judgments in a form that would permit the examiner, or another examiner, to make sense of a decision at a later time. Documentation serves to maximize the transparency of the interpretative process and to provide a record that can be useful for many purposes, including reports and testimony, future research and evaluation, and quality assurance."[82]

and

> "A report and contemporaneous supporting notes or materials should document the examination to make the interpretive process as transparent as possible. Although the degree of detail may vary depending on the perceived complexity of the comparison, documentation should, at a minimum, be sufficient to permit another examiner to assess the accuracy and validity of the initial examiner's assessment of the evidence."[83]

The same report also raised concerns about reliance on the exemplar print to select features in the questioned impression:

> "At a minimum, there should be an explicit determination of features in the latent before the comparison process. This initial determination need not limit the features that can be used in subsequent analysis; identifying this initial set ensures that the analyst's approach remains transparent. But because of the danger of bias emerging in going back and forth between latent and exemplar prints—and to maintain the transparency of the process—any features that are noted after comparison has begun or as the result of the comparison process (rather than before comparison begins) should be indicated and explicitly included in the documentation."[84]

The report repeats several times that contemporaneous documentation of the features during the Analysis (before Comparison) is important. It also emphasizes the need to document verification.

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[82] Kaye, David H, et. al., The Report of the Expert Working Group on Human Factors in Latent Print Analysis-- *Latent Print Examination and Human Factors: Improving the Practice through a Systems Approach* (2012) Item 3.2.1 p.41. https://dx.doi.org/10.2139/ssrn.2050067

[83] *Id*. at, p.42. Recommendation 3.1.

[84] *Id*. at p. 43. Item 3.2.1.

3. Accreditation Standards on Documentation

For FSSPs accredited by ANAB,[85] expectations regarding documentation have increased over time. Originally, ASCLD/LAB (the predecessor accrediting body to ANAB) had the following essential requirement it its Legacy Program:

> "1.4.2.16(E): Are conclusions and opinions in reports supported by data available in the case record, and are the examination documents sufficiently detailed such that, in the absence of the examiner(s), another competent examiner or supervisor could evaluate what was done and interpret the data?"

The requirement included this discussion (edited to focus on the issue):

> "In the latent print discipline, the examination documentation should include each examination activity conducted, the sequence of those activities and the results of the activities. The activities can include the development techniques applied, controls or reagent checks used in development techniques, photography/digital imaging used, any AFIS searches conducted, known exemplar capture and/or retrieval, comparisons conducted, and conclusions reached. It is not required that the examination documentation provide a detailed description of the thought process involved in the analysis, comparison, or evaluation. However, examination documentation must include which prints were analyzed, compared, evaluated, and conclusions reached. Examination documentation must also acknowledge the existence and disposition of any captured latent prints which are not analyzed, compared, or evaluated."

As ASCLD/LAB transitioned to the International program, the requirement was revised to reflect only the supplemental requirements. ISO/IEC 17025 (both 2005 and 2017) established the following criteria regarding technical records: contemporaneous, identifiable to a task and individual, and contain sufficient information. ASCLD/LAB focused on the technical record supporting what was reported in the following language:

> **AL 2011 (for 17025:2005)** 4.13.2.5 Records to support conclusions shall be such that in the absence of the analyst (however named), another competent reviewer could evaluate what was done and interpret the data.
>
> **NOTE** Examples of ways to record the basis for conclusions derived from evidence examination/analysis, include, but are not limited to a narrative description of the

[85] The Commission is grateful to ANAB for providing this concise explanation of the historical evolution of expectations regarding documentation.

> examination/analysis process and observations made, photographs, photocopies, diagrams, drawings, worksheets.

In addition, record requirements for inspection bodies under ISO/IEC 17020 (the standard to which many friction ridge FSSPs are currently accredited) were previously less prescriptive than the requirements for laboratories under ISO/IEC 17025.[86] ANAB's current supplemental accreditation requirements (AR 3120 and AR 3125) have been harmonized around documentation to ensure that records sufficient to meet the needs of the sector are created and maintained regardless of the applicable ISO/IEC standard. For example, AR 3125 Section 7.7 includes a requirement for the documentation of verification, while 7.5.1.3 requires the analysis itself to be documented as part of the technical record:

> Technical records to support a report (including results, opinions, and interpretations) shall be such that, another reviewer possessing the relevant knowledge, skills, and abilities[87] could evaluate what was done and interpret the data.

4. OSAC Standards on Documentation

The OSAC Friction Ridge Subcommittee calls for more rigorous documentation at each step of ACE-V. Multiple proposed standards emphasize the importance of and indeed require documentation of the features relied upon to reach conclusions (such as value decisions, source conclusions, etc.). Proposed standards also emphasize the added need when dealing with complex or difficult marks. Relevant proposed standards include:

- OSAC Proposed Standard for Examining Friction Ridge Impressions (2020).
- OSAC Proposed Best Practice Recommendation for Analysis of Friction Ridge Impressions (2020).

[86] ISO/IEC 17020 7.1.7 requires for observation to be "recorded in a timely manner so as to prevent loss of relevant information and 7.2.4 requires the inspection body maintain records…to enable an evaluation of the inspection."
[87] The Commission confirmed with ANAB that terms like "another competent examiner," or "another reviewer," have always referred to a qualified individual who may be either internal or external to the FSSP. The term is not limited to examiners internal to the provider. The point here is that an examiner qualified in friction ridge analysis, when provided access to the laboratory's standard operating procedures and pertinent quality system documentation, should be able to evaluate what was done and interpret the data.

- OSAC Proposed Best Practice Recommendation for Comparison and Evaluation of Friction Ridge Impressions (2020).

The following is excerpted from the OSAC Proposed Best Practice Recommendation for Analysis of Friction Ridge Impressions (2020):

> 4.1.2. The observable data in the questioned friction ridge impression shall be analyzed and documented prior to comparison with an exemplar friction ridge impression.
>
> 4.1.3. The features and related observable data that should be considered during the analysis include classification pattern, ridge flow, minutiae, creases or wrinkles, and scars, as well as their individual attributes, such as type, location, orientation, shape, texture, and morphology.
>
> 4.1.3.1. At a minimum, minutiae shall be included to support the examiner's utility decision (*i.e.*, ridge endings, bifurcations, and dots).

Since the Commission's creation in 2005, it has issued reports in various disciplines where FSSPs have pointed out that SWG documents were not required, but rather voluntarily. The same observation is made today regarding OSAC Registry standards. While the Commission acknowledges the accuracy of this statement, the SWG documents in particular were created by practitioners for practitioners with the aim of increasing consistency and quality of work performed. Historically, SWG documents have undeniably served as a guidepost for sound practice across forensic disciplines. Friction ridge is no exception.

D. The Palm Mark in this Case Highlights the Need for Blind Verification

In February 2011, SWGFAST published a standard for blind verification ("Standard for the Application of Blind Verification of Friction Ridge Examinations.") The standard emphasized that the choice to implement blind verification was left to the FSSP; however, if blind verification was employed, the standard should be followed. Most importantly, the document provided numerous suggestions for when blind verification should be considered. Over half of them would

apply in this case and the first four are circumstances that according to the standard, *must* trigger blind verification.

- Strong contextual influence (*e.g.,* CODIS hit to Webster, unsolved cold case).
- The existence of high distortion factors.
- Low number of features, features with low quality, or features that are not discriminative.
- Conflicting conclusions among examiners (*e.g.,* RS&A Examiner 1's initial "Non-identification").
- Highly probative location of the recovered mark.
- A single questioned print association (as opposed to multiple evidentiary items).

Similarly, the 2012 NIST/Human Factors report supported the use of blind verification as an important tool to reduce error from cognitive bias:[88]

> However, being consistent with widely accepted psychological phenomena, this research has prompted proposals for blinding forensic examiners to the origin of samples being compared with each other and for using multiple exemplars in comparisons. Likewise, blind verification shields the verifying examiner from contextual bias that might otherwise affect the outcome in difficult cases. The Noblis-FBI experiment [Black Box; Ulery, et. al 2011] ...indicated "that blind verification of exclusions could greatly reduce false negative errors." Taking the human factors perspective, an agency might wish to adopt one or more of these systemic changes rather than simply warning examiners to do their best not to be influenced by potentially biasing information.

Following the misidentification in the Brandon Mayfield case, for instance, the FBI implemented blind verification in some cases, and reported on its use of blind verification five

[88] National Institute of Standards and Technology, *Latent Print Examination and Human Factors: Improving the Practice through a Systems Approach* (2012).

years later in a follow up report [89] (U.S. Department of Justice, Office of the Inspector General, 2011)[90]:

> Single identifications, which pose the highest risk of a false positive, are both verified and blind-verified. The FBI Laboratory also requires blind verification of any analysis change involving a single previously reported print, such as where examiners disagree about the value of a latent fingerprint, and all final identification decisions that required conflict resolution. Blind verifications may be conducted for complex prints, where an examiner changes his opinion from "value" to "no value," or in any other situation at the discretion of a supervisor.

RS&A asserts that multiple examiner verification is preferable to blind verification. In multiple examiner verification, many examiners review and discuss the comparison through a consultation process. The argument is that the consultative process leads to "better" results. While there is some intuitive appeal to the notion that multiple examiners working together is "better" than a single examiner, the Commission notes that blind testing is a core concept in many (if not most) areas of science and medicine. Given the fact that we do not have ground truth for crime scene samples and the need to establish reliability and validity is a cornerstone of admissibility, the Commission observes that the most prudent and transparent course in a complex case is to include blind verification as a preferred means of quality control, especially if examiners may have been exposed in any way to contextual information (*e.g.*, CODIS hit, defendant confession, etc.) that could influence outcomes.

Strategies for achieving the benefits of blind verification (short of performing 100% blind verification) have been discussed extensively in the literature for various forensic disciplines. In the friction ridge context, Champod et. al. suggest that "systematic blind testing is not necessary during most routine examinations; it is time consuming and unnecessarily consumes personnel

[89] US Department of Justice: Office of Inspector General, *A Review of the FBI's Progress in Responding to the Recommendations in the Office of the Inspector General Report on the Fingerprint Misidentification in the Brandon Mayfield Case* (2011).
[90] *See*, *supra* n 25.

resources. Rather, a verification structure should cater to potentially problematic latent prints and cases."[91] However, to be effective the system should not be reserved for identification conclusions only, but rather include other conclusion categories (inconclusive or exclusion).

E. The Process Used by an FSSP to Guard Against Potentially Biasing CODIS Hit(s) Merits Documentation

The facts of this case raise the issue that extraneous case information, namely the CODIS hit to Webster, could have influenced the 2013 examination that identified the left-hand palm print of Webster to the crime scene mark (L-1) in suspected blood.

The RS&A Project Manager testified on direct-examination that she was personally aware of the CODIS hit to a suspect, but the examiner performing the comparison (RS&A Examiner 4) was not supplied that information. The RS&A Project Manager would have been responsible for providing that information to RS&A Examiner 4 (she testified she did not) and the hit was not documented elsewhere in the technical record. On cross-examination the RS&A Project Manager acknowledged the team leader, RS&A Examiner 6, was also aware of the CODIS hit, but she had no personal knowledge of whether RS&A Examiner 6 directly or indirectly informed Examiner 4 of the DNA hit. The Commission notes that RS&A Examiner 6 also served as a technical reviewer in the case and agreed with the identification of L-1 to Webster.

The requested examination in 2013 was to the known exemplars of suspects Webster and Jones. If an examiner were exposed to the existence of the CODIS hit to a suspect, even if not specific as to which suspect, the examiner was exposed to extraneous case information that was both irrelevant to the examination and potentially biasing.

[91] Champod, C., Lennard, C., Margot, P., Stoilovic, M. *Fingerprints and Other Ridge Skin Impressions*. Boca Raton: CRC Press, 2004, 200.

The Evaluation phase of the ACE-V process involves a subjective decision about the data observed during the Analysis and Comparison phase. Subjective conclusions are prone to interpretive errors that may include contextual and/or confirmation biasing information. These interpretive errors are subconscious and not the result of deliberate decisions or intentional manipulation of information.[92]

Contextual bias happens when extraneous information influences a decision. In the past, friction ridge examiners were routinely exposed to extraneous case information, but current published literature cautions against access to task irrelevant information. The assertion that extraneous case information could influence a friction ridge examiner's decision-making is demonstrated by at least one study in which friction ridge impressions that were initially determined to be source identifications were represented to the same examiners with case information inferring the questioned impressions were exclusions. As a result of this new contextual information, most experts in the study made different judgments and contradicted their own previous identification decisions.[93] The study showed that fingerprint identification decisions of experts are vulnerable to irrelevant and misleading contextual influences.[94] Other studies of fingerprint examiners and bias have generally shown the potential for task irrelevant information to influence fingerprint examiner decisions.[95] Furthermore, operational changes in the FBI Latent Print Unit included routine blind verification, resulting from lessons learned in the Mayfield case.

