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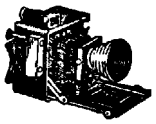

Scientific Comparison and Identification of Fingerprint Evidence

By PAT A. WERTHEIM, C.L.P.E.

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Abstract: The methodology of identification as described by Tuthill and Ashbaugh is a three-phase process consisting of analysis, comparison, and evaluation. This process is discussed is its application to fingerprint identification. An alternative method of describing the same mental exercise employs a five-step applied science formula. The five steps in this formula are as follows: 1) examination of the unknown; 2) formulation of a hypothesis; 3) experimentation; 4) formation of a conclusion; and 5) testing the conclusion to prove the hypothesis. For some, this five-step formula may help in understanding and explaining the mental process of identifying a fingerprint.

FOREWORD

Fingerprint terminology varies greatly. From one agency to the next, one region to the next, or one country to the next, different words may be used to express the same concept. Conversely, a particular word or phrase may have different or even opposite meanings in different locales.

For purposes of this discussion, the terms ''latent print,'' ''crime scene mark,'' and ''unknown print'' all have fundamentally the same meaning. Likewise, ''inked print'' and ''known print'' mean the same. For that matter, ''print'' and ''impression'' are used more or less interchangeably and the word ''image'' has much the same application. While there are circumstances in which more specific definitions would be necessary and subtle distinctions need apply, the author asks the reader's indulgence in recognizing the broader meanings and accepting the interchangeability of the various terms as mentioned above.

INTRODUCTION: THE SCIENTIFIC BASIS OF FINGERPRINT IDENTIFICATION

In spite of the fact that the early pioneers clearly considered fingerprint identification a science, an attitude has developed during the last century in some (but not all) regions of the world that fingerprint identification is not science. Many people working in forensic science laboratories feel this way, and even some fingerprint experts themselves feel slighted if they are referred to as ''scientists.''

Fingerprint identification is based on two primary factors, uniqueness and permanence. On that, we all agree. But in order to truly understand these factors and not just simply parrot some dogmatic explanation, one must understand both human fetal development of friction skin (the foundation of uniqueness) and the subsurface structure of human friction skin (the basis for permanence). This requires some fundamental study of human biological sciences. Thus, the basis for fingerprint identification is firmly rooted in science.

Clearly, however, fingerprint identification can not be considered an ''exact'' science in the same way as, say, mathematics, in which exact numbers or measurements are used to express results. Further, fingerprints can not be considered a ''descriptive'' science such as, say, ornithology, which identifies a particular species of bird, but not an individual within that species.

Rather, fingerprint identification falls into a category we call applied science. That is, we apply scientific knowledge and principles to real-life problems to arrive at conclusions. This application gives scientific validity to the conclusions. The powerful evidential value of fingerprint identification has its foundation in this scientific validity. Without it, no fingerprint identification is anything more than the rendering of an educated guess.

Fingerprint identification is also frequently referred to as a forensic science. The word ''forensic'' simply denotes the use of the discipline in court proceedings. Since fingerprint identification is employed primarily for use in legal situations, it is correctly designated as a forensic science.

Description of fingerprint identification as a ''forensic science'' or an ''applied science'' in no way implies that it is not a reliable science. It is an understanding of all of the related scientific principles and their correct application that yield accurate, valid results in any fingerprint comparison. Fingerprint identification, correctly understood and applied, is just as scientifically valid and reliable as any other science and, indeed, more accurate than many.

A characteristic of any field of science is that of allowing the practitioner to make precise statements within the discipline that may be checked or verified by other qualified persons.[1] This is true in ''exact'' sciences, ''descriptive'' sciences, and it is also true in ''applied'' sciences. The fingerprint expert applies knowledge gained through training and experience to reach a conclusion. From the earliest days of fingerprint identification, verification has been recognized as an important part of the process.

The designation ''applied science'' extends beyond just the biological foundation of identification, explained as uniqueness and permanence. In order for any identification to be scientifically valid, the entire process of making the identification from start to finish must meet the tests of science. If any element fails to meet scientific standards, then the validity of the identification falls into question.

The concept of ''Ridgeology'' was sparked originally from the realization that most fingerprint examiners have had only disjointed training in both the scientific foundation and the scientific application of identification principles.[2] Ridgeology is <u>not</u>, as some people mistakenly believe, making risky identifications based on poreoscopy and edgeoscopy. Rather, the term ''ridgeology'' should be thought of as an umbrella that covers every conceivable related science and concept to the extent that each has application in fingerprint identification.

That said, both poreoscopy (Edmund Locard, 1912)[3] and edgeoscopy (Salil Kumar Chatterjee, 1962),[4] are topics studied by serious students of ridgeology. The shapes and relative positions of sweat pores and the shapes of the edges of the ridges have their origin in fetal development and their physical roots deep in the subsurface structure of the skin. Through study of these features, their formation on the fetus, and their foundation in the dermis and the basal layer of the epidermis, it has been learned that they, like traditional minutiae points, are permanent and unique. And when understood, like minutiae points, they add weight to the conclusion of identification.

