ACE-V: A Latent Print Examiners Scientific Method

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In all areas of science whether forensic science or biology or chemistry, when an experiment is preformed there is a methodology followed by the analyst in order to obtain results, both expected or unexpected. Latent print examiners follow an alternative to the traditional scientific method; this method is called ACE-V. Failure to follow the scientific method when conducting research experiments or laboratory examinations may result in an incorrect conclusion or deviation from the hypothesis. This can have a major impact in places such as pharmaceutical companies, where a medication was thought not to have a fatal side effect; however a common effect was fatality. Similarly, if latent print examiners deviate from the ACE-V process, then errors can occur. These types of situations have been recorded in the past. In the forensic science field, errors can have long lasting repercussions. The innocent can be prosecuted and incarcerated, or the perpetrator is not identified. Based on the consequences of what could a linear approach to the application of the ACE-V methodology is ideal. [1] This allows and examiner to limit bias and formulate an appropriate conclusion.

The application of ACE- V is followed in order in order to arrive at an independent conclusion. Analysis is the first step of the ACE-V process, where the latent print examiner analyzes the latent impression(s) in order to determine the sufficiency of a latent impression. This is attained by examining the three levels of detail present within the impression. The first level of detail is the overall ridge flow or pattern type of the impression. These features can be present by the appearance of a loop, whorl, or arch pattern in fingers, or the determination of an interdigital, thenar or hypothenar region of the palm. The second levels of detail are the individual characteristics, or minutiae, of ridge formations such as ridge endings and bifurcations that can be used as the points of comparison during the examination. The third levels of detail used in analysis are the pores and edges, described by Ashbaugh, as poroscopy and edgeoscopy [2]. These features may or may not be present in the latent impressions(s). Refer to figures 1-3 for images of level I, II, and III detail [3]. Following the analysis phase of the examination, the analyst must make a determination as to the sufficiency of the impression for additional examination. Examiners may utilize worksheets, diagrams, and digital annotations in order to

document the thought process. Laboratory policy will determine the approach used by the examiner in formulating a conclusion of: sufficient value for identification, sufficient value for exclusionary purposes only, insufficient also for examination, and the suitability of the impression for search in the automated databases (i.e. AFIS). Additional features such as creases, scars, and warts may be used during the analysis of a latent impression.

Comparison is the second phase of the ACE-V process, where following the examiner's determination of sufficiency; the latent is compared to known exemplar records provided. During the comparison phase of the examination, the analyst must begin by utilizing the target group they have documented, or focused upon, during the analysis phase. By using this group, the examiner may continue their linear approach by continuing to use their initial data. The recognition of complex circumstances and distortion issues may lead to consultations during the comparison phase of the examination in order to interpret the features present.

The final step of the initial examination is the evaluation phase, where the examiner forms a conclusion of: Identification, Exclusion, or Inconclusive. A conclusion of Identification may be effected when there is a sufficient amount of details in common, without the presence of unexplainable discrepancies or dissimilarities to conclude that the latent and the exemplar record have come from the same source. The finding of a sufficient level of unexplainable dissimilarities between the latent impression and known exemplar record can lead the examiner to an exclusion conclusion. An inconclusive conclusion may be reached during an examination if the exemplar record is of poor quality or is missing the portions of friction ridge detail to perform a thorough examination. In instances where a latent impression may be of sufficient exclusionary quality for a level 1 exclusion, an inconclusive conclusion may be reached if the examiner is unable to exclude the source based on pattern type alone. In rare circumstances, examiners may determine that the comparison result is inconclusive based upon the latent. This application of a circular approach has a very limited application, and must be well documented. In the event of a complex examination, citing areas of distortion or masked features in the latent can result in a valid determination of lack of detail in the latent upon comparison. If an identification is made, the final step in ACE-V is an independent verification by another examiner. Another type of verification performed in the laboratory may be done in the form of a technical review. During this process, a second examiner reviews all findings in order to verify

the original conclusions. This phase of the methodology is a secondary application of ACE by the verifying examiner [4].

Fig 1: Level I pattern and ridge flow [3]

Fig 2: Level II ridge formations such as bifurcations and endings [3]

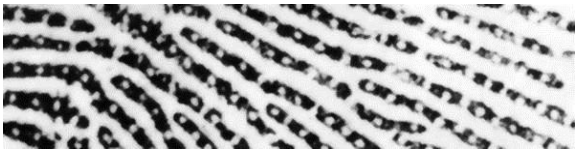

Fig 3: Level III Pores and Edges (poroscopy and edgeoscopy) [3]

Each of the steps of the scientific method is synonymous with the corresponding steps of the ACE-V methodology. Analysis is analogous with the hypothesis, as determined by the latent examiner. By conducting a thorough examination at the analysis phase, the hypothesis reached may be the sufficiency of the latent, that the examiner could identify or exclude the latent, given the corresponding area of exemplar information. The comparison is the materials and methods used for the examination, which may include the exemplars provided. By ensuring the suitability of the known information found in the exemplar records, and the data examined during the analysis of the latent impression, the examiner has obtained the proper materials in order to conduct the comparison. The evaluation phase is synonymous with conclusion that is reached,

based on the materials provided (latent and exemplars), and finally the verification is a secondary peer-review of the results. The formulation of a verifiable conclusion following the evaluation phase may prove or disprove the initial hypothesis formulated during the analysis phase. Conclusions may be different from the analysis determination based upon the available records during the comparison process.