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[92] *See generally*, Hillary Moses Daluz, *Courtroom Testimony for Fingerprint Examiners* 155-161 (2nd ed., CRC Press 2021).

[93] Itiel Dror, David Charlton, and Ailsa E. Péron, *Contextual Information Renders Experts Vulnerable to Making Erroneous Identifications*, Forensic Sci. Int'l., January 6, 2006, at 74-78.

[94] *See*, Daluz, *supra* note 24 at 160.

[95] See generally: Dror IE, Charlton D. *Why experts make errors*. J Forensic Identification. 2006;56(4):600–616; Dror, et al. (2012) *The Impact of Human-Technology Cooperation and Distributed Cognition in Forensic Science: Biasing Effects of AFIS Contextual Information on Human Experts*. J Forensic Sci 57(2):343-352; Langenburg, G., C. Champod, et al. (2009). *"Testing for Potential Contextual Bias Effects During the Verification Stage of the ACE-V Methodology when Conducting Fingerprint Comparisons."* J Forensic Sci 54(3): 571-582.

Friction ridge examiners should not be exposed to task irrelevant information before conducting an examination. One strategy to mitigate contextual bias is a process known as "sequential unmasking."[96] The examination is performed in a linear sequence that shields the analyst from potentially biasing information until exposure to that information is necessary. This linear sequential unmasking approach ideally begins with an examination of the unknown mark before exposure to a known exemplar and ideally applies through a verification process that is blinded to the results of the original examiner.[97]

Unsurprisingly given the period in question, an independent reviewer would be unable to discern from a review of the technical record whether the original examiner in this case was exposed to or shielded from the task irrelevant fact that suspect exemplars submitted for re-examination were associated with CODIS hit(s). Not only is shielding examiners from potentially biasing information the most scientifically supportable approach, but research also shows that jurors may find experts less credible when they admit to having been exposed to potentially biasing task-irrelevant information.[98] Thus, from a risk management perspective, documentation of good scientific practice may also improve public confidence in individual forensic science service providers and the forensic science enterprise.

F. Friction Ridge Testimony Language Has Evolved

The complaint alleges that the RS&A Project Manager expressed her comparison opinion using language now recognized as scientifically invalid – *i.e.*, answering in the affirmative when asked if she was able to "match" the latent print to Webster's known print. The complaint further

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[96] *See*, Itiel Dror, William C. Thompson, et. al., *Context Management Toolbox: A Linear Sequential Unmasking (LSU) Approach for Minimizing Cognitive Bias in Forensic Decision Making*, J. Forensic Sci., July 2015, at 1111-1112. Kunkler, K., Roy, T., *Reducing the impact of cognitive bias in decision making: Practical actions for forensic science practitioners*, Forensic Science International: Synergy 7 (2023). doi.org/10.1016/j.fsisyn.2023.100341.

[97] *See, supra,* n 24 at 162.

[98] *See*, William C. Thompson & Nicholas Scurich, *How Cross-Examination on Subjectivity and Bias Affects Jurors' Evaluation of Forensic Science Evidence*, J. Forensic Sci., September 2019, at 1379-1388.

alleges the RS&A Project Manager cited the number of latent print comparisons performed in her career in response to questions concerning confidence in the accuracy of her conclusion. Following is the relevant testimony:

> Q. And was your conclusion regarding the identification as a result of the comparison of those two prints, was that consistent with the report that was issued in 2013?
>
> A. Yes, it was.
>
> Q. What degree of confidence or certainty as a print examiner can you give to any one of your conclusions in that comparison between prints?
>
> A. When you're making a conclusion for an identification, you have to have enough information present in both the known print and in the latent print to determine that they came from the same source. I've compared hundreds of thousands of fingerprints, and in my opinion, these did come from the same source.
>
> Q. And so the latent print that was submitted in this case, the bloody print from galvanized pipe, in your expert opinion, that matched the prints that now you've confirmed belong to this defendant here?
>
> A. Yes. They belong to the left palm print.

The use of "same source" language was common in the friction ridge discipline at the time of the RS&A Project Manager's testimony (*see, e.g.*, "individualization is the decision by an examiner that there are sufficient features in agreement to conclude that two areas of friction ridge impressions originated from the same source.").[99] Like many forensic disciplines, the friction ridge community is in the process of shifting away from individualization terminology.[100] For example, in the OSAC Proposed Standard for Friction Ridge Examination Conclusions, section 4.5 defines

[99] SWGFAST Guideline for the Articulation of the Decision-Making Process for the Individualization in Friction Ridge Examination (2013) Item 10.2.2.

[100] OSAC Proposed Guideline for the Articulation of the Decision-Making Process Leading to an Expert-Opinion of Source Identification in Friction Ridge Examinations (2017) Item 4.7.2.1.

a "source identification" in the form of a qualitative expression of a likelihood ratio and section 4.6.1 states "an examiner shall not assert that a source identification is the conclusion that two impressions were made by the same source or imply an individualization to the exclusion of all other sources." This is because lay jurors may understand "originated from the same source" or similar individualization language as precluding the possibility that another source, were it to be identified and compared, could also be the "same source." The 2012 SWGFAST Position Statement on Individualization/Identification referenced the inherent problem: "The ability of a latent print examiner to individualize a single latent impression, with the *implication* that they have definitely excluded all other humans in the world, is not supported by research . . . ."[101] Similarly, in 2012, the NIJ/NIST Latent Print Examination and Human Factors Report recommended that examiners not testify directly or by implication to a source attribution (*i.e.,* individualization.)[102]

The community has also shifted away from testifying that marks from a crime scene "match" the known prints of an individual because the term "match" risks misleading the factfinder by implying the association is to the exclusion of all others. In this case, the term "match" was introduced by the prosecutor during questioning, not by the examiner herself. When a lawyer asks poorly framed questions or uses outdated and/or improper terminology, an expert witness should endeavor to clarify the attorney's question in a way that corrects mistaken information imbedded in it. The same is true for yes/no questions that cannot be answered without risk of misleading the trier of fact. [103]

When asked about her level of confidence, the RS&A Project Manager referenced her experience in the field as an apparent measure of the accuracy of her conclusion. This was

[101] SWGFAST Individualization/Identification Position Statement, Item 11.2.2. [emphasis added.]
[102] NIJ/NIST Latent Print Examination and Human Factors Report, Recommendation 3.7.
[103] *See*, 37 Tex. Admin. Code Sec. 651.219 (b) (10) (2020) (Tex. Forensic Science Commission Code of Professional Responsibility).

common practice across several pattern analysis disciplines for decades (*e.g.*, microscopic hair comparison, firearms examination, footwear/tire, etc.). However, several more recent sources (including the Department of Justice Uniform Language for Testimony and Reports) caution that an examiner should not cite the number of friction ridge comparisons performed in his or her career as a measure for the accuracy of a conclusion offered.[104]

The complaint alleges the RS&A Project Manager characterized the latent print as a "blood print" on direct examination, but on cross-examination conceded that she could not say for certain the substance on the post was "blood." The complaint notes "the metal post was tested for DNA in 2021 and no human DNA was detected."

Amido black is a dye used to detect and enhance blood marks by staining proteins present in the blood a dark blue-black color. However, it can produce false positive results with other proteinaceous materials. Because amido black may not be used to confirm the presence of blood; other confirmatory test(s) should be performed.

A review of the RS&A Project Manager's testimony indicates the term "blood print on a galvanized pipe" was referenced by the prosecutor as a term taken from a report. The RS&A report states that the "location of the lift" identified as the left palm of Joseph Webster is listed as "blood print on a galvanized pipe." Throughout her direct-examination the substance on the post was loosely identified as blood, mostly through leading questions.

[104] An examiner shall not cite the number of forensic latent print examinations performed in his or her career as a direct measure for the accuracy of a conclusion provided. An examiner may cite the number of forensic latent print examinations performed in his or her career for the purpose of establishing, defending, or describing his or her qualifications or experience. DOJ Uniform Language for Testimony and Reports for Forensic Latent Print Discipline (2020); *See also* OSAC Proposed Standard for Friction Ridge Examination Conclusions 4.6.4 (2018).

When the topic of amido black was addressed on cross-examination, the RS&A Project Manager readily volunteered that the dye reacted with other proteins and was not specific to blood. She also explained that the origin of the term "blood print" was documentation on a photograph provided by HPD. She reiterated the term "blood" was not her conclusion, just a description borrowed from the police department.

The record indicates the print was referred to as a "bloody print" by many individuals (lawyers, law enforcement, etc.) throughout the trial, not just in the RS&A Project Manager's testimony. Stakeholders should guard against overstating the significance of a presumptive test or other non-specific testing procedure, unless the results are confirmed through additional testing. While jurors may deduce the presence or absence of blood based on crime scene photographs or other evidence presented during trial, forensic examiners have an obligation to maintain accuracy in describing the evidentiary items.

XII. RECOMMENDATIONS

The Commission makes the following recommendations with respect to all FSSPs that perform friction ridge examination in Texas,[105] understanding that a particular agency's ability to implement these items will necessarily depend on the availability of resources. The Commission also understands that changes take time to implement, and some FSSPs are reluctant to implement proposed standards, acknowledging the documents may change during the SDO process at ASB. To assist the community with evaluating questions regarding OSAC Proposed Standards, the Commission will work with the Texas Division of the International Association for Identification (TDIAI) OSAC Implementers Group, which will be instrumental in conducting outreach and supporting Texas practitioners with tools for standards gap analysis and implementation.

[105] None of these are accreditation "checklist" items because friction ridge is exempt from the Texas accreditation requirement under Texas Code of Criminal Procedure Art. 38.35.

Quality of Images

1. Examiners should make best efforts to obtain and examine the highest quality images available for both marks and reference exemplars, seeking (where possible) to obtain confirmation that the best available images were provided. Photocopies, facsimiles, overly compressed formats, and low-resolution images should be avoided to the extent possible.

Analysis Phase

2. Examiners should analyze and document the observable data in a questioned friction ridge impression before comparison with an exemplar friction ridge impression. *See*, OSAC Proposed Best Practice Recommendation for Analysis of Friction Ridge Impressions Item (2020) 4.1.2.[106]

3. FSSP documentation of the quality of the features and related observable data should include a marking system such as the GYRO System[107] or the NIST Markup Instructions for Extended Friction Ridge Instructions.[108] *See*, OSAC Proposed Best Practice Recommendation for Analysis of Friction Ridge Impressions (2020) 4.1.4.2.

   The difficulty and complexity (non-complex, low complexity, or high complexity) of friction ridge impressions should be assessed during the Analysis phase and documented in the report (or at a minimum, in the case technical records). *See*, OSAC Proposed Best Practice Recommendation for Analysis of Friction Ridge Impressions (2020) 4.1.8.4.

4. FSSPs should require additional quality control measures for impressions designated as difficult or complex. FSSPs should use difficulty and/or complexity of the comparison as assessed by the examiner to drive blind verification schemes. Particular attention should be paid to resource-efficient methods for including blind verification. *See*, OSAC Proposed Best Practice Recommendation for Analysis of Friction Ridge Impressions (2020) 4.1.6.

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[106] *See also*, ISO/IEC 17025:2017 Forensic Science Testing and Calibration Laboratories AR-3125 Item 7.2.1.1.2: "All test methods that involve the comparison of an unknown to a known for the purposes of source association shall require the evaluation of the unknown item(s) to identify characteristics suitable for comparison and, if applicable, characteristics suitable for statistical rarity calculations, prior to comparison to one or more known item(s)." (effective Jan. 2023).

[107] Langenburg, G., Champod, C (2011): *GYRO System – A Recommended Approach to More Transparent Documentation.* Journal of Forensic Identification 61(4): 373-384.

[108] NIST (National Institute of Standards and Technology) 2013. Markup Instructions for Extended Friction Ridge Features, NIST Special Publication (SP) 1511, DOI https://doi.org/10.6028/NIST.SP.1151 or NIST Publication Link: https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.1151.pdf

Comparison and Evaluation Phase

5. An exemplar impression should be selected to compare against the unknown impression (*i.e.*, the mark) and should take into consideration, among other things, the completeness of the recording of the impression. *See*, OSAC Proposed Best Practice Recommendation for Comparison and Evaluation of Friction Ridge Impressions (2020) 4.1.2.2.

6. Comparison of features should account for the features interpreted during Analysis. *See*, OSAC Proposed Best Practice Recommendation for Comparison and Evaluation of Friction Ridge Impressions (2020) 4.1.6.

7. Features of the two impressions should be assessed for correspondence or non-correspondence in a side-by-side comparison.[109] *See*, OSAC Proposed Best Practice Recommendation for Comparison and Evaluation of Friction Ridge Impressions (2020) 4.1.7.

8. Features assessed as corresponding should be documented for comparisons that will be evaluated for a source conclusion. *See*, OSAC Proposed Best Practice Recommendation for Comparison and Evaluation of Friction Ridge Impressions (2020) 4.1.8.