To ignore sweat pores and edge shapes when they are present is to ignore part of the valid information in the total image. This is by no means to suggest that an expert should ignore the minutiae points and concentrate on the pores and edge shapes. It is simply to say that one must consider <u>all</u> of the information present in both the latent print (or mark) and the inked print. Traditional minutiae points are still the backbone of most comparisons.

Perhaps the best way to understand this concept is to consider a balance scale and a box of one-ounce brass weights. If one begins putting the brass weights on the balance scale one at a time opposite a one pound object,

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the scale tips when there are 16 little brass weights in the pan. Using a 16-point standard for fingerprint identification is analogous to putting sixteen brass weights on the scale. Under the 16-point threshold, sixteen points equal an identification just as, in the English system of weights, sixteen ounces equals a pound.

In a truly scientific comparison, however, one accepts the idea that not all features in a fingerprint are exactly equal in the weight they contribute to the identification. Some features contribute more to the conclusion, others less. Some features may weigh as a grain of sand when tested on the scale, others may weigh as a cobblestone. In ridgeology, it is up to the expert doing the comparison to determine the relative weight of each feature. The expert makes that determination based upon training and experience.

Clearly, then, one can never have too much training. Study should be an ongoing endeavor of the serious, professional expert. Likewise, one's judgment improves with experience in the comparison of fingerprints.

But no expert should ever extend an opinion beyond scientific understanding and justification. It is up to the expert doing the comparison to determine what may be used and what may not, and further, to determine what relative weight to give each feature represented in each image. Therefore, if the expert does not have a basis for understanding the permanence and uniqueness of a feature or if the expert cannot account for a feature, then the expert cannot give any consideration to that feature in making an identification. No expert should ever give weight to any feature he or she does not understand or is not able to defend in court.

This whole idea of ridgeology, that is, a scientific examination accompanied by accountability on the part of the examiner, may be frightening to some. It means that it is not sufficient to simply count to some magic number and hide behind dogma in making an identification. In ridgeology, the expert must actually understand the basis for identification and be able to account completely for each identification.

The much simpler, much easier, but less valid idea of a threshold limit for identification began with Sir Francis Galton. In his book, *Finger Prints*, in 1892,[5] Galton proposed a statistical model that divided an entire inked fingerprint into a grid of 35 squares. Galton calculated probabilities based on the presence or absence of minutiae points in a each grid area and concluded that the odds of two people having points in the same squares when all 35 are considered is one in 2 to the 47th power.

Galton's model overlooked any consideration of the direction of ridge flow in any of the 35 grid areas and took into account only whether or not a minutiae point was present in any given square. Obviously, Galton's model completely ignored not only ridge flow, but also the shapes of the ridges, the presence of prominent sweat pores, scars, creases or wrinkles, incipient ridges, etc. (Yes, scars,[6] creases and wrinkles,[7] incipient ridges,[8] etc. also have a foundation in biology for permanence and uniqueness.) Thus, Galton's model was sorely lacking in many respects.

Since Galton's time, numerous researchers, both fingerprint examiners and statisticians alike, have proposed new models and refined previous models in an attempt to arrive at a reliable ''point'' threshold for identification. Ultimately, however, all have failed to arrive at a model accurate in all respects. This is because the minute variations of shape within friction skin are infinite. No model can completely capture all of the possible shapes and features present in an area of friction skin.

Counter to the idea of statistical modeling as the definitive tool of identification, many prominent scientists during the Twentieth Century have added to our understanding of biological uniqueness. Most prominent among these are Wentworth & Wilder in 1918[9], Cummins and Midlo in 1943,[10] Hale in 1952,[11] Holt in 1968,[12] and Montagna & Parakhal in 1974.[13] Most recently, Dr. William Babler has added significantly to our understanding of the growth of friction ridge skin on the developing fetus.[14] The work of all of these scientists and many others belongs under the umbrella of ridgeology.

The fact is that human friction ridge skin is unique. One empirical way of grasping this concept is to start with the premise that the friction ridge skin on a whole fingertip is unique. That is to say, no two people now living, or who ever have lived, or who ever will live, can have exactly the same minute details of the friction ridge skin across the whole surface of a fingertip. If that fact is accepted, then one must accept that, if a fingertip were cut in half, each half would still be unique; half of unique must still be unique. Slice again the remaining half a finger, and still there is uniqueness; one-fourth of unique is still unique. At no point in the division process does some small fraction of uniqueness cease to be unique. Our ability to discern that uniqueness will undoubtedly falter at some point, but the skin itself, even in a very small area, remains unique.

The shapes and features present on any area of friction skin are impossible to completely quantify. Probabilities cannot be accurately calculated. Any predetermined point threshold fails to provide for a reliable basis of identification unless the number is set so high that a substantial percentage of valid identifications go unclaimed by virtue of failing to meet the threshold.

