AN ANALYSIS OF STANDARDS IN FINGERPRINT IDENTIFICATION

". . . an evaluation of fingerprints containing a score of 'points' in the hands of an unknowledgeable person could constitute a greater hazard to the science than a comparison of prints possessing relatively few points in the hands of a thoroughly experienced technician. Experience, therefore, is an indispensable factor in fingerprint work."

Fingerprint identification is the most positive form of personal identification known because it is based on the unique and unchanging arrangement of the ridge details on a person's fingers. The fact that the ridge arrangement is different on every finger of every individual is so well established that it will not be discussed further here. Fingerprints generally are understood to be impressions of the end joints of the fingers since those areas are taken for record or filing purposes and are most frequently involved in criminal investigative (latent print) work. The technique of identifying fingerprints, however, is equally applicable to identifying any of the other ridged areas of the hand or foot.

In identifying fingerprints, the expert matches or shows the coincidence of the ridge characteristics contained in two impressions. Rolled fingerprints may contain from 75 to 175 ridge details or "points" on an average. To establish identity, the fingerprint technician does not need the impressions of all 10 fingers of a person, or even the complete impression of a single finger; a relatively small area of one fingerprint is adequate for the purpose. The question persists then: Is there a minimum number of points which can be used to show identity beyond any possible error? Longtime consideration of this question has resulted in various methods of evaluating a print and the adoption of a number of different standards in various countries, localities, and organizations. Most of these are based to some extent on either empirical or statistical viewpoints. The standards thus set, or suggested, vary from a half dozen characteristics or less to a maximum of 17. This gives rise to the question of the feasibility of establishing in the United States a common standard requiring a certain number of points for an identification.

Variation in Standards

Despite the multiplicity of standards and methods of calculation, there exists no universally acceptable number of ridge characteristics which can be required in every identification in every case. This observation is not a criticism of fingerprint identification, but stems from factors which continue to elude concrete statistical computation. Long experience in the FBI Identification Division has shown that 12 ridge characteristics which correspond in shape and relationship are ample in any case to establish an identification. Experience has also shown that identifications can be based on fewer characteristics, but thus far no absolute number which is logically convincing or has universal validity has been established. The frequently quoted 12-point standard or "rule" probably originated from the writing of Edmond Locard, the French criminalist who formulated certain

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widely published conclusions regarding the number of points necessary to establish identity. He commented that prints having more than 12 points of similarity are identical beyond doubt.

Technical Factors

The ridges in the various sectors of a fingerprint have typical directions or trends. As a prerequisite to identity, the ridges in two prints must show obviously similar trends. Thus, no fingerprint area having completely straight ridges could be identical with the print of a fingertip having ridges with a pronounced arc-like curvature. There might be a very unusual exception to this observation, however, in a case involving a fragmentary latent print grossly distorted by slippage or a print in which extensive mutilation has obscured the original ridge trend.

To be identical, the ridge characteristics in two prints must correspond in both shape and relationship. Some technicians have cataloged as many as 18 distinctive shapes or types of ridge characteristics. For all practical purposes, however, a majority of these occur so infrequently or are so infrequently discernible in prints that they have little significance in the average identification. Microscopic distances or formations may be obliterated by development techniques or lack of continuity of ridges in a latent print. From the general working standpoint, the types of characteristics can be narrowed to the ridge ending, the bifurcation, and the dot. Two additional characteristics are commonly distinguished or mentioned because of the ease with which they are visually discernible as distinctive formations. These are the short ridge and the enclosure or island. Technically, however, unless these formations are of extremely short length or extent, they can be used legitimately as two ridge endings instead of a short ridge and as two bifurcations instead of an enclosure. The logic of this procedure can be seen in mentally lengthening the short ridge or enclosure steadily to the point where it cannot be perceived as a unit ridge formation, that is, extending it to the point where both ends of the short ridge or island are not apparent at a glance.

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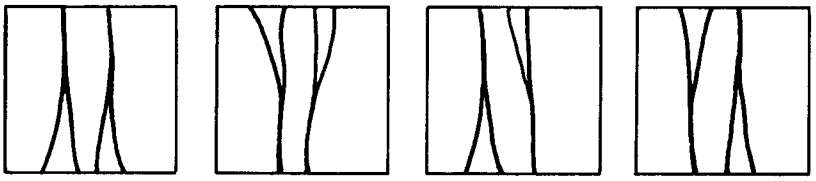
Most efforts to calculate an absolute standard have dwelt solely on the frequency of occurrence of the various types (shapes) of ridge characteristics. The ridge ending and bifurcation by far occur the most frequently. From such data it is possible to assign each characteristic shape a relative numerical (weight) value and, by adding the values, conceivably to arrive at an absolute sum which could be used as a minimum standard to establish identity.

Despite the infrequency of the numerous other distinctive ridge formations cataloged by researchers, the values assigned or suggested for characteristics on the basis of such occurrences frequently do not correspond with the statistical figure and indicate that this may not be a reliable method.

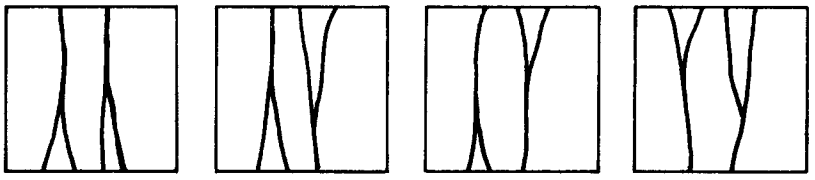
The more subtle technical factor ignored by many researchers is the frequency of relationship of various ridge formations. In other words, what is the relative frequency of occurrence of two ridge endings at the same level and pointing in the same direction which are adjacent, separated by one ridge, by two ridges, by three ridges, and so forth? Likewise, what is the variation of occurrence between two opposed (pointing opposite directions) bifurcations at the same level which are adjacent compared to two such bifurcations separated by one ridge, two ridges, three ridges, and so forth? A little study will show that the variations in the relationship of such characteristics including separated or overlapping linear positions would reach extremely high numerical possibilities (see illustrations A, B, and C). Shape and total relationship are equally important.