9. Documentation should distinguish between features initially interpreted during comparison and features interpreted during Analysis (prior to side-by-side comparison). *See*, OSAC Proposed Best Practice Recommendation for Comparison and Evaluation of Friction Ridge Impressions (2020) 4.1.8.4.

10. Once the features have been documented to support a source conclusion, the complexity of the Comparison process should be assessed and documented (non-complex comparison, low complexity comparison, high complexity comparison). *See*, OSAC Proposed Best Practice Recommendation for Comparison and Evaluation of Friction Ridge Impressions (2020) 4.1.9. [Note: this BPR document distinguishes a separate assessment for the complexity of the Comparison process, which may differ from the assessment of complexity of the mark in the Analysis phase].

11. The similarities and differences should be evaluated to formulate a source conclusion. *See*, OSAC Proposed Best Practice Recommendation for Comparison and Evaluation of Friction Ridge Impressions (2020) 4.2

12. Changes to the interpretation of observed data in the mark during the comparison of the exemplar impression should be documented such that they are clearly

[109] It is possible the "side-by-side" comparison language will evolve to include "top-to-bottom," physical or digital overlay as options for assessing impressions for correspondence. The Commission defers to the friction ridge subcommittee on the extent to which the "side-by-side" concept might include other approaches designed to achieve the same purpose.

distinguished from the observed data interpreted prior to comparison. *See*, OSAC Proposed Best Practice Recommendation for Comparison and Evaluation of Friction Ridge Impressions (2020) 4.2.4.

13. The technical record should include, among other things, documentation of each unknown and exemplar impression compared. *See*, OSAC Proposed Best Practice Recommendation for Comparison and Evaluation of Friction Ridge Impressions (2020) 4.2.5.

Conclusions

14. FSSPs should consider incorporating examination conclusions that expand on the traditional three-tiered decision categories (source identification, inconclusive, source exclusion) to a more nuanced decision expression.[110] The Commission recognizes that opinions on this subject are variable, and discussions are currently in progress. The Commission encourages all FSSPs to closely follow and participate in the standards development process. *See e.g.*, OSAC Proposed Standard for Friction Ridge Examination Conclusions (2018).

15. FSSPs should abandon the use of the term "non-identification." This term is ambiguous, confusing, has multiple meanings, and is highly misleading to end-users.

16. FSSPs should adopt clear criteria for all conclusions, being mindful of ongoing published research.[111] FSSPs should adopt appropriate quality assurance measures (*e.g.*, exclusion verification, automated searching tools, blinding procedures) for reducing errors.

Consultations and Disagreements

17. Consultations must be documented in the report (ideally) or case record (at a minimum) in the interest of full disclosure to legal stakeholders who rely on the information to fulfill their respective roles. Disagreements should be clearly identified in the report itself. A "consultation" may consist of varying levels of discussion between examiners. While not all discussions rise to the level of a consultation that requires documentation, the FSSP should be clear about what discussions do rise to this level. If there is doubt whether a discussion has risen to the level requiring documentation, it should be documented. *See*, OSAC Proposed Standard for Consultation During Friction Ridge Examination (2020).

[110] This weaknesses of the traditional three-layer conclusion scale are emphasized in *Interpol Review of Fingermarks and Other Body Impressions*, *supra* n. 52: "The authors have also observed that the use of three-level categorical conclusions scale (ID, Inconclusive, Exclusion) may understate or overstate the reproducibility of conclusions when compared to a seven-layer scale."

[111] For example, in Eldridge, et al. (2020), when a participant reported an exclusion decision for a palm print, they were incorrect 24% of the time (false negative discovery rate). Compare this to Ulery, et al. (2011) study where participants were incorrect 11% of the time when reporting an exclusion for a fingerprint.

Special Considerations re: Liquids

18. FSSPs should ensure that friction ridge examiners have specialized training addressing complex mark matrix/residue (such as liquids, blood, etc.). This training should include complex substrates beyond common flat, smooth surfaces (*e.g.*, curved surfaces, non-porous surfaces, textured surfaces, metal/galvanized surfaces). Such complex matrices and substrates should be included in proficiency and competency testing.

19. Examiners should be careful not to overstate the value of presumptive testing in the absence of confirmatory testing and should not mischaracterize the reaction of amido black or other analogous reagents to suspected blood as an indicator that the substance is in fact blood. While the jury may be permitted to draw inferences from a bloody crime scene, law enforcement agencies, examiners and lawyers should not overstate the conclusions that one may draw from a particular test.

Avoiding Experience as a Measure of Accuracy

20. An individual examiner should not cite the number of forensic latent print examinations performed in his or her career as a direct measure for the accuracy of a conclusion provided. However, an examiner may cite the number of forensic latent print examinations he or she performed for the purpose of establishing, defending, or describing his or her qualifications or experience.

Accreditation and Licensure

21. FSSPs should strive to achieve ISO/IEC 17025: 2017 accreditation where resources permit. Where FSSPs are unable to achieve accreditation due to resource limitations, they should still follow industry standards and best practices, including rigorous quality assurance processes and comprehensive documentation.

22. Individual examiners should participate in the Commission's voluntary licensure program for friction ridge examination, as it focuses on many critical aspects of the intersection between science and the criminal legal system (*e.g.*, legal disclosure; statistics for forensic application; evidence handling; root cause analysis; human factors; professional responsibility; courtroom testimony, etc.)

Discovery and Legal Disclosure Compliance

23. Stakeholders should obtain entire forensic technical records during discovery. Entire technical records include more than just the final report(s) issued by the FSSP and include bench notes, diagrams, annotations, photographs, etc. The Commission recently issued a final investigative report in a capital murder case that was reversed by the Court of Criminal Appeals. In that case, none of the legal stakeholders obtained or reviewed the bench notes showing improper storage

conditions.[112] In cases involving technical records beyond the expertise required of the lawyers, an expert should be retained to assist with the review.

24. We encourage all FSSPs, regardless of accreditation status, to adopt and follow a written forensic disclosure compliance policy for the purposes of complying with the Michael Morton Act, Article 39.14 Texas Code of Criminal Procedure. The policy should provide clear instructions for identifying and disclosing any exculpatory, impeachment, or mitigating document, item, or information in the possession, custody, or control of the laboratory. *See*, 37 Tex. Admin. Code - §651.219(c)(7) and (8) (2020).

The following observations pertain to ongoing efforts by the federal government in collaboration with state and local partners to improve forensic science in the United States:

25. The OSAC Friction Ridge subcommittee should consider alternatives to individualization terminology which carries a high risk of overstating the strength of an association (*e.g.*, move toward adoption of probabilities, likelihood ratios, or other continuous reporting methods).[113]

26. The OSAC Friction Ridge subcommittee should incorporate indicia of complexity beyond counting features. *See*, OSAC Proposed Best Practice Recommendation for Analysis of Friction Ridge Impressions (2020)

27. NIST and federal agencies with grant funding should assist state and local laboratories with the development of blind proficiency testing programs such as the program developed by HFSC.

28. Due to variations in feature selection, federal funding should be dedicated to the development of technological tools (automated quality mapping software, auto-encoding minutiae extractors), methods (OSAC Proposed Best Practice documents) or noise reduction techniques (consensus feature sets, crowdsourcing) to reduce variance and stabilize the feature selection process.

[112] Final Report on Houston Forensic Science Center Self-Disclosure No. 22.18, Forensic Biology/DNA; Trial Testimony of Stephen Adam Vinson.

[113] For example, the OSAC Proposed Standard for Friction Ridge Examination Conclusions attempts to distinguish "source identification" as different from "individualization." In the document, "source identification" is the strongest degree of association between two friction ridge impressions. Source identification is not meant to indicate a conclusion that two impressions were made by the same source or imply individualization to the exclusion of all other sources. The Commission encourages the OSAC Friction Ridge Subcommittee to continue to consider the extent to which the terms "source identification" and "individualization" may amount to a distinction without a difference from the perspective a criminal justice partner or lay juror.

29. Additional high-quality federally funded research is needed for all areas of friction ridge. When updating its research needs, the OSAC Friction Ridge Subcommittee should consider additional palm print research among its requests.

EXHIBIT A

This terminology exhibit consists of two documents.

The first is a *draft* compiled by the ASB Friction Ridge Consensus Body (Technical Report 016) that has not yet been through the public comment process. A copy of the document can be found at www.aafs.org/sites/default/files/media/documents/016_TR_Ballot01.pdf

The second is the SWGFAST Standard Terminology of Friction Ridge Examination (Document 19) (2013) that is included for historical reference and to aid in demonstrating the evolution of terminology in the discipline.

ASB Technical Report 016, First Edition
2022

Terminology Related to Friction Ridge Examination

Terminology Related to Friction Ridge Examination

ASB Approved Xxxxx 2021

410 North 21st Street
Colorado Springs, CO 80904

Foreword

This document was revised, prepared, and finalized as a standard by the Friction Ridge Consensus Body of the AAFS Standards Board. The draft of this standard was developed by the Friction Ridge Subcommittee of the Organization of Scientific Area Committees (OSAC) for Forensic Science.

The American Academy of Forensic Sciences established the Academy Standards Board (ASB) in 2015 with a vision of safeguarding Justice, Integrity and Fairness through Consensus Based American National Standards. To that end, the ASB develops consensus based forensic standards within a framework accredited by the American National Standards Institute (ANSI), and provides training to support those standards. ASB values integrity, scientific rigor, openness, due process, collaboration, excellence, diversity and inclusion. ASB is dedicated to developing and making freely accessible the highest quality documentary forensic science consensus Standards, Guidelines, Best Practices, and Technical Reports in a wide range of forensic science disciplines as a service to forensic practitioners and the legal system.

This document was revised, prepared, and finalized as a standard by the Friction Ridge Consensus Body of the AAFS Standards Board. The draft of this standard was developed by the Friction Ridge Subcommittee of the Organization of Scientific Area Committees (OSAC) for Forensic Science.

Questions, comments, and suggestions for the improvement of this document can be sent to AAFS-ASB Secretariat, asb@aafs.org or 401 N 21st Street, Colorado Springs, CO 80904.

All hyperlinks and web addresses shown in this document are current as of the publication date of this standard.

ASB procedures are publicly available, free of cost, at www.aafs.org/academy-standards-board.

Keywords: *terms, definitions, friction ridge, examination*

Table of Contents

Terminology Related to Friction Ridge Examination

1 Scope

This document provides a consolidated list of standardized terms and definitions related to friction ridge examination.

2 Terms and Definitions

2.1
ABIS
The acronym for Automated Biometric Identification System. A generic term for a computer based system which is a primary repository of individuals' biometrics (such as fingerprints, palm prints, facial and/or iris images) and secondary repository of associated demographic data, equipped with functionality to process biometric searches, store and retrieve records for identification purposes.

2.2
ACE (an examination method)
An examination method used to refer to Analysis, Comparison and Evaluation.

2.3
administrative information
Records—such as evidence receipts, chain of custody, and submission forms (electronic or hard copy)—that do not constitute data or information resulting from examination work.

2.4
administrative review
An evaluation of the report and supporting documentation for consistency with organizational policies and for editorial correctness.
OSAC Preferred Term

2.5
AFIS
The acronym for Automated Fingerprint Identification System. A generic term for a computer based system which is a primary repository of individuals' friction ridge detail (such as fingerprints and/or palm prints) and secondary repository of associated demographic data, equipped with functionality to process biometric searches, store and retrieve records for identification purposes.

2.6
agreement
correspondence
corresponding friction ridge detail
Observation of pattern type, ridge flow, and friction ridge features in sequence, of the same or similar type, in the same relative position to each other, with associated intervening ridge counts. An accumulation of similarities between two impressions resulting in overall conformity.

2.7
amended report
A report used to document any modifications from a previously issued report, particularly those that affect or correct an original result or interpretation.

2.8
analysis (phase of the Examination method)
The interpretation of observed data in a friction ridge impression in order to categorize its utility.

2.9
blind verification
A type of verification in which the subsequent examiner(s) has no knowledge of any other examiner's decisions, conclusions or observed data used to support the conclusion.

2.10
case record
A type of file (electronic or hard copy) in which all documentation and case relevant information is kept and maintained.

2.11
chain of custody
Chronological record of the handling and storage of an item from its point of collection to its final return or disposal.

NOTE Chain of custody is one element that contributes to the integrity of an item.
ISO 21043-1[a], OSAC Preferred Term

2.12
clarity
The fidelity and coherence with which the anatomical details of friction ridge skin are reproduced in a friction ridge impression, and are able to be visualized.
Hicklin paper[b]

2.13
cognitive bias
A set of influences that may affect the reliability and validity of one's observations and conclusions.
OSAC Preferred Term

2.14
comparison (phase of the Examination method)
The search for and detection of similarities and dissimilarities in observed data between friction ridge impressions.

2.15
competency
Possessing and demonstrating the requisite knowledge, skills and abilities to successfully perform a specific task.