Another problem with establishing a threshold limit for identification is the fact that a latent print or mark results from friction ridge skin touching and depositing some contaminant on a surface. No touch of a surface can be completely free of distorting influences. We do not compare skin to skin to establish identity; rather, we compare image to image to determine if the two images originated with the same source, i.e., the same area of friction skin. Each image, usually one a latent print and the other an inked print, is subject to numerous sources of distortion affecting interpretation of the image. The consequence of distortion is that no two touches can have, in all regards, exactly the same distorting factors affecting the prints or images that are being compared.

Therefore, the degree of clarity in the resulting print is a factor in its potential value for identification. As the clarity of a print decreases, the actual physical area or number of features required for making an identification increases.[15] Most examiners would agree that, in general, fewer matching ''points'' are necessary to form an opinion with a very clear print than with a badly smudged print. That is because, even subconsciously, the human brain uses the finer detail, i.e., the shapes, in reaching a conclusion.

Along with the consideration of clarity comes the concept of tolerance. The greater the clarity of an image, the lower the level of tolerance one can allow for differences in appearance between the latent and inked prints. Conversely, the less clarity, the greater the tolerance one would have to allow. But at the same time, as clarity goes down and tolerance goes up, so must the physical size of the print or the number of features to conclude a positive identification.[16]

International bodies of experts have studied the subject of point standards and issued consensus reports to the effect that no valid threshold limit exists. In 1973, the report of the Standardization Committee of the International Association for Identification resulted in the adoption by the IAI of Resolution VII, which stated:

> The International Association for Identification assembled in its 58th Annual Conference at Jackson, Wyoming, this First Day of August, 1973, based upon a three-year study by its Standardization Committee, hereby states that no valid basis exists at this time for requiring that a pre-determined minimum number of friction ridge characteristics must be present in two impressions in order to establish positive identification. The foregoing reference to friction ridge characteristics applies equally to fingerprints, palm prints, toe prints and sole prints of the human body.[17]

More recently, at a symposium attended by approximately one hundred recognized fingerprint experts from around the world and hosted by the Israel National Police in 1995, the ''Ne'urim Declaration'' was adopted by the fingerprint examiners assembled, stating:

> No scientific basis exists for requiring that a pre-determined minimum number of friction ridge features must be present in two impressions in order to establish a positive identification.[18]

IDENTIFICATION METHODOLOGY: ANALYSIS – COMPARISON – EVALUATION (A.C.E.)

The most popular published contemporary methodology of forensic identification employs a three-phase process.[19,20] The first phase is **analysis**. Analysis is a thorough examination of the unknown. In the case of fingerprints, the latent print would be examined to determine the ridge formations that exist at three levels of detail. ''Level one detail'' refers to the first appearance of the print noticed at the beginning of an examination. Generally, ''Level one'' refers to the overall pattern or ridge flow tendencies of the print. ''Level two detail'' refers to the next features observed, generally those with a physical dimension on the order of magnitude of a ridge width. The so-called ''Minutiae'' or ''points,'' are level two detail. ''Level three detail'' refers to smaller features generally observed under magnification. Level three features are normally contained within a single ridge, such as shapes and positions of sweat pores (poreoscopy) or distinctive shapes on the edge of a ridge (edgeoscopy). Incipient ridge shapes are also usually considered level three details, but the presence of incipients in general would be a level one consideration. A large scar might be considered as level one detail, whereas a small scar might only be observed at level two. Within a scar there may be valuable level three detail. A thorough analysis of the unknown consists of far more than simply looking at the minutiae points.

Another part of the analysis of a latent print is the assessment of all of the various causes of distortion and their effect upon the print. Distortion could result from a number of sources, including the matrix, or residue, which comprises the print; the substrate, or surface, on which the print was left; the direction of touch; the pressure of the touch; reaction of the matrix with the development medium; and so on. All of these factors should be assessed during the analysis of the latent print.

Analysis also takes into consideration the clarity of the print. Clarity differences result from distortion. A latent print lacking level three detail as a result of pressure distortion, for example, might be described as having a low degree of clarity, whereas a print showing good pore and edge structure and having minimal distortion might be characterized as having a high degree of clarity.

Inherent in the analysis of the latent print is the selection of a suitable target to be memorized and used when searching the inked prints. Such a target is usually an easily recognizable cluster of minutiae points. On the other hand, it might be a distinctive scar, a prominent crease or wrinkle pattern, or any other significant and easily recognizable formation that results from features in the area of friction skin that left the print. The target will be the starting point for the second and third phases of the identification process, therefore it should be both an easily recognizable feature in the unknown print and potentially the easiest to find in the known prints.

A thorough analysis should be accompanied by the taking of detailed notes describing the latent print. Notes should make reference to all observed distortion factors. Notes may also include reference to the level of clarity present in the print. One might actually draw the target, both as an aid in its memorization and as a part of the description of the latent. On occasion, one may even choose to physically follow or trace the ridges completely throughout the print and draw a representation of the entire latent in the notes. This type of demonstrable analysis lends credence to any subsequent identification.