The Brandon Mayfield case is one of the most notorious cases where a misidentification (see photo below for latent misidentified to Brandon Mayfield) was made by more than one examiner and resulted in the wrongful conviction of Brandon Mayfield. This was largely due to the improper use of the ACE-V methodology. In this case, the root cause analysis performed by the Federal Bureau of Investigation determined that a circular rather than a linear approach was taken, therefore contributing to the errors recorded. [1] These errors were due in part to backtracking after the initial comparison and evaluation determinations were made, instead of continuing in a linear manner. The circular approach allowed for contextual bias, therefore causing the analyst to make incorrect determinations, in this instance a repeated misidentification. Ultimately, Spanish authorities identified Ouhnane Daoud as the source of this print. Subsequently leading to the release of Brandon Mayfield after two weeks of wrongful incarceration. Some believe that if ACE-V methodology was applied in a linear manner, this misidentification could have been avoided. Others believe that ACE-V can be performed in a circular manner but only under certain circumstances.


Complex latent print from Madrid Bombing [5]

Many court cases involving the identification of latent prints have questioned the use and reliability of latent print comparisons as viable scientific evidence. In states following the Frye standard, if the scientific practice is generally accepted within the relevant community, it can be admitted into the court. [6] However, the more detailed Daubert standard calls for a five prong appraoch to scientific methods. The Daubert standard states that the judge is the gatekeeper for the admissibility of all scientific evidence presented by an expert witness. the five prongs of the

Daubert standard are: the evidence has to be relevant and reliable, the methodology is based on the scientific method, it is repeatable, there is a known or potential error rate and it has to be peer reviewed.[7] Most of the challenges have been raised in courts under the Daubert standard, however that does not preclude agencies in states following the Frye standard from addressing these concerns. One case that the questioned the science of latent print comparisons was U.S. v. Llera Plaza I. In this case, the presiding judge, Judge Louis Pollock, determined that even based on the ACE-V methodology, latent print comparisons is not a science. The excluded the admissibility of expert witness to the identification of a latent print to a particular person. Following Judge Pollock's decision, the validity of the science of fingerprint identification brought into question thousands of convictions, the reliability of latent print examination as a discipline, and the future course of latent print examination. [8]

A short time after Judge Pollock's decision in US v. Llera Plaza I, he revoked his previous decision and decided that latent print examination was in fact a science. He based his decision on the resonable dispute that fingerprints are permanent and unique, and that the ACE-V methodology employed by the FBI in fact satisfies all the Daubert prong requirements. This judgement allowed for the admissibility of latent print expert testimony in trial proceedings. [8] The importance of following ACE-V is not only to formulate proper conclusions but also to articulate the parallel of the ACE-V methodology to the roots of the scientific method. In addition, the examiners must be able to explain the fundamental principles of biology, physiology, genetics and embryology when describing the contributing factors of fingerprint identification as a reliable science.Without the fundamental knowledge of the pure sciences as applied to fingerprint identification, the factors that allow examiners to reach a conclusion as to the source of the latent impression would be meaningless. These scientific fields provide the physiological background dictating the principles of uniqueness and permanence, which guide the methodology. The ACE-V methodology provides latent print examiners a tool on how to conduct their examination in order to reach a sound conclusion.

The ACE-V methodology is the latent print examiners scientific method, but without proper documentation to demonstrate that it was followed properly, it may be inadmissible in court. The State of New Hampshire v. Richard Langhill is one court case where the fingerprint examiner was questioned on the use of ACE-V, due the percieved lack of documentation to

support the conclusion. The judge excluded the expert testimony based on lack of laboratory bench notes to supporting the examiner's conclusion. Meanwhile, the sole physical evidence in this case was the latent print evidence. The case was heard in February of 2008, and the initial decision was reversed in April 2008. [9] The possession of proper ACE-V documentation is a paramount need for the latent print examiner. Thorough notetaking allows for transparancy during the though process, allowing for a reproducable result. This documentation should be for each and every latent impression in all examinations, showing a clear application of the methodology free of bias.

In conclusion, based on the subjectivity in the latent print discipline, questions arise concerning its reliability as a forensic science in criminal cases. Science and research have proven that friction ridges form in the womb and are unchanged until after death, when decomposition occurs, barring amputation and/ or permanent scarring. This research allows us to demonstrate permanence as a fundamental principle of induviduality throughout one's lifetime in the court room. Biology and genetic research also allows for testimony relating to uniqueness, as it has been proven that friction ridge skin is not only genetically influenced but also based on differential growth within the womb. These environmental influences lead to the knowledge that no two persons will have the same fingerprints, validating the value of this type of identification. While it's value as a means of identification is clear, what is in question is the examiners reliability in the application of the analysis and comparison processes. ACE-V is the proven methodolgy that allows for judicial proceeding to continue. as the linear application of ACE-V, paired with proper documentation, will allow for the continued use of fingerprint identification to be a reliable and prosecutorial form of forensic evidence.

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