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[b] Kalka, N.D., Beachler, M., Hicklin, R.A. (2020), LQMetric: A Latent Fingerprint Quality Metric for Predicting AFIS Performance and Assessing the Value of Latent Fingerprints, JFI 70(4): 443-463.

2.16
competency testing
Evaluation of a person's knowledge and ability to perform work before authorization to do so independently.
OSAC Preferred Term

2.17
competent friction ridge examiner (refer to examiner -friction ridge)
An individual who has successfully completed their FSP's training program and has demonstrated to the FSP that they possess the knowledge, skills, and abilities to perform the tasks required of their current position.

2.18
complexity (of a comparison)
A characteristic of a comparison in which the attributes of one or both impressions may require additional consideration and quality assurance measures relating to the evaluation of a source conclusion.

2.19
complexity (of an impression)
A characteristic of an impression whose attributes may require additional consideration and quality assurance measures.

2.20
conclusion
source conclusion
Opinion stated by an examiner after interpretation of observed data. The opinion is the personal judgment that the observed data can offer support for one proposition over another. A conclusion is distinct from a "*proposition.*"

2.21
confirmation bias
The tendency to search for data or interpret information in a manner that supports one's preconceptions, expectations or desires.
OSAC Preferred Term

2.22
conflict
A condition in which two or more examiners disagree on a suitability decision or source conclusion.

2.23
consensus review
consensus opinion
A type of examination in which a reported decision or conclusion is determined that reflects the collective judgment of a group of examiners.

2.24
consultation
A discussion or interaction initiated by an examiner seeking guidance for the purpose of interpreting an image or comparison.

2.25
contextual bias
A deviation in human judgment caused by exposure to information that is either irrelevant to the judgmental task or inappropriate for consideration.
OSAC Preferred Term

2.26
control
Material of established origin used to evaluate the performance of a test or comparison. Or a test performed to demonstrate that a test method works correctly and to ensure that data are valid. Positive controls confirm that the procedure will produce the expected result. Negative controls confirm that the procedure does not produce an unintended result.
OSAC Preferred Term

2.27
corrective action
Action to eliminate or mitigate the cause of a non-conformity and to prevent recurrence.

NOTE A corrective action is taken to prevent recurrence whereas preventive action is taken to prevent occurrence.
ISO 9000:2015[c] *(modified "or mitigate" added)*

2.28
customer
Client, authority, organization or person(s) requesting forensic services.
ISO 21043-1[d] *("the" deleted)*

2.29
disagreement
A dissimilarity, or an accumulation of dissimilarities, that is deemed to be outside of expected variations in the appearance of impressions from the same source, resulting in overall nonconformity.

2.30
discriminability
The degree to which information in an impression can be used to distinguish it from impressions made by different sources. The discriminability of an impression is a combination of the quantity, spatial arrangement, clarity, and rarity of features observed.

2.31
dissimilarity
An observation that two impressions have a general difference of appearance when comparing an individual feature or detail. Not to be confused with "*disagreement.*"

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[d] ©ISO. This material is reproduced from ISO 21043-1:2018 with permission of the American National Standards Institute (ANSI) on behalf of the International Organization for Standardization. All rights reserved.

2.32
enhancement
process to reveal, intensify, magnify, or clarify an observation or result.
ISO 21043-1[e]

2.33
evaluation (phase of the Examination method)
The weighting of the aggregate strength of the evidence (observed similarities and dissimilarities when considering two competing propositions) between the observed data in the friction ridge impressions being compared in order to formulate a source conclusion.

2.34
examiner (friction ridge)
An individual authorized to conduct independent friction ridge examinations for the forensic service provider by observing and interpreting data, making decisions, forming conclusions and opinions, issuing reports and/or providing testimony. Use of the term "*examiner*" in these documents refers to a "*competent friction ridge examiner*" and not a "*trainee*."

2.35
exemplar impression
exemplar or known
exemplar prints
The deliberately recorded images or impressions from the friction ridge skin of an individual.

NOTE Examples may include, but are not limited to, inked tenprints, inked palm prints, Livescan prints, powder and lift prints, casted/moulded prints, or photographs of friction ridge skin.

2.36
forensic service provider
FSP
Organization or individual that conducts and/or supplies forensic services.
ISO 21043-1[f]

2.37
friction ridge detail
friction ridge features
The combination of ridge flow, ridge characteristics, and ridge structure of friction ridge skin, as reproduced and observed in an impression. The observed data used to compare and interpret similarity or dissimilarity between impressions.

2.38
friction ridge skin
The skin found on the palms of the hands (full palmar surface including fingers) and soles of the feet (full plantar surface including toes).

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2.39
high quality impression
An impression with observed data that are unambiguous and self-evident due to high clarity and quantity

2.40
impression
friction ridge impression
A reproduction of an area of friction ridge skin produced on a substrate by contact or transfer. Impressions may be referred to as *exemplar impressions*, *latent impressions*, or *questioned impressions* (refer to those definitions for further clarification).

2.41
inconclusive
INC
The conclusion that the observed data does not provide more support for one proposition over the other.

2.42
inconclusive with dissimilarities
The conclusion that the observed data provide more support for the proposition that the impressions originated from different sources rather than the same source; however, there is insufficient support for a Source Exclusion.

2.43
inconclusive with similarities
The conclusion that the observed data provide more support for the proposition that the impressions originated from the same source rather than different sources; however, there is insufficient support for a Source Identification.

2.44
interlaboratory comparison
Organization, performance, and evaluation of measurements or tests on the same or similar items by two or more laboratories in accordance with predetermined conditions.
OSAC Preferred Term

2.45
interpretation
Explanations for the observations, data and calculations.
OSAC Preferred Term

2.46
intralaboratory comparison
Organization, performance, and evaluation of measurements or tests on the same or similar items within the same laboratory in accordance with predetermined conditions.
OSAC Preferred Term

2.47
item
Object, substance or material that is collected, derived or sampled as part of the forensic process.
ISO 21043-1[g]

2.48
latent impression
latent or unknown
fingermark (as opposed to fingerprint)
An impression from an unknown source of friction ridge skin, usually deposited on a substrate unintentionally. Typically, latent impressions are not readily visible and can be developed or enhanced by optical, physical, and/or chemical processing techniques.

2.49
livescan impression
An inkless, electronic means of capturing impressions from the friction ridge skin of an individual associated with a known source or claimed identity in a digital format.

2.50
minutia
The point where a friction ridge terminates, or splits into two or more ridges. A subset of the friction ridge detail/features traditionally consisting of ridge endings, bifurcations, and dots used to compare and interpret similarity and dissimilarity between two impressions.

2.51
nonconforming work
Work that does not comply with FSP policies and procedures.

2.52
observation
Recognizing and noting an occurrence.
OSAC Preferred Term

2.53
observed data
Any information seen within an impression that an examiner relies upon to reach a decision, conclusion, or opinion. This not only includes minutiae, but attributes such as clarity, scars, creases, edge shapes, pore structure, and other friction ridge features.

2.54
open (non-blind) verification
A type of verification in which the subsequent examiner knows the identity of the other examiner(s) and has access to their decisions, conclusions or observed data used to support their conclusion.

2.55
opinion
View, judgment, belief – takes into consideration other information in addition to observations, data, calculations and interpretations.
OSAC Preferred Term

2.56
pattern force area
A region of friction ridge skin which in theory, minutiae were forced to form due to pattern type and existing ridge fields during friction ridge formation. As these minutiae form more predictably, their configurations are more common and less random.

NOTE For example, in the outflow of a loop, many ridges converged during formation, which forced many ridge endings to form as space ran out.

2.57
peer review
An independent evaluation of a scientific, professional, or academic manuscript or publication, by a qualified second party, to evaluate the claims, methods, interpretations, and conclusions.
OSAC Preferred Term

2.58
preventive action
Action to eliminate the cause of a potential non-conformity or other potential undesirable situation.

NOTE A preventive action is taken to prevent occurrence whereas a corrective action is taken to prevent recurrence.
ISO 9000:2015[h]

2.59
probability
An expression of the chance that a particular event occurs.

2.60
proficiency testing
Evaluation of participant performance against pre-established criteria by means of interlaboratory comparisons.
OSAC Preferred Term

2.61
propositions
Hypotheses about the actual state of nature or an event, which is unknown or unknowable. Not to be confused with "*conclusions*," nor "*source conclusions"* (refer to those definitions for further clarification).

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2.62
quality assurance measures
Steps taken by an FSP to detect, correct, minimize and/or prevent non conforming work.

NOTE This may include, but is not limited to, root cause analysis, additional verification, non-conformity assessment, audits and corrective and/or preventive actions.

2.63
questioned impression (also questioned image or questioned item)
An impression or image of friction ridge skin whose source or identity is unknown; it can include latent impressions, impressions from an unknown source or a known source.

2.64
rarity (of a feature type)
The frequency or prevalence of a friction ridge feature, either in isolation or in conjunction with other information about its local context.

NOTE For example, the prevalence of a type of feature could be affected by its proximity to a pattern force area, the finger number or palmar region on which it is located, or the pattern type in which it is located.

2.65
record
Document providing information on observations or activities performed during examination.
ISO 21043-1[i] *("during examination" added for clarification)*

2.66
reliability, evidentiary/legal
Credibility and trustworthiness of proffered evidence.
OSAC Preferred Term

2.67
reliability, statistical
Consistency of results as demonstrated by reproducibility or repeatability.
OSAC Preferred Term

2.68
repeatability
Extent of agreement between more than one result determined in the same place, by the same person, on the same equipment, in the same way at similar times.
OSAC Preferred Term

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2.69
report
communication of outcomes of the forensic process.

EXAMPLE observations, findings, interpretations, conclusions and/or opinions.
ISO 21043-1[j]

2.70
reproducibility
replicability
Extent of agreement between more than one result determined under any combination of different conditions.
OSAC Preferred Term

2.71
result
The product of the forensic service provider. This term is broad and includes observations, data, calculations, interpretations and opinions.
OSAC Preferred Term

2.72
risk assessment
Systematic process of the identification and evaluation of perceived or potential risks throughout the forensic process.
ISO 21043-1[k]

2.73
sample
Portion drawn from a whole or population for the purpose of examination/testing, not necessarily representative of the whole.

NOTE This includes biological material taken from a person (e.g., hair blood, saliva).
ISO 21043-1[l]

2.74
scene
Place or object that is subject to and/or requires forensic examination.

NOTE A crime scene is a common description of a scene where a presumed crime has been committed. The scene can be a person or an animal.
ISO 21043-1[m]

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2.75
similarity
An observation that two impressions share a general likeness when comparing an individual feature or detail. Not to be confused with "*correspondence*."

2.76
source
An area of friction ridge skin of an individual from which an impression originated.
The Fingerprint Sourcebook

2.77
source exclusion
EXC
The conclusion that the observed data provide substantially stronger support for the proposition that the questioned impression originated from a different source than the exemplar impressions compared.

2.78
source identification
ID
The conclusion that the observed data provide substantially stronger support for the proposition that the two impressions originated from the same source rather than different sources.

2.79
stakeholder (interested party)
A person or organization that can affect, be affected by, or perceive itself to be affected by a decision or activity.
ISO 9000:2015[n]

2.80
standard operating procedure
SOP
Authorized, documented, specified way to carry out an activity or process.
ISO 21043-1[o]

2.81
strength of the evidence
A means of describing the relative support the evidence lends to one proposition over another. It may be described verbally or numerically.

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2.82
substrate
Surface or material upon which a substance is deposited.
ISO 21043-1[p]

2.83
suitability decision
utility decision
A decision made by an examiner in accordance with FSP policy and/or procedure as to whether or not an impression will proceed to the next step in the examination process.

2.84
suitability for Automated Biometric Identification System (ABIS) searches
utility for Automated Biometric Identification System (ABIS) searches
A decision made by an examiner in accordance with FSP policy and/or procedure as to whether or not an impression will proceed to an ABIS database search.

NOTE This designation is often referred to as "suitable for ABIS/AFIS" or "of value for ABIS/AFIS".

2.85
supplemental report
A report used to document additional work performed with subsequent reporting of results.

2.86
target group
A specific set of friction ridge features selected as a starting point during comparison.

2.87
technical review
A qualified second party's evaluation of reports, notes, data, and other documentation to ensure there is appropriate and sufficient support for the actions, results, conclusions, opinions, and interpretations.
OSAC Preferred Term

2.88
trainee
An individual not yet authorized to conduct independent friction ridge examinations for the FSP; usually still in training.

2.89
utility
The usefulness of an impression for a further step in the examination process, such as comparison or Automated Biometric Identification System (ABIS) entry.

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2.90
validation
A process of evaluating a system, method or component to determine that requirements for an intended use or application have been fulfilled.
OSAC Preferred Term

2.91
verification (phase of examination method)
Independent examination by one or more examiners to ascertain if a decision, conclusion, or opinion is reproduced or is in conflict with the decision, conclusion, or opinion of another examiner.