Once a thorough analysis of the latent print has been completed, the second phase of the identification process is **comparison**. Whereas, during analysis the examiner focuses exclusively on the unknown print, during the comparison phase the examiner concentrates primarily on the known, or inked, prints. The examiner searches each inked print in turn, observing all three levels of detail in a search for an image that is consistent with the detail found in the latent print during its analysis, and that has the target selected for the search.

Once a known print is located that is consistent in appearance with the unknown and contains the target, the examiner enters the third phase of the identification process, **evaluation**. In this phase, the two prints are examined together, side by side. The examiner finds features first in the unknown print, then in the known print, then evaluates the corresponding features to determine if they are within tolerance for the level of clarity that exists in the images. In this manner, the examiner goes back and forth between the two prints, finding features first in the unknown, then evaluating their appearance in the known print.

The reason for working from the unknown image to the known has its foundation in human psychology. When dealing with a less clear image, usually the latent or unknown print, the brain is subject to influence by ''mind-set.'' If a feature is first observed in a clear image, the brain may form an expectation and be tricked into ''seeing'' the same feature in an unclear image even though it does not actually exist there. Take, for example, in the case of a faint ninhydrin print in which the ridges appear primarily as a series of light dots. If the examiner concentrates on first finding points in a clear, high contrast inked print, then tries to find the same points in the poorly defined latent, mind-set might easily lead the examiner to ''see'' points that do not exist. To avoid this possibility, a cautious examiner always finds the features in the unknown print first, free from mind-set, then locates and evaluates the corresponding features in the known print.[21]

During the evaluation phase of the identification process, the examiner must consider all of the differences in appearance between the two images. It is an accepted tenant of fingerprint science that no two prints will ever be exactly the same in all respects. First, any touch is a contact between a complex curved surface (the skin) and, usually, a flat surface. This touch must necessarily be accompanied by distortion of the skin itself. Second, the amount and type of matrix (residue left behind) will differ. Third, the angle and pressure of the contact will change from one touch to the next. Fourth, the size of the area of skin coming into contact with the surface will vary. Any number of other factors may also contribute to differences, some subtle and some extreme, in the appearance of two prints that result from two touches by the same region of friction skin. It is not sufficient to look only for similarities and ignore the differences, nor is it proper to look at only some features and ignore others. The true expert must consider everything appearing in each image.

It is at this point that tolerance enters the equation. Based on an understanding of distortion and its sources, some differences in appearance fall within acceptable limits of tolerance. For example, it is an easy task to understand and to account for the differences in appearance between a print resulting from a light touch and a print resulting from a heavy touch. The differences in appearance between a fully rolled inked print and a crime scene mark are also easy to understand and easy to account for. These differences would be said to be within tolerance.

On the other hand, for example, a clear crime scene mark with a whorl pattern having an outer tracing, when compared to an inked print having a whorl pattern with an inner tracing, would be considered out of tolerance, even at level one. A ridge ending or bifurcation in one print where an open field of ridges exists in the other print would be out of tolerance at level two. Two bifurcations opening in the same direction, whose shoulders are essentially even in a crime scene mark with high clarity, would also be out of tolerance when evaluated with two bifurcations opening in the same direction in the inked print in which the shoulders were offset.

Analysis, *comparison*, and *evaluation* – **ACE –** takes into consideration much more than simply looking at the points in a crime scene mark, checking the inked print, and counting until a threshold number is reached. It is the *evaluation*, that is, the determination that all features are within tolerance as determined by the clarity of the two images, that sets the scientific process apart from the simpler idea of counting points. For that reason, this methodology is sometimes referred to as the ''evaluative process.''

COMPLETE SCIENTIFIC METHODOLOGY: ACE-V

As stated earlier, a field of science has the characteristic of allowing the practitioner to make precise statements within the discipline that may be checked or verified by other qualified persons. For any result or conclusion to be scientifically valid, that conclusion has to be reproducible by other qualified experts in the discipline. Applied to any given fingerprint identification, **verification** is proof of the scientific validity of that identification.

Some might argue that since not all experts can verify all identifications, the results cannot be considered scientific. By contrast, however, not all mathematicians are capable of resolving all mathematical equations and not all physicists are able to perform all physics experiments. The ability of the practitioner becomes a factor in any science. Just as errors in mathematics result from mistakes made by mathematicians, errors in fingerprint identification result from the mistakes of fingerprint examiners. The science is valid even when the scientist errs.

Technically speaking, verification is not a part of the *identification* process. The identification itself takes place in the mind of the examiner making the comparison. Verification is the identification process repeated in someone else's mind.

Independent verification, however, is a crucial part of the *scientific* process. Without such verification, identification has not been proven to the level required by science. No report should be made of an identification until a second qualified expert has made that verification independently of influence or pressure from any source.

Of course, the most important practical reason for having verification performed is that it reduces the risk of an erroneous identification being reported. In any field of human endeavor, there exists the potential for human error. When an erroneous identification is formally reported, almost certainly an innocent person will suffer. A conscientious program of independent verification, followed without exception, should catch erroneous identifications and prevent them from being acted upon.

Erroneous identifications among cautious, competent examiners, thankfully, are exceedingly rare; some might say, ''impossible.'' Clerical errors, however, are not uncommon. Writing down the wrong finger, or worse, writing down the wrong name, occurs far more frequently than a true erroneous identification. If the most important practical function of verification is to prevent the reporting of erroneous identifications, the more frequent benefit of verification is the avoidance of embarrassment, or worse, false arrest resulting from clerical errors. A true clerical error should not be considered an erroneous identification, but department policies and procedures should be written to ensure the prevention of clerical errors.

TERMINOLOGY CONSIDERATIONS IN TESTIMONY

Some experts have used terms such as ''explainable dissimilarities'' and ''unexplainable dissimilarities'' or other ambiguous terminology to differentiate between variations in appearance that are within tolerance or out of tolerance. Such use of terms is regrettable because it is too easily misunderstood by lay persons and inevitably leads to confusion. The ambiguity of such terms is also a boon to opposing attorneys in their attempts to create ''reasonable doubt'' in the jury box. Therefore, ambiguous terms such as those above should be avoided.[22]

Instead, one should speak either of distortion (an artifact resulting from differing factors in the two touches) or dissimilarity (a feature that exists in one area of friction skin but not the other.) With the former, a latent print may still be identified. In the latter, the two prints could not have come from the same source. When speaking to lay persons or others not familiar with fingerprint concepts, one should be careful to establish the correct definitions prior to using any specialized terminology in a discussion.

Regrettably, the use of terminology among fingerprint experts is not universal. For example, some use the term ''dissimilarity'' to refer to simple appearances that are not exactly the same in two prints, in which case one is never free from dissimilarity, whereas the term ''difference'' may be used to refer to features that are out of tolerance.

It should also be recognized that, in latent print science, the term ''identification'' is normally used to indicate a conclusion that two prints originated from the same area of friction skin and therefore from the same person. In the other comparative sciences, the term ''identification'' refers only to inclusion in a group. In those other disciplines, the term ''individualization'' is used when an unknown print or impression is matched to its source. For example, a footwear examiner might ''identify'' a shoe print as having been made by a certain brand, style, or size of shoe. The examiner might then ''individualize'' the shoe print to the specific shoe from which it originated. Thus, the term ''to identify'' is used to include the known as a possible source of the unknown, whereas the term ''to individualize'' is used to exclude all other sources except the known.

It is unfortunate that this divergence in the use of terminology has evolved between fingerprints and other sciences. However, in fingerprint science, the use of the term ''identification'' is too deeply entrenched to realistically expect a change that would bring usage in line with the other comparison sciences. Likewise, other comparison scientists are not likely to change their usage in order to accommodate latent print examiners. Since it appears this divergent usage of the terminology will continue indefinitely, it is important that latent print examiners understand the meanings in order to avoid confusion, either in conversation with other scientists, or in presenting evidence to a jury.

METHODOLOGY: FIVE-STEP FORMULA

In the foregoing discussion, the identification process was explained as ACE and the scientific methodology as **ACE-V**.

In counterpoint to the three-phase identification process of ACE, a five-step formula may be applied that, in essence, is nothing more than an alternative way of explaining the same mental process. The conclusion reached by the examiner would be the same and verification is still required. But some examiners find the five-step formula easier to understand, easier to apply, and more precise in its explanation to a lay person.

In this formula, the first step is an **examination of the unknown**. For all practical purposes, this step is the same as the *analysis* phase described above. The latent print is studied in the same manner until its full detail is fixed in the mind of the expert and all of the factors of distortions have been considered.

Following this step, the examiner studies the known prints in an attempt to arrive at the **formulation of a hypothesis**. In practice, the hypothesis is always that the latent print was made by the same person as the inked prints.

Inherent in the formulation of a hypothesis is the consideration of the corresponding null hypothesis. The null hypothesis would mean that the unknown print could not be individualized to the known print. In practice, however, a more practical term for the opposite of the hypothesis would be ''counter-hypothesis.''[23] If the hypothesis is identification, then the counter-hypothesis would be exclusion. The ''null hypothesis'' might include the possibility that the examiner could not reach a conclusion, which will be dealt with separately, later in this discussion.

Once the stage of hypothesis and counter-hypothesis has been reached, the examiner proceeds to the third step, **experimentation**. In this step, the examiner goes back and forth between the two prints, first finding features in the unknown print, then examining the known print for the same features within tolerance. At the same time, the examiner should always be aware of features in the known print in order to recognize dissimilarities in the unknown. However, experimentation consists primarily of finding the features first in the unknown, then looking in the known.

Working correctly, then, to test the *hypothesis* of identification, the examiner would proceed with *experimentation* (finding features in the latent print, then examining the inked print for the same features) until the instant that the thought first crystallizes that this is, in fact, an identification. This instant represents the **formation of a conclusion**.