NOTE 1 Verification may be implemented in multiple ways including blind verification, open verification and consensus review. The general term verification is inclusive of these various types.

NOTE 2 Verification is a quality assurance measure for friction ridge examination.

NOTE 3 The use of the term "independent" indicates an autonomous examination but not necessarily one without knowledge of a prior decision, conclusion or opinion.

2.92
verification (analytical)
Performing subsequent testing to ascertain if the results are concordant.
OSAC Preferred Term

Bibliography

1] ISO 9000:2015, *Quality management systems — Fundamentals and vocabulary*, Fourth Edition[q]

2] ISO 21043-1:2018, *Forensic sciences — Part 1: Terms and definitions*, First Edition[r]

3] Kalka, N.D., Beachler, M., Hicklin, R.A. (2020), LQMetric: A Latent Fingerprint Quality Metric for Predicting AFIS Performance and Assessing the Value of Latent Fingerprints, JFI 70(4): 443-463.

4] OSAC Preferred Terms https://www.nist.gov/osac/osac-lexicon

[q] Available from: https://www.iso.org/standard/45481.html
[r] Available from: https://www.iso.org/standard/69732.html

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Document #19

Standard Terminology of Friction Ridge Examination[1] (Latent/Tenprint)

ACE-V

The acronym for a scientific method; Analysis, Comparison, Evaluation, and Verification (see individual terms).

AFIS

The acronym for Automated Fingerprint Identification System, a generic term for a fingerprint matching, storage, and retrieval system.

Analysis

The first step of the ACE-V method. The assessment of an impression to determine suitability for comparison.

APIS

The acronym for Automated Palmprint Identification System, a generic term for a palmprint (or complete friction ridge exemplar) matching, storage, and retrieval system.

Arch – plain

A pattern type in which the friction ridges enter on one side of the impression and flow, or tend to flow, out the other side with a rise or wave in the center.

Arch - tented

A pattern type that possesses either an angle, an upthrust, or two of the three basic characteristics of the loop.

Artifact

1. Any distortion or alteration not in the original friction ridge impression, produced by an external agent or action.

[1] This document provides standard definitions for relevant terminology used in the friction ridge discipline. Common definitions found in other reference sources may not be included.

2. Any information not present in the original object or image, inadvertently introduced by image capture, processing, compressions, transmission, display, or printing.

Bias

See cognitive bias, confirmation bias, and contextual bias.

Bifurcation

The point at which one friction ridge divides into two friction ridges.

Blind verification

The independent examination of one or more friction ridge impressions at any stage of the ACE process by another competent examiner who is provided with no, or limited, contextual information, and has no expectation or knowledge of the determinations or conclusions of the original examiner.

Bridge

A connecting friction ridge between, and generally at right angles to, parallel running friction ridges.

Characteristics

Distinctive details of the friction ridges, including Level 1, 2, and 3 details (also known as features).

Cognitive bias

The effect of perceptual or mental processes on the reliability and validity of one's observations and conclusions.

Comparison

The second step of the ACE-V method. The observation of two or more impressions to determine the existence of discrepancies, dissimilarities, or similarities.

Competency

Possessing and demonstrating the requisite knowledge, skills, and abilities to successfully perform a specific task.

Complete friction ridge exemplars

A systematic recording of all friction ridge detail appearing on the palmar sides of the hands. This includes the extreme sides of the palms, joints, tips, and sides of the fingers (also known as major case prints).

Complex examinations

The encountering of uncommon circumstances during an examination (e.g., the existence of high distortion, low quality or quantity, the possibility of simultaneity, or conflicts among examiners).

Consensus determination or conclusion

Agreement reflecting the collective judgment of a group of examiners trained to competency when making determinations or conclusions with respect to one or more impressions.

Conclusion

Determination made during the evaluation stage of ACE-V, including individualization, inconclusive, exclusion.

Confirmation bias

The tendency to search for data or interpret information in a manner that supports one's preconceptions.

Conflict

A difference of determinations or conclusions that becomes apparent during, or at the end of, an examination.

Consultation

A significant interaction between examiners regarding one or more impressions in question.

Contextual bias

The effect of information or outside influences on the evaluation and interpretation of data.

Core

1. The approximate center of a fingerprint pattern.
2. A specific formation within a fingerprint pattern, defined by classification systems such as Henry.

Delta

The point on a friction ridge at or nearest to the point of divergence of two type lines, and located at or directly in front of the point of divergence. Also known as a tri-radius.

Deviation

1. A change in friction ridge path.
2. An alteration or departure from a documented policy or standard procedure.

Discrepancy

The presence of friction ridge detail in one impression that does not exist in the corresponding area of another impression (compare with dissimilarity).

Dissimilarity

A difference in appearance between two friction ridge impressions (compare with discrepancy).

Dissociated ridges

1. Disrupted, rather than continuous, friction ridges.
2. An area of friction ridge units that did not form into friction ridges, generally due to a genetic abnormality.

Distortion

Variances in the reproduction of friction skin caused by factors such as pressure, movement, force, and contact surface.

Dot

An isolated friction ridge unit whose length approximates its width in size.

Edgeoscopy

1. Study of the morphological characteristics of friction ridges.
2. Contour or shape of the edges of friction ridges.

Elimination prints

Exemplars of friction ridge skin detail of persons known to have had legitimate access to an object or location.

Enclosure

A single friction ridge that bifurcates and rejoins after a short course and continues as a single friction ridge.

Ending ridge

A single friction ridge that terminates within the friction ridge structure.

Erroneous exclusion

The incorrect determination that two areas of friction ridge impressions did not originate from the same source.

Erroneous individualization

The incorrect determination that two areas of friction ridge impressions originated from the same source.

Error

A conclusion reached by an examiner that contradicts the mating status of two impressions, and therefore is probably wrong (compare with non-consensus decision.

Evaluation

The third step of the ACE-V method wherein an examiner assesses the value of the details observed during the analysis and the comparison steps and reaches a conclusion.

Exclusion

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.

Exemplars

The prints of an individual, associated with a known or claimed identity, and deliberately recorded electronically, by ink, or by another medium (also known as known prints).

False-negative rate (FNR)

The proportion of the comparisons between mated prints that result in an erroneous exclusion conclusion.

False-positive rate (FPR)

The proportion of the comparisons between non-mated prints that result in an erroneous individualization conclusion.

Features

Distinctive details of the friction ridges, including Level 1, 2, and 3 details (also known as characteristics).

Fingerprint

An impression of the friction ridges of all or any part of the finger.

Focal points

1. In classification, the core(s) and the delta(s) of a fingerprint.
2. Another term for target group.

Friction ridge

A raised portion of the epidermis on the palmar or plantar skin, consisting of one or more connected ridge units.

Friction ridge detail (morphology)

An area comprised of the combination of ridge flow, ridge characteristics, and ridge structure.

Friction ridge examiner

A person who analyzes, compares, evaluates, and verifies friction ridge impressions.

Friction ridge unit

A single section of ridge containing one pore.

Furrows

Valleys or depressions between friction ridges.

Galton details

Term referring to friction ridge characteristics (also known as minutiae) attributed to the research of English fingerprint pioneer, Sir Francis Galton.

Ground truth

Definitive knowledge of the actual source of an impression.

Henry Classification

An alpha-numeric system of fingerprint classification named after Sir Edward Richard Henry used for filing, searching, and retrieving tenprint records.

IAFIS

The acronym for Integrated Automated Fingerprint Identification System, the FBI's national AFIS.

Identification

1. See individualization.
2. In some forensic disciplines, this term denotes the similarity of class characteristics.

Impression

Friction ridge detail deposited on a surface.

Incipient ridge

A friction ridge not fully developed that may appear shorter and thinner than fully developed friction ridges.

Inconclusive

The determination by an examiner that there is neither sufficient agreement to individualize, nor sufficient disagreement to exclude.

Individualization

The determination by an examiner that there is sufficient quality and quantity of detail in agreement to conclude that two friction ridge impressions originated from the same source.

Joint (of the finger)

The hinged area that separates segments of the finger.

Known prints (finger, palm, foot)

The prints of an individual, associated with a known or claimed identity, and deliberately recorded electronically, by ink, or by another medium (also known as exemplars).

Latent print

1. Transferred impression of friction ridge detail not readily visible.
2. Generic term used for unintentionally deposited friction ridge detail.

Level 1 detail

Friction ridge flow, pattern type, and general morphological information.

Level 2 detail

Individual friction ridge paths and associated events, including minutiae.

Level 3 detail

Friction ridge dimensional attributes, such as width, edge shapes, and pores.

Lift

An adhesive or other medium used to transfer a friction ridge impression from a substrate.

Loop

A pattern type in which one or more friction ridges enter upon one side, recurve, touch or pass an imaginary line between delta and core and flow out, or tend to flow out, on the same side the friction ridges entered. Types include left slant loops, in which the pattern flows to the left in the impression; right slant loops, in which the pattern flows to the right in the impression; radial loops, in which the pattern flows in the direction of the radius bone of the forearm (toward the thumb); and ulnar loops, in which the pattern flows in the direction of the ulna bone of the forearm (toward the little finger).

Major case print

A systematic recording of the friction ridge detail appearing on the palmar sides of the hands. This includes the extreme sides of the palms, joints, tips, and sides of the fingers (also known as complete friction ridge exemplars).

Mark

Term commonly used in the United Kingdom and some Commonwealth countries to designate a latent print.

Mated impressions

Impressions intentionally collected to originate from the same source, and used for the purpose of measuring error rates.

Matrix

The substance that is deposited or removed by the friction ridge skin when making an impression.

Minutiae

Events along a ridge path, including bifurcations, ending ridges, and dots (also known as Galton details).

Missed exclusion

The failure to make an exclusion when in fact the friction ridge impressions are non-mated (includes false positive, non-consensus inconclusive and non-consensus no value).

Missed individualization

The failure to make an individualization when in fact both friction ridge impressions are are mated (includes false negative, non-consensus inconclusive and non-consensus no value).

Negative predictive value (NPV)

The proportion of exclusion determinations that are correct.

NGI

The acronym for Next Generation Identification, the updated version of IAFIS.

Non-consensus determinations of no value

Decisions of no value that conflict with the consensus.

Non-consensus determination of suitability

When an examiner's determination of suitability does not concur with consensus. Suitability determinations include non-consensus no value, and non-consensus value decisions.

Non-consensus determination of value

Decisions of value that conflict with the consensus.

Non-consensus exclusion conclusion

When an examiner reaches a decision of exclusion that conflicts with the consensus, exclusive of false negative errors.

Non-consensus inconclusive

When an examiner reaches a decision of inconclusive that conflicts with the consensus, exclusive of false positive and negative errors.

Non-consensus individualization conclusion

When an examiner reaches a decision of individualization that conflicts with the consensus, exclusive of false positive errors.

Non-mated impressions

Impressions intentionally collected to originate from different sources, and used for the purpose of measuring error rates.

Original image

An accurate replica (pixel for pixel) of the primary image.

Palmprint

An impression of the friction ridges of all or any part of the palmar surface of the hand.

Pattern classification

Sub-division of pattern type, defined by classification systems such as Henry or National Crime Information Center (NCIC) classifications.

Pattern type

Fundamental pattern of the ridge flow: arch, loop, whorl. Arches are subdivided into plain and tented arches; loops are subdivided into radial and ulnar loops; whorls are subdivided into plain whorls, double loops, pocket loops, and accidental whorls.

Phalanx/Phalange

1. A bone of the finger or toe.
2. Sometimes used to refer to a segment of a finger.

Poroscopy

A study of the size, shape, and arrangement of pores.

Positive predictive value (PPV)

The proportion of individualization decisions that are correct.

Primary image

The first recording of an image onto media.

Proficiency

The ongoing demonstration of competency.

Quality

The clarity of information contained within a friction ridge impression.

Quantity

The amount of information contained within a friction ridge impression.

Ridge flow

1. The direction of one or more friction ridges.
2. A component of Level 1 detail.

Ridge path

1. The course of a single friction ridge.
2. A component of Level 2 detail.

Ridge unit

See friction ridge unit.

Segment (of the finger)

The proximal, medial, or distal section of the finger.

Short ridge

A single friction ridge beginning, traveling a short distance, and then ending.

Simultaneous impression

Two or more friction ridge impressions from the same hand or foot deposited concurrently.

Source

An area of friction ridge skin from an individual from which an impression originated.

Spur

A bifurcation with one short friction ridge branching off a longer friction ridge.

Stand-alone

A segment of a simultaneous impression that has sufficient information to arrive at a conclusion of individualization independent of other impressions within the aggregate.

Substrate

The surface upon which a friction ridge impression is deposited.

Sufficiency

The product of the quality and quantity of the objective data under observation (e.g., friction ridge, crease, and scar features).

Sufficient

The determination that there is sufficiency in a comparison to reach a conclusion at the evaluation stage.

Suitable

The determination that there is sufficiency in an impression to be of value for further analysis or comparison.

Target group

A distinctive group of ridge features (and their relationships) that can be recognized.

Technical review

Review of notes, documents, and other data that forms the basis for a scientific conclusion (see *ASCLD-LAB 2008 Manual*).

Tenprint

1. A generic reference to examinations performed on intentionally recorded friction ridge impressions.
2. A controlled recording of an individual's available fingers using ink, electronic imaging, or other medium.

Tolerance

The amount of variation in appearance of friction ridge features to be allowed during a comparison, should a corresponding print be made available.

Trifurcation

The point at which one friction ridge divides into three friction ridges.

Type lines

The two innermost friction ridges associated with a delta that parallel, diverge, and surround or tend to surround the pattern area.

Verification

The independent application of the ACE process as utilized by a subsequent examiner to either support or refute the conclusions of the original examiner; this may be conducted as blind verification. Verification may be followed by some level of review as specified by agency policy.

Whorl - accidental

1. A pattern type consisting of the combination of two different types of patterns (excluding the plain arch) with two or more deltas.
2. A pattern type that possesses some of the requirements for two or more different types of patterns.
3. A pattern type that conforms to none of the definitions of a pattern.

Whorl - central pocket loop

A pattern type that has two deltas and at least one friction ridge that makes, or tends to make, one complete circuit, which may be spiral, oval, circular, or any variant of a circle. An imaginary line drawn between the two deltas must not touch or cross any recurving friction ridges within the inner pattern area.

Whorl - double loop

A pattern type that consists of two separate loop formations with two separate and distinct sets of shoulders and two deltas.

Whorl - plain

A fingerprint pattern type that consists of one or more friction ridges that make, or tends to make, a complete circuit, with two deltas, between which, when an imaginary line is drawn, at least one recurving friction ridge within the inner pattern area is cut or touched.

1. Revision Table

Version	Effective Start	Effective End	Posted	Archived	Change
3.1	02/11/11	11/16/12	09/04/12	11/16/12	Added in terms from new documents
4.0	11/16/12	N/A	11/24/12	N/A	No change to content Reformatted (start of new version number)
4.1	03/14/13	N/A	04/27/13	N/A	Change in definition of “original image”

EXHIBIT B

1. PERSON COMPLETING THIS FORM

Name: Maggie Kiely
Address: 1201 Franklin, Floor 13
City: Houston
State: Texas Zip Code: 77002
Home Phone: N/A
Work Phone: 713-274-7209
Email Address *(if any)*: maggie.kiely@pdo.hctx.net

2. SUBJECT OF COMPLAINT

List the full name, address of the laboratory, facility or individual that is the subject of this disclosure:

Individual/Laboratory: RSA/Anne Steinmetz
Address: P.O. Box 670
City: Collinsville
State: Missouri Zip Code: 39323
Date of Examination, Analysis, or Report: Dec. 13, 20
Type of forensic analysis: Latent print comparison
Laboratory Case Number *(if known)*: HPD Incident # 1

Is the forensic analysis associated with any law enforcement investigation, prosecution or criminal litigation?
Yes ☒ No ☐

* If you answered "Yes" above, provide the following information *(if possible)*:

* Name of Defendant: Joseph Webster

* Case Number/Cause Number: 1470226
(if unknown, leave blank)

* Nature of Case: Murder
(e.g burglary, murder, etc.)

* The county where case was investigated, prosecuted or filed: Harris County

* The Court: 176th District Court

* The Outcome of Case:
Guilty; Life in prison

* Names of attorneys in case on both sides *(if known)*:
Defense - Joseph Owmby
State - Justin Wood, Cameron Calligan

Your relationship with the defendant:

Self	☐	Family Member	☐
Parent	☐	Friend Attorney	☒
None	☐	Other *(please specify)*:	

Habeas attorney

If you are not the defendant, please provide us with the following information regarding the defendant:
Name: Joseph Webster
Address *(if known)*: Terrell Unit, 1300 FM 655 Rosha
Home Phone: N/A
Work Phone: N/A

3. WITNESSES

Provide the following about any person with factual knowledge or expertise regarding the facts of the disclosure. Attach separate sheet(s), if necessary.

First Witness *(if any)*:
Name:
Address:
Daytime Phone:
Evening Phone:
Fax:
Email Address:

Second Witness *(if any)*:
Name:
Address:
Daytime Phone:
Evening Phone:
Fax:
Email Address:

Third Witness *(if any)*:
Name:
Address:
Daytime Phone:
Evening Phone:
Fax:
Email Address:

4. DESCRIPTION OF COMPLAINT

Please write a brief statement of the event(s), acts or omissions that are the subject of the disclosure.

In 2001, a woman was found dead in an alley alcove in downtown Houston. A latent palm print was found on a metal pole near the victim's body and treated with amido black, resulting in a positive reaction. Houston PD compared the latent print against a number of suspects, including Webster, and no identification resulted. In 2011, examiners from Ron Smith & Assoc. (RSA, who, at the time, was under contract by HPD) re-worked the case and compared the latent print to 51 suspects, including Webster, and reached a "no identification" conclusion. In 2013, following information pertaining to a DNA hit on Webster and another suspect, RSA was asked to perform another comparison of the latent print against Webster and the other suspect. During Webster's 2016 murder trial, Anne Steinmetz, who was an RSA supervisor at the time, testified that the 2013 comparison resulted in a "positive identification," and that the latent print found at the crime scene "belong[s] to the left palm print" of Webster. The State's case hinged entirely on Steinmetz's "positive identification" testimony. Since the trial, three blind examinations have been conducted comparing the latent print and Webster's print (among two others), and all three have resulted in "inconclusive." Additionally, expert Henry Swofford assessed the quality of minutiae of the latent print using objective quality metrics (LQMetric) and expert consensus and concluded that the "quality and quantity of minutiae available on the latent print is insufficient to support a conclusion of Source Identification based on criteria set forth by the OSAC Friction Ridge Subcommittee."

Complaint #1: The "positive identification" conclusion Steinmetz testified she and other RSA examiners reached is not reproducible.

Complaint #2: During her testimony, Steinmetz expressed her comparison conclusion using language that has been recognized as scientifically invalid – i.e. "same source," answering in the affirmative when asked if she was able to "match" the latent print to Webster's print. Steinmetz also cited the number of latent print comparisons performed in her career in response to questions concerning the confidence in the accuracy of her conclusion.

Complaint #3: Steinmetz characterized the latent print as a "blood print" on direct examination, but on cross conceded that she could not say for certain that the substance on the pole was "blood." NOTE: The metal pole was tested for DNA in 2021 and no human DNA was detected.

Complaint #4: The quality of the evidence does not meet established criteria to support an "identification" as set forth by the OSAC Friction Ridge Subcommittee Best Practice Recommendations for Analysis and Comparison & Evaluation.

5. EXHIBITS AND ATTACHMENT(S)

Whenever possible, disclosures should be accompanied by readable copies **(NO ORIGINALS)** of any laboratory reports, relevant witness testimony, affidavits of experts about the forensic analysis, or other documents related to your disclosure. Please list and attach any documents that might assist the Commission in evaluating the complaint. Documents provided will **NOT** be returned. List of attachments:

Exhibit 1: Testimony of Anne Steinmetz from Webster's 2016 murder trial

Exhibit 2: Email thread between RSA employee Paul Chamberlain and ADA William Exley stating that HPD compared the latent print against Webster's and no identification resulted (See bottom of the first page)

Exhibit 3: 2011 Lab report from RSA latent print comparison resulting in "no identification"

Exhibit 4: 2013 Lab report from RSA latent print comparison (involving Anne Steinmetz) resulting in Webster being identified as source of latent print

Exhibit 5: 2021 Lab report from Houston Forensic Science Center latent print blind comparison resulting in "inconclusive"

Exhibit 6: Affidavit of latent print expert Henry Swofford and image of LQMetric assessment of latent print

Exhibit 7: Affidavit of latent print expert Carey Hall who conducted a blind comparison of the latent print against Webster's and two other suspects' known prints and found "no meaningful correspondence"

Exhibit 8: Analysis of Steinmetz's trial testimony compiled by Harris County Public Defenders Office investigator C.J. Connelly

Exhibit 9: 2021 lab report from Houston Forensic Science Center showing that no human DNA was detected on the metal pole the latent print was found on

6. YOUR SIGNATURE AND VERIFICATION

By signing below, I certify that the statements made by me in this disclosure are true. I also certify that any documents or exhibits attached are true and correct copies, to the best of my knowledge.

Signature:

Date Signed: 2022.04.01

EXHIBIT C

EXHIBIT
6

AFFIDAVIT OF HENRY SWOFFORD

I, HENRY SWOFFORD, state that the following is true and correct to the best of my knowledge:

1. My name is Henry Swofford. I live in Washington, D.C. I am over 18 years of age and competent to make this affidavit.

2. I am an independent forensic consultant certified by the International Association for Identification (IAI) to perform forensic examinations of latent print evidence. I have been certified by the IAI since 2010 and I have testified as an expert in latent print examinations on multiple occasions in military, federal, and state courts. I have a Bachelor of Science Degree in Biology with a minor in Chemistry from Georgia State University and a Master's of Science degree in Forensic Science from the University of Florida.

3. Prior to becoming an independent forensic consultant, I was employed for ten years by the United States Army Criminal Investigation Laboratory (USACIL)—the only full-service forensic laboratory supporting the Department of Defense—where I served as the Chief of the Latent Print Branch for the last four years (approximately) of my tenure. In this capacity, I was responsible for conducting and overseeing forensic latent print operations in support of the criminal investigative mission of the Department of Defense worldwide. During my tenure at the USACIL, I also served as a Physical Scientist/Latent Print Examiner, Research Coordinator, and Quality Assurance Manager. Prior to the USACIL, I served as a laboratory technician at the Georgia Bureau of Investigation Division of Forensic Sciences.

4. I have successfully completed a formal training program by the USACIL to perform latent print examinations, which consisted of a series of academic and practical training exercises and competency tests. I have completed numerous residency courses, participated in professional conferences, and served on several professional committees and boards related to latent print examination.

5. I currently serve as the Chair of the Friction Ridge Subcommittee for the Organization of Scientific Area Committees (OSAC), which is administered by the National Institute of Standards and Technology

(NIST) and responsible for developing minimum standards and best practice recommendations related to latent print examination throughout the United States. I also serve as a member of the Physics/Pattern Scientific Area Committee of the OSAC, which is responsible for providing general guidance and oversight to five pattern evidence subcommittees (bloodstain pattern analysis, firearms & toolmarks, footwear & tire, forensic document examination, and friction ridge examination). I also serve as a member of the Friction Ridge Consensus Body of the Academy Standards Board (ASB), member of the Board of Directors for the IAI, member of the Editorial Review Boards for the Journal of Forensic Identification and Journal of Forensic Sciences, Senior Editor for Forensic Science International: Synergy, and member of the Forensic Research Committee of the American Society of Crime Laboratory Directors, among other memberships and professional affiliations.

6. I have published 24 peer reviewed scientific articles and given over 150 professional presentations, lectures and workshops related to friction ridge development, methods, and practices.

7. On September 9, 2020, I was contacted by Brass Facts (BF), the innocence arm of the Anthony Graves Foundation (AGF) in Houston, Texas, regarding the need for an expert to assist with reviewing palm print evidence and related testimony in a particular case (*Webster v. State* of Texas, NO. 01-16-00163-CR)[1]. This inquiry was related to a National Institute of Justice grant awarded to Texas Southern University (TSU) and BF/AGF to identify and review post-conviction cases involving violent felony offenses in which actual innocence might be demonstrated by DNA testing, retesting, or interpretation. I agreed to provide assistance relating to the palm print evidence to help TSU and BF/AGF determine the merits of the case for further evaluation.