As most experienced latent print examiners will recognize, the comparison does not cease at the first instant the expert reaches a conclusion. In practice, the comparison always continues past this point. The conclusion at the very first instant is, indeed, tentative. The examiner continues to search for additional features until it is reliably proven that each time a new feature is found in the latent print, a corresponding feature will exist in the inked print. This continuing comparison, **testing the conclusion**, is the final step in the process. The hypothesis is said to be proven, and the identification finalized, when the examiner has established ''reliable predictability'' in the relationship of features as they exist in the unknown and known prints.[24]

So, as an alternative to ACE, we have a five-step formula as follows: *1) Examination of the Unknown, 2) Formulation of a Hypothesis and Counter-hypothesis, 3) Experimentation, 4) Formation of a Tentative Conclusion,* and *5) Testing the Conclusion.*

One advantage of thinking in terms of this formula is that it easily allows the examiner to answer the question, ''At what exact point did you know that you had an identification?'' The answer using this five-step formula would be, ''At the point at which I established the reliable predictability of features between the latent print and the known print.''

Just as important as the consideration of proving the hypothesis is the consideration of disproving the counter-hypothesis. In order to say that we have ''individualized'' the unknown print, that is, identified it to the exclusion of all other sources, we must be able to disprove the counter-hypothesis as well as to prove the hypothesis. Likewise, if we are going to exclude a particular person as the source of the unknown print, we must be able to prove the counter-hypothesis and disprove the hypothesis.

INCONCLUSIVE RESULTS

Another possibility exists, that of being able to prove neither the hypothesis nor the counter-hypothesis. In this circumstance, the examination is said to be ''inconclusive.'' The latent can neither be identified nor excluded as having been made by the same area of friction skin as the inked print.

If we accept the fact that any area of friction skin is unique, then we must agree that each latent print or crime scene mark must also be unique. From this understanding, it may be seen that it is not technically correct to say that the suspect could have made the unknown print or some other person could have made it. The truth is that only one person could have left the unknown print. Even when the result is inconclusive, it is not the print itself that lacks uniqueness. That which is lacking is the ability of the examiner to distinguish the uniqueness that exists.

An inconclusive result may stem from either of two causes. First, the latent print may not be of value for comparison, or second, the inked print may not be of value for comparison. It is occasionally the lack of clarity in the inked print in the area of concern that renders an identification or exclusion impossible. In such a case, additional inked prints should be requested and the comparison repeated.

In the case where the inked prints do, in fact, have sufficient clarity to allow a comparison in the area of interest, and the result is still inconclusive, then the latent print is of no value for further comparison. If a latent can be neither identified nor eliminated as having been made by any given area of friction skin based on a comparison with a clear known print, then to continue to compare that latent to other inked prints is meaningless. If suspect ''A'' cannot be excluded as the source of a crime scene mark, then the expert cannot logically claim at a later date that suspect ''B'' is the source of the mark to the exclusion of all other persons.

In many cases, it is obvious that the image lacks sufficient distinguishable features for any expert to make an identification. However, there are varying levels of ability in any group of examiners and some may be able to make an identification when others may not. Many factors enter into differences in skill or ability.[25] Therefore, in many cases, an inconclusive opinion should only be considered the opinion of the examiner issuing that conclusion and should not be binding on other experts.

A fingerprint expert performing a comparison may reach one of only three conclusions. The latent print or crime scene mark may be identified, it may be excluded, or the finding is inconclusive for the expert conducting that examination. The process does not allow for the results of ''possible, probably, or likely'' conclusions. Fingerprint identification is based on biological uniqueness. Since it is impossible to design a statistical model for the determination of uniqueness, there is no scientific basis for determining probabilities.

CONCLUSION

After careful consideration, most fingerprint experts will recognize in the foregoing discussion that the fingerprint identification methodology proposed is neither new nor radical. Indeed, the processes described are, in large part, what cautious experts have been doing for decades. The methodology we have been using all along is correct. Only our understanding of the process and our ability to explain it has been, in some cases, lacking.

Fingerprint identification is based on sound scientific principles. A thorough understanding of these principles and the methodology of comparison are fundamental to the correct practice of the science. To have every identification independently verified is crucial. Whether one chooses to think in terms of a three-phase process or a five-step formula is irrelevant, but to be able to articulate the methodology used is important. Careful consideration of the two alternative schemes of comparison and identification will allow the expert to both understand and explain what is done. To fail to try to understand the process is to be less than an expert.

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For more information, contact:

Pat A. Wertheim
P. O. Box 4232
Salem, OR 97302
USA

Phone: 503-363-6962
Fax: 503-589-9990
Email: foridents@aol.com

Proficiency Tests

(This information is reprinted from the October 2000 ASCLD/LAB Newsletter and is of particular interest to all examiners working in accredited laboratories.)

One of the most frequent maxims used concerning proficiency test samples is that they should be handled as ''regular'' case work. What does the ASCLD/LAB Board of Directors think? Should proficiency tests be handled like case work? Well, yes and no.