8. On September 11, 2020, I was asked to review transcripts related to the testimony of Latent Print Examiner Anne Steinmetz. In particular, I was asked (a) whether a positive reaction with Amido Black is an appropriate method for the identification of the presence of blood, (b) whether processing evidence with Amido Black would prevent subsequent DNA analysis, and (c) whether the reported conclusion relating to the palm print comparison with the known reference exemplars of WEBSTER were acceptable according to current standards and best practice

[1] https://law.justia.com/cases/texas/first-court-of-appeals/2017/01-16-00163-cr.html

recommendations. My opinion relating to each of these questions are as follows:

a. Amido Black is not an appropriate method for the identification of the presence of blood. Amido Black is a reagent that reacts to trace amounts of proteins. A positive reaction causes the impression to appear dark blue-black in color rendering it visible to the unaided eye. Amido Black is often used by forensic analysts to enhance the visibility of impressions (e.g., friction ridge impressions, footwear impressions) that are suspected to have been deposited in blood due to the existence of proteins within the blood. It is important to note, however, that Amido Black is not specific to blood and therefore a positive reaction with Amido Black is not conclusive for the presence of blood. Amido Black is known to react to any substance that contains proteins, which includes a wide variety of natural and manufactured plant and animal products.

b. Amido Black does not damage DNA and thereby prevent subsequent DNA analysis using *Profiler Plus™* fluorescent short tandem repeat (STR). However, in situations where the DNA sample is very limited, the Amido Black solution could dilute the sample causing insufficient amounts of DNA available[2].

c. The reported conclusions relating to the comparison between the latent palm print and the known reference exemplars of WEBSTER do not conform to best practices. For reference, the following quote was taken from line 23, page 157 through line 11, page 158, of the transcript of Steinmetz' testimony:

> *Q [Prosecutor]: What degree of confidence or certainty as a print examiner can you give to any one of your conclusions in that comparison between prints?*
>
> *A [Steinmetz]: When you're making a conclusion for an identification, you have to have enough information present in both the known print and in the latent print to determine they came from the same source. I've compared hundreds of thousands of fingerprints, and in my opinion these did come from the same source.*

[2] See Frégeau CJ, Germain O, Fourney RM. Fingerprint enhancement revisited and the effects of blood enhancement chemicals on subsequent Profiler Plus™ fluorescent short tandem repeat DNA analysis of fresh and aged bloody fingerprints. *J Forensic Sci* 2000; 45(2):354–380.

Q [Prosecutor]: And so the latent print that was submitted in this case, the bloody print from galvanized pipe, in your expertise opinion, that matched the prints that now you've confirmed belong to this defendant here?

A [Steinmetz]: Yes. They belong to the left palm print.

The Standard for Friction Ridge Examination Conclusions proposed by the OSAC Friction Ridge Subcommittee state[3]:

4.6.1. An Examiner shall not assert that a source identification is the conclusion that two impressions were made by the same source or imply an individualization to the exclusion of all other sources.

4.6.4. An Examiner shall not cite the number of latent print comparisons performed in his or her career as a measure for the accuracy of a conclusion offered in the case at hand.

In her responses, Steinmetz testified that the latent palm print and the known reference exemplars of WEBSTER "did come from the same source." Further, Steinmetz cited the number of latent print comparisons performed in her career in response to questions concerning the confidence or certainty in the accuracy of her conclusion. Such testimony is now prohibited by sections 4.6.1 and 4.6.4 of the Standard for Friction Ridge Examination Conclusions proposed by the OSAC Friction Ridge Subcommittee.

9. On October 7, 2020, I was asked to assist with determining the reliability of the palm print comparison originally conducted in the case and identified to Webster. This request was based on concern that the original examination could have been biased by other contextual information in the case. With that concern in mind, it was decided that the best way to assess the reliability of the evidence and appropriateness of the original conclusion would be to proceed in the following ways:

    a. Measure the quality and quantity of friction ridge detail in the latent palm print using objective quality metrics and determine whether it

[3] See Standard for Friction Ridge Examination Conclusions proposed by the OSAC Friction Ridge Subcommittee, available at: https://www.nist.gov/system/files/documents/2020/03/23/OSAC%20FRS%20CONCLUSIONS%20Document%20Template%202020_Final.pdf

satisfies the criteria set forth by current standards and best practice recommendations proposed by the OSAC Friction Ridge Subcommittee[4] to support a Source Identification conclusion, and

b. Facilitate a blind-examination of the evidence by a separate expert that did not have any knowledge of the circumstances of the case to ensure the results of a re-examination were void of any potential biases due to exposure to task-irrelevant case information.

10. On December 14, 2020, I was provided with multiple images of the latent palm print and a set of known reference exemplars of the left palm print for three individuals that were considered suspects in the case (Lorenzo JONES, Xavier THOMAS, and Joseph WEBSTER). I was also provided with an image of the latent palm print with annotations documenting the specific features (i.e., minutiae) relied upon by Ms. Anne Steinmetz during her original examination of the evidence. I removed all identifying information from the digital images of the known reference exemplars and labeled each one "Exemplar A," "Exemplar B," and "Exemplar C," respectively (i.e., the known exemplars of WEBSTER were labeled "Exemplar C") for purposes of facilitating the blind examination. Images of the latent palm print and known reference exemplars were provided to Ms. Carey Hall, a latent print examiner certified by the IAI, to conduct a blind examination. Ms. Hall was unaware of any details concerning the case, circumstances for the request, or the results of any prior examinations. The only information Ms. Hall was made aware of is that the latent print was "reported to have been developed with amido black on a metal pole."

11. After sending the materials to facilitate the blind examination, I measured the clarity of friction ridge detail using LQMetric software[5]. LQMetric is a software application that was developed in 2014 by the Federal Bureau of Investigation (FBI) and Noblis, Inc. to provide an objective measure of the clarity of friction ridge impressions. The LQMetric produces a color-coded overlay (local quality map) that corresponds to the criteria set forth by the Best Practice Recommendation for Analysis of Friction Ridge

[4] See Best Practice Recommendation for Analysis of Friction Ridge Impressions and Best Practice Recommendation for Comparison & Evaluation of Friction Ridge Impressions proposed by the OSAC Friction Ridge Subcommittee, available at: https://www.nist.gov/document/best-practice-recommendation-analysis-friction-ridge-impressions and https://www.nist.gov/system/files/documents/2020/10/02/OSAC%20FRS%20Comparison-and-Evaluation%20BPR_Final_Sept2020.pdf, respectively.

[5] For more information about LQMetric, see: Kalka N., Beachler M., and Hicklin RA. LQMetric: A Latent Fingerprint Quality Metric for Predicting AFIS Performance and Assessing the Value of Latent Fingerprints. *J. For. Ident.*, 70(4): 443-463.

Impressions proposed by the OSAC Friction Ridge Subcommittee (adopted from the Markup Instructions for Extended Friction Ridge Features (NIST Special Publication 1151), which is supplemental to the Extended Feature Set (EFS) defined in the American National Standard for Information Systems: Data Format for the Interchange of Fingerprint, Facial & Other Biometric Information, American National Standards Institute/National Institute of Standards and Technology, Information Technology Laboratory (ANSI/NIST-ITL 1-2011)).

12. The local quality map produced by the LQMetric was used to categorize the quality of the features (i.e., minutiae) annotated by Ms. Anne Steinmetz during her original examination. One (1) minutia was annotated in a Category 3 (green) quality region (indicating the "presence, absence, and location of minutiae is definitive"). Fourteen (14) minutiae were annotated in Category 2 (yellow) quality regions (indicating the "presence, absence, and location of the minutiae are debatable"). The Best Practice Recommendation for Comparison & Evaluation of Friction Ridge Impressions proposed by the OSAC Friction Ridge Subcommittee specifies that "[t]he corresponding data include at least 8 minutiae designated as Category 3 (green) quality or higher and documented during Analysis" as the minimum criteria that should be present to support a conclusion of Source Identification[6]. As such, based on this assessment of the reliability of minutiae using objective quality metrics and criteria set forth by the OSAC Friction Ridge Subcommittee, a conclusion of Source Identification would not be warranted.

13. On February 11, 2021, I was notified by Ms. Hall that she completed her examination and concluded "inconclusive."

14. On February 12, 2021, I notified the Harris County Public Defender's Office (HCPDO), who had since taken over the case, of the results of my assessment of the quality of the latent palm print using LQMetric and the blind examination conducted by Ms. Hall.

15. On October 5, 2021, HCPDO notified me that the Houston Forensic Science Center (HFSC) agreed to conduct a blind examination of the latent palm print using the redacted known reference exemplars provided to Ms. Hall.

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[6] The Best Practice Recommendation for Analysis of Friction Ridge Impressions proposed by the OSAC Friction Ridge Subcommittee specifies that the criteria "are recommended for quality assurance purposes and based on consensus opinion of the OSAC Friction Ridge Subcommittee where supporting evidence in the scientific literature is limited."

16. On October 19, 2021, HCPDO notified me that the HFSC completed their examination by two separate analysts and both analysts concluded "inconclusive."

17. On February 23, 2022, HCPDO provided copies of the images from the examinations conducted by the HFSC analysts. Using Adobe Photoshop, I created an overlay of the minutiae annotated by Ms. Anne Steinmetz, Ms. Carey Hall, and the two HFSC analysts as another approach to assess the reliability of minutiae (e.g., only those features that were independently interpreted and documented by all analysts would be considered "reliable" and therefore akin to a Category 3 quality or higher as set forth by the OSAC Friction Ridge Subcommittee). Overall, only six (6) minutiae that were annotated by Ms. Steinmetz were interpreted and documented by the other three analysts in relatively similar locations within the latent palm print impression. Among those six minutiae, three (3) of the minutiae were annotated as being "definitive" by all three analysts conducting the blind examinations, two (2) of the minutiae were annotated as being "definitive" by two of the analysts and "debatable" by one of the analysts conducting the blind examinations, and one (1) of the minutiae was annotated as being "definitive" by two of the analysts and "unreliable" by one of the analysts conducting the blind examinations. The Best Practice Recommendation for Comparison & Evaluation of Friction Ridge Impressions proposed by the OSAC Friction Ridge Subcommittee specifies that "[t]he corresponding data include at least 8 minutiae designated as Category 3 (green) quality or higher and documented during Analysis" (indicating the minutiae are "definitive") as the minimum criteria that should be present to support a conclusion of Source Identification[7]. As such, based on this assessment of the reliability of minutiae using consensus across all experts and criteria set forth by the OSAC Friction Ridge Subcommittee, a conclusion of Source Identification would not be warranted.

18. In my opinion, the palm print comparison originally conducted in this case and identified to Webster is not reproducible and therefore not reliable[8]. This is based on the following:

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[7] The Best Practice Recommendation for Analysis of Friction Ridge Impressions proposed by the OSAC Friction Ridge Subcommittee specifies that the criteria "are recommended for quality assurance purposes and based on consensus opinion of the OSAC Friction Ridge Subcommittee where supporting evidence in the scientific literature is limited."

[8] Ground truth does not exist in actual casework; therefore, the *accuracy* of the original conclusion cannot be assessed. The reproducibility of the conclusion and supporting information when the evidence is subject to blind examinations by independent experts is the most appropriate way to assess the reliability of the original conclusion.

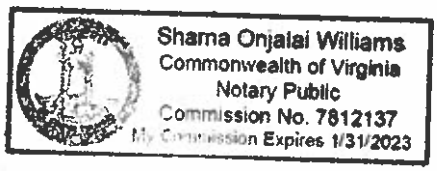
a. The conclusion of "Identification" resulting from the original examination was not reproduced by other experts. The evidence in this case has been subject to blind examination by three different experts without any contextual information relating to the case. In all three instances, the conclusion reported was "inconclusive."

b. The quality and quantity of minutiae available on the latent palm print is insufficient to support a conclusion of Source Identification based on the criteria set forth by the OSAC Friction Ridge Subcommittee. The quality of minutiae was assessed using both objective quality metrics (LQMetric) and expert consensus.

I hereby affirm under penalty of perjury that the foregoing is true and correct.

Henry Swofford

Sworn and subscribed to before me on this 31st day of March, 2022.