Proficiency tests should attempt to test your whole quality system, which would include receipt, handling, analysis, technical review, administrative review and reporting. With the typical proficiency samples, it is difficult to truly mimic an actual case sample, so the analysis, review and reporting stages are usually being tested.

Proficiency tests are designed to ''evaluate the competence of analysts, support personnel and the quality of performance of a laboratory.'' The proficiency test should test analytical methods, how they are applied and the resulting data. The proficiency test should not be subject to policies adopted by a laboratory for efficiency or expediency.

Concerns recently brought to the Board have included a situation whereby a laboratory adopted a latent print comparison policy on case work which stated that once a suspect is identified on a particular surface, additional latent prints on that surface do not need to be compared. In casework, this is a way of managing your resources. In proficiency testing, this may result in only a few of the proficiency test latent prints being compared which would lead to incomplete results sent to the provider. A proficiency test will be subject to the full complement of available laboratory examinations without regard to efficiency or expediency.

In another case a laboratory failed to detect a controlled substance on botanical material. The laboratory did not make it a practice to extract botanical material for controlled substances since the policy of their prosecutor's office was not to prosecute these types of cases.

In this instance, not finding a controlled substance was inconsistent with the consensus answer. Despite whatever operational policy a laboratory might maintain, this would be a situation where the laboratory has not demonstrated the competence of the analyst and the quality performance of the laboratory in analyzing a not infrequent type of controlled substance submission. A laboratory with this type of policy should seriously review their analytical procedures regarding these types of cases.

Another issue frequently raised is proficiency testing being performed like case work in ***group*** analysis, where by several analysts work the same proficiency test sample, arrive at the consensus answer and report that answer. If you don't perform and review case work this way, you should not do proficiency testing this way. However, if your laboratory requires that a casework conclusion be verified by re-analysis of an actual case sample or result, that action is an acceptable proficiency test practice. Contrast this with a ***team*** analysis scenario that can occur in disciplines such as DNA. If you normally have a technician prepare a sample for DNA typing by an analyst, both can share a proficiency test to the extent that they perform these duties on casework. The proficiency test is worked like a ''regular'' case.

What's the bottom line answer? Do casework like casework, but do proficiency tests in such a manner that the competence of analysts, support personnel, and the quality of performance of a laboratory can be evaluated.

SCAFO Sponsored* Training Courses

Advanced Ridgeology Comparison Techniques (40 hrs)

December 12 - 16, 2000
~~$495.00 normal~~
$250.00 for SCAFO Members
Course restricted to 24 attendees.

This 40-hour seminar primarily addresses ridgeology concepts. Lecture topics include the psychology, philosophy, and methodology of comparing and identifying fingerprints. Related topics include expert witness testimony, reversed images, and detection of fabricated latent print evidence.

This is not a beginning class. Although every effort will be made to accommodate persons new to the field, some foundation in latent print matters is strongly recommended prior to taking the class. Students are expected to be familiar with fingerprint terminology and should also be doing some latent print comparisons on the job. Each student must bring a latent print comparison magnifier(s) and desk lamp. For more information visit: www.home.earthlink.net/~foridents/arc.html

Analysis of Problem Latents (24 hrs)

December 18 - 20, 2000
~~$395.00 normal~~
$200.00 for SCAFO Members
Course restricted to 36 attendees.

This advanced three-day class focuses specifically on the analysis phase of the identification process. Numerous "problem latents" will be examined in order to gain an understanding of dissimilarities and distortion so that the latents may be confidently identified and presented in court. In addition, students will learn to use a detailed, organized protocol for their analyses and to take comprehensive examination notes that allow a quick and accurate review of the case prior to trial. For more information visit: www.home.earthlink.net/~foridents/problatn.html

About the instructor: Pat A. Wertheim has been doing latent print comparisons since 1976 and has been teaching this class since 1986. To prove the effectiveness of his methods, he repeated the IAI certification test recently and correctly identified all fifteen latents in a record one hour, ten minutes!

Location: Embassy Suites Hotel, 8425 Firestone Blvd., Downey, CA. (562) 861-1900 (Gov. room rates)
Special Notice: Each student must bring a latent print comparison magnifier and desk lamp.
SCAFO members will have priority enrollment. Non-member applicants will be put on a waiting list until 30 days prior to the courses.

Name on Certificate: _____

Agency: _____

Mailing address: _____

City, State, Zip code: _____

SCAFO Membership Number: _____ Work phone: _____

FORWARD PAYMENT (payable to SCAFO) AND REGISTRATION FORM TO:

JAMES LAWSON
6357 Lake Athabaska Pl
San Diego CA 92119-3531

** With special arrangements and co-sponsorship by the Los Angeles Sheriff's Department - Scientific Services Bureau, SCAFO is pleased to offer these two classes at a special reduced rate.*

PRESIDENTS MESSAGE

As I sit anxiously awaiting the moment that I can turn the clock back one hour and regain that precious hour of sleep I lost last year I have a moment to reflect and contemplate.

I sit here realizing that fall is waning into winter (even though it's hard to tell here in California) and my year as President of this great organization is almost over. One more meeting and my year will be history. I will actually be able to go to the meetings and relax. That will be hard to get used to. RIGHT!!!!!

I would like to say that it has been an exceptional year and even though it isn't over I wanted to start thanking all the people who have helped me get through it successfully a little early.

I would like to take a moment to thank Bill Leo, Steve Tillmann, Jim Lawson, Bob Goss, George Durgin, Rodrigo Viesca and Alan McRoberts for all the hard work and enthusiasm they put in on this years Annual Training Seminar. Their combined energy and efforts made this year's seminar one of the most successful since its inception ten years ago. Yes, it's been ten years. The average daily attendance this year was over 130 per day and, with the exception of it being a little crowded and a temperamental sound system, it was a grand affair. There were also others who assisted in making this seminar a great success and they include the rest of the Board and many individual members who took their time to chip in and help out. To all of you I give my heartfelt thanks.

BUT the year isn't over and we have two more great functions to offer you, the membership. The first will be our annual Christmas Party / Installation Dinner. It will be held in Covina on the evening of December 2nd, 2000. The flyer with all the details about the evening's festivities should be winging its way to you as I write this message. SO mark your calendar and make it a point to attend.

Also S.C.A.F.O. and L.A.S.D. will be co-sponsoring two Training Courses in December. The courses will be the Advanced Ridgeology Comparison Techniques Workshop (40 hrs) and the Analysis of Problem Latents workshop (24hrs). They will be December 12- 16 and December 18-20 respectively. Both are being taught by Pat Wertheim. In this issue you will find an excellent paper by Pat. He presented the paper at the The Fingerprint Society Lectures, 17-19th March 2000. This only adds to the fact that S.C.A.F.O. is pleased to host Pat as the instructor for these two workshops. Because of Pat's long standing relationship with S.C.A.F.O., we have been able to offer these workshops at half the normal rate. These courses are especially helpful if you are intending to apply for your certification as a Certified Latent Print Examiner or just improve your comparison skills. They will be held in Downey at the Embassy Suites Hotel (562-861-1900). For additional information contact any of the members of the Board or Alan McRoberts, Bill Leo or Steve Tillmann. Get your spots now because the available slots were filling up fast the last time I checked.

Well, I hope I haven't forgotten anything but that's how it goes when you're my age. In closing I'd again like to thank all of you for making my year as President an interesting (and, from what I've been told, a successful) one. Again ''Thank You All.''

Fraternally,

Art Coleman

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

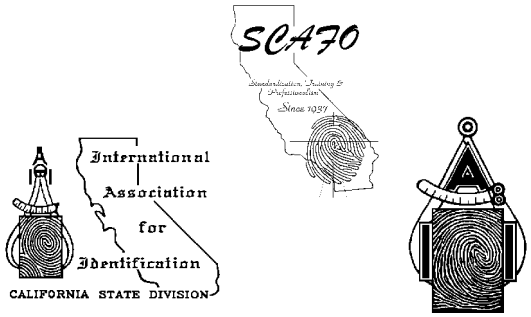
- President Theodore Roosevelt - 1908

For subscription or membership information contact:

S.C.A.F.O. *Steve Tillmann, Secretary*
2020 West Beverly Blvd., Los Angeles CA 90057
(213) 989-5107 email tillmann@scafo.org
$20.00 yearly subscription (attendance required for membership)
$30.00 yearly for International subscriptions

C.S.D.IA.I. *Ashley R. Crooker*
1521 Annie Court, Tracy CA 95376-2269
(209) 832-8236
$25.00 yearly membership

I.A.I. *Joseph P. Polski, Secretary-Treasurer*
2535 Pilot Knob Road, Suite 117, Mendota Heights, MN 55120
(612) 681-8566 (612) 681-8443 FAX
$60.00 yearly membership



S.C.A.F.O.
2020 West Beverly Blvd.
Los Angeles, CA 90057-2404

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SCAFO Members
get "yourname@scafo.org"

See instructions on the website's email page.

-- Upcoming Events/Schools/Seminars--

December 2, 2000	***S.C.A.F.O. Meeting*** Host Bob Goss San Bernardino Police Department
December 12 - 16, 2000	***Advanced Ridgeology Comparison Techniques*** *Downey, CA* *hosted by SCAFO (see announcement)*
December 18 - 20, 2000	***Anaylsis of Problem Latents*** *Downey, CA* *hosted by SCAFO (see announcement)*
February 3, 2001	***S.C.A.F.O. Meeting*** Host Steve Tillmann Los Angeles Sheriff's Dept.
April 30 - May 3, 2001	CSDIAI 85th Annual Training Seminar Concord, CA
July 22 - 28, 2001	International Association for Identification Miami, FL
Call for Dates	Field Evidence Technician Course Center for Criminal Justice California State University, Long Beach (562) 985-4940
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