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State of Virginia

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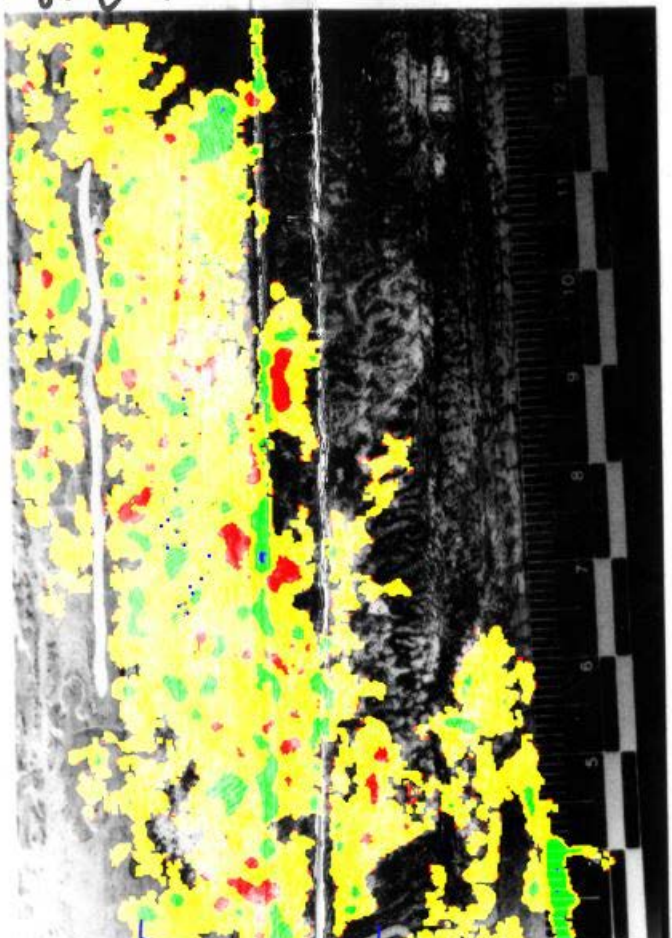

EXHIBIT D

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TITLE Forensic Scientist, Consultant

EDUCATION

University of Lausanne, Switzerland; Ph.D. Forensic Science, 2012
University of Minnesota, M.S. Analytical Chemistry, 1999
Michigan State University, B.S. Forensic Science, 1993

EXPERIENCE

Aug 2012 – present:	Elite Forensic Services, LLC Owner, Primary Consultant, Instructor
Sep 2013 – Oct 2018:	Minnesota Bureau of Criminal Apprehension Forensic Science Laboratory, Drug Chemistry Section Supervisor
Jan 2000 – Sep 2013:	Minnesota Bureau of Criminal Apprehension Forensic Science Laboratory, Latent Print Section
Jan 2003 – Dec 2010:	Metropolitan State University, Community Faculty
Sep 2003 – May 2005:	Hamline University, Adjunct Faculty
Jun 1995 – Jan 2000:	Pace Analytical Inc./3M Environmental Laboratory, Research Chemist
May1993 – Sept 1993:	Dundee Royal Infirmary Dept. of Forensic Medicine, Toxicology Summer Internship

PROFESSIONAL ORGANIZATIONS

International Association for Identification (IAI)
National and Minnesota Division membership (since 2000)
Pattern Evidence SAC (Scientific Area Committee) (2019-2021)
Canadian Identification Society (CIS) (2002-2013)
Midwest Association of Forensic Scientists (MAFS) (since 2003)
SWGFAST (Scientific Working Group for Friction Ridge Analysis, Study, and Technology) (2004-2014)
Fingerprint Society (U.K.), fellow status (2006-2010)
NIST-NIJ Committee—Expert Working Group on Human Factors in Latent Print Analysis (2008-2011)
NIST-NIJ Committee—Expert Working Group on Human Factors in DNA Analysis (2020 to present)

AWARDS/POSITIONS HELD/CERTIFICATIONS

Status as a certified latent print examiner (IAI) granted May 2003
Status as a certified fellow of criminalistics (ABC) granted (2011-2020)
Editorial review board for Journal of Forensic Identification (since 2006)
Distinguished Member of the IAI Award (2007)
Recipient of Inaugural IFRG "Roland Menzel Award" (2007)
Ethics Committee for MAFS (2006-2010)
MAFS "New Scientist Award" (2002)
Minn. DPS Forensic Science Lab Service Recognition Award (2002)
MAFS Latent Print Section Coordinator (2002-2011)
IAI Committee—Standardization II Committee (2008-2010)
IAI Standing Committee, Science & Practices: Forensic Management (Chair, since 2018)

TRAINING

In-house Training at the BCA (core training)

Latent Print Training (Jan 2000-Nov 2000)	Approx. 1700 hours
Courtroom Testimony Workshop (Nov 2001)	24 hours
Crime Scene Training (May 2000-present)	Approx. 500 hours

External Courses Attended

Advanced Fingerprint Courses	Approx. 125 hours
Advance Bloodstain Pattern Analysis Courses	Approx. 85 hours
ASCLD-LAB-International Assessor Training Course	40 hours
Crime Scene related workshops	Approx. 15 hours

Conferences Attended

IAI Educational Conferences (local and nat'l) (2000-2022):	Approx. 1000 hours
Other Forensic Conferences in the U.S.	Approx. 400 hours
International Forensic Conferences	Approx. 440 hours
Legal Conferences and Seminars	Approx. 125 hours

Professionally Taught Courses and Workshops

Over 5000 hours of instruction with over 3100 students
Taught in U.S., Canada, U.K., China, Taiwan, Brazil, Switzerland, Denmark, Australia, France

PUBLISHED WORKS

- Langenburg, G. (**2023**) Analysis, Comparison, Evaluation, and Verification (ACE-V). Max M. Houck (ed.) *Encyclopedia of Forensic Sciences, 3rd Ed*, pp. 151–156. Oxford: Elsevier.
- Kennedy, K; Heaton, C; Langenburg, G; Francese, S; Pre-validation of a MALDI MS proteomics-based method for the reliable detection of blood and blood provenance. *Scientific Reports*, **2020**; 10:17087. https://doi.org/10.1038/s41598-020-74253-z.
- Deininger, L; Francese, S; Clench, M.R; Langenburg, G; Sears, V; Sammon, C. Investigation of infinite focus microscopy for the determination of the association of blood with fingermarks. *Science & Justice*, **2018**; 58:397-404.
- Dror, I; Langenburg, G. "Cannot Decide": The Fine Line Between Appropriate Inconclusive Determinations Versus Unjustifiably Deciding Not To Decide. *J For Sci,* **2018**; 64(1):10-15.
- Langenburg, G. Addressing potential observer effects in forensic science: a perspective from a forensic scientist who uses linear sequential unmasking techniques. *Australian J of Forensic Sci,* **2017**; online, doi: 10.1080/00450618.2016.1259433.
- Patel, E.; Cicatiello, L.; Langenburg, G.; Francese, S.; et al. A proteomic approach for the rapid, multi-informative and reliable identification of blood. *Analyst* **2015,** doi: 10.1039/c5an02016f.
- Langenburg, G.; Hall, C.; Rosemarie, Q. Utilizing AFIS searching tools to reduce errors in fingerprint casework. *For Sci Intl* **2015**, 257, 123-33.
- Neumann, C.; Champod, C.; Yoo, M.; Genessay, T.; Langenburg, G. Quantifying the weight of fingerprint evidence through the spatial relationship, directions and types of minutiae observed on fingermarks. *For Sci Intl* **2015**, 248, 154-171.
- Langenburg, G.; Bochet, F.; Ford, S. A Report of Statistics from Latent Print Casework. *Forensic Science Policy & Management: An International Journal* **2014**, 5(1-2), 15-37.
- Sheets, H.D., Gross, S., Langenburg, G., Bush, P.J., and Bush, M.A. Shape measurement tools in footwear analysis: A statistical investigation of accidental characteristics over time. *For Sci Intl*, **2013**, 232 (1-3), 84-91.
- Neumann, C; Champod, C; Yoo, M; Gennessay, T; Langenburg, G. Improving the Understanding and the Reliability of the Concept of "Sufficiency" in Friction Ridge Examination. Final Report to U.S. Dept. of Justice-National Institute of Justice, Washington, D.C. July 2013. Award Grant 2010-DN-BX-K267.
- Langenburg, G; Neumann, C; Meagher, S; Funk, C; Avila, J. Presenting Probabilities in the Courtroom: A Moot Court Exercise. *Journal of Forensic Identification* **2013,** 63(2), 424-488.
- Langenburg, G. The consideration of fingerprint probabilities in the courtroom. *Australian Journal of Forensic Sciences*, **2013**, doi:10.1080/00450618.2013.784360.
- Langenburg, G; Hall, C. "Friction Ridge Skin: Comparison and Identification" in Wiley Encyclopedia of Forensic Science, eds A. Jamieson and A.A. Moenssens, John Wiley: Chichester. DOI: 10.1002/9780470061589.fsa355.pub2. Published 15th March 2013.
- Praska, N; Langenburg, G. Reactions of latent prints exposed to blood. *Forensic Sci Intl*, **2013**, 224, 51-58.
- Langenburg, G. A Critical Analysis and Study of the ACE-V Process. PhD thesis, Ecole des Sciences Criminelles / Institut de Police Scientifique, Université de Lausanne, Switzerland, **2012**.
- Langenburg, G., Champod, C., Gennessay, T. Informing the Judgments of Fingerprint Analysts Using Quality Metric and Statistical Assessment Tools. *Forensic Sci Intl*, **2012**, 219 (1-3), 183-198; doi:10.1016/j.forsciint.2011.12.017.

- Neumann, C; Langenburg, G, et al. Operational benefits and challenge of the use of fingerprint statistical models: a field study. *Forensic Sci Intl*, **2011,** *212*, 32-46.
- Langenburg, G; Champod, C. The GYRO System—A Recommended Approach to More Transparent Documentation. *Journal of Forensic Identification* **2011** *61* (4), 373-384.
- Mnookin, J., Langenburg, G, et al. The Need for a Research Culture in the Forensic Sciences. UCLA Law Review, **2011**, 58 (3), 725-779.
- Langenburg, G. Scientific Research Supporting the Foundations of Friction Ridge Examinations", Chapter 14 *in* The Fingerprint Source Book; Eds.: McRoberts, A; Fitzpatrick, F., U.S. Department of Justice, National Institute of Justice, Washington, D.C., **2011**.
- Langenburg, G., Champod, C., Gennessay, T. Jones, J. Informing the Judgments of Fingerprint Analysts Using Quality Metric and Statistical Assessment Tools, Summary Report to the Midwest Forensics Resource Center. Midwest Forensic Resource Center (MFRC) Research and Development Program Summary, 2010, November, 42-44.
- Dror, I, Langenburg, G., et al. Cognitive issues in fingerprint analysts: inter- and intra-expert consistency and effect of a 'target' comparison. *Forensic Sci Intl*, 2010, *208*, 10-17.
- Langenburg, G. Friction Ridge Skin: Comparison and Identification. In Wiley Encyclopedia of Forensic Science, eds. Jamieson, A; Moenssens, A. John Wiley & Sons, Ltd, U.K., 2009.
- Langenburg, G; Champod, C; Wertheim, P. Testing for potential contextual bias effects during the verification stage of the ACE-V methodology when conducting fingerprint comparisons" *J Forensic Sci* 2009, *54* (3), 583-590.
- Langenburg, G. A performance study of the ACE-V process: A pilot study to measure the accuracy, precision, repeatability, reproducibility, and biasability of conclusion resulting from the ACE-V process, *J Forensic Identification* **2009**, *59* (2), 219-257.
- Langenburg, G. Deposition of Bloody Fingermarks" *J Forensic Ident.* **2008** *58* (3), 355-389.
- Langenburg, G. Letter to Editor re: Saks and Koehler "The Coming Paradigm Shift in Forensic Science", *Science*, 3 Feb **2006**, vol 311.
- Langenburg, G. A Report of Latent Print Examiner Accuracy During Comparison Training Exercises" *J Forensic Identification* **2006**, *56* (1), 55-93.
- Langenburg, G. "Ask the Expert" column for *Scientific American*, 292 (5), May **2005.**
- Langenburg, G. Pilot Study: A Statistical Analysis of the ACE-V Methodology—the Analysis Stage," *J Forensic Identification* **54** (1), **2004**, 64-79.
- Langenburg, G. Defense Against the Dark Arts: Defending Against the Critic's Curse, *The Chesapeake Examiner* **2003**, 41, Spring volume.

EXHIBIT E

Inter-Examiner and Intra-Examiner Variability Studies

Dror, I.E., C. Champod, G. Langenburg, D. Charlton, H. Hunt, R. Rosenthal, Cognitive issues in fingerprint analysis: inter- and intra-expert consistency and the effect of a 'target' comparison, *Forensic Science International* 208 (2011) 10–17.

Evett, I; R.L. Williams, A review of the sixteen-points fingerprint standard in England and Wales, Journal of Forensic Identification 46(1) (1996) 49-73.

Langenburg, Pilot study: a statistical analysis of the ACE-V methodology—Analysis Stage, *Journal of Forensic Identification* 54 (2004) 64–79.

Langenburg (2012). A Critical Analysis and Study of the ACE-V Process. ESC-IPS. University of Lausanne, Switzerland. Ph.D. thesis.

Langenburg G, Champod C, Genessay T. Informing the judgments of fingerprint analysts using quality metric and statistical assessment tools. *Forensic Science International* 2012;219(1-3):183–198.

Swofford, et al. (2013) Inter- and Intra-Examiner Variation in the Detection of Friction Ridge Skin Minutiae, *Journal of Forensic Identification* 63(5):553-570.

Ulery, B.T., R.A. Hicklin, G.I. Kiebuzinski, M.A. Roberts, and J. Buscaglia. "Understanding the sufficiency of information for latent fingerprint value determinations." *Forensic Science International.* 230(1):99-106. July 2013.

Ulery, B.T., R.A. Hicklin, M.A. Roberts, J. Buscaglia, "Measuring what latent fingerprint examiners consider sufficient information for individualization determinations." *PLoS ONE* 9(11): e110179. Nov 2014.

Ulery, B.T., R.A. Hicklin, M.A. Roberts, J. Buscaglia, "Changes in latent fingerprint examiners' markup between analysis and comparison." *Forensic Science International* 247(2014):54-61. Feb 2015.

Ulery B.T., Hicklin R.A., Roberts M.A., Buscaglia J. (2016) Interexaminer variation of minutia markup on latent fingerprints. *Forensic Science International*, 264:89-99.

Gardner, et. al, Latent Print Comparison and Examiner Conclusions: A Field Analysis of Case Processing in One Crime Laboratory. *Forensic Science International*, 319: 110642 (2021).