Many statements concerning other technical factors in the fingerprint itself have been made. The opinion has been voiced that a relatively small number of characteristics in the delta or core area of the impression bear greater weight in effecting an identification than a much larger number of characteristics present in a tip or peripheral area. Experienced fingerprint technicians do not agree with this opinion. It is apparent also from routine observation that the distribution or density of characteristics in fingerprints is not uniform but varies

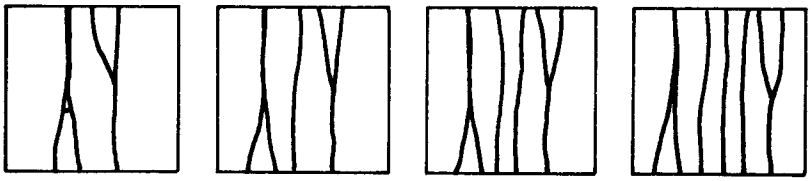
Relationship of Characteristics



A. Variations in direction of two bifurcations.



B. Variations in elevation (separation or overlap) of two bifurcations.



C. Intervening ridge relationship of two bifurcations.

greatly in different areas of different impressions. Although the delta and core areas are sometimes cited as uniquely occurring spots in any given fingerprint, any experienced fingerprint technician knows that fragmentary prints showing only delta formations (cores being absent) occasionally have to be compared in all three possible positions of the delta. The delta formation in itself is no more unique than any other portion of a fingerprint, and there is no justification for giving it preferential consideration in establishing identity.

It has also been stated that in the absence of the core or delta, a greater number of ridge details are required in making an identification. The arch pattern is singled out as an example. The arch, however, constitutes only about 3 percent of the total pattern types, and consequently it is difficult to see how such a relatively infrequent-occurring pattern would require a greater number of ridge details for identification.

Another practical, technical factor involved in identification is the determination of the exact finger of a hand. Thus, if the presence of adjacent finger impressions, whether identifiable or not, enables the technician to ascertain the position of the digit in the prints of two hands, the number of possible comparisons is necessarily reduced to one-tenth of the original total.

Writers on fingerprints quite frequently mention the value of poroscopy in effecting identifications where only a few characteristics are present. FBI technicians know of no case in the United States in which pores have been used in the identification of fragmentary impressions. To the contrary, our observations on pores have shown that they are not reliably present and that they can be obliterated or altered by pressure, fingerprint ink, or developing media.

Some of the less common and more minute ridge formations or connections categorized by researchers may be considerable factors in identifications when they are readily visible in both prints. Rudimentary or incipient ridges, although they are ignored for classification purposes because sufficient pressure is not always exerted on the finger to print them, are legitimate characteristics in effecting identifications provided they are present and legible in both prints. Thickness of the ridges ordinarily is not a factor since it varies with pressure on the finger, but unusual thickness in isolated single ridges could conceivably have some corroborative value. Microscopic breaks (of less than ridge width) usually are not significant since the nature of latent prints and the means of development often determine the appearance or nonappearance of such breaks. Scars and creases, while they are not in themselves decisive elements, could be of some import.

Special situations are sometimes encountered with adjacent fragmentary finger impressions where their position and relative lengths indicate be-

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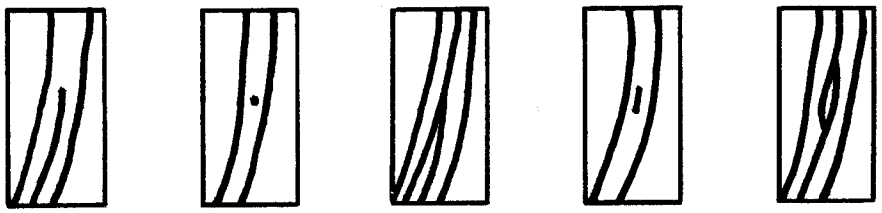
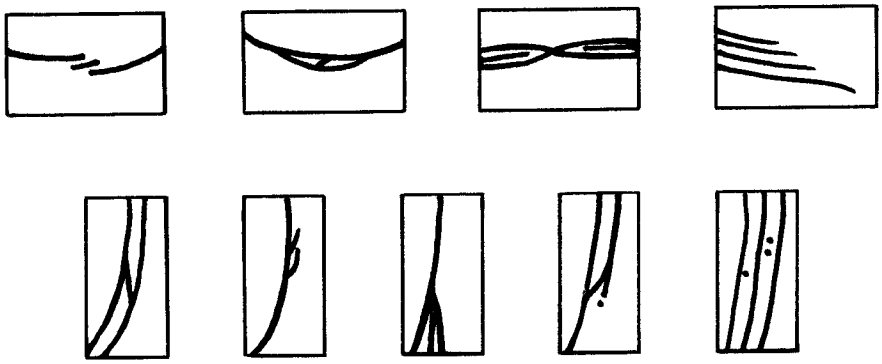
Basic Ridge Characteristics



Basic ridge characteristics are the ridge ending, the dot, and the bifurcation. The short ridge and the island are also generally regarded as individual characteristics because they are easily recognized, but if they are of appreciable extent, each can be regarded as two characteristics.

Unusual Ridge Formations



A number of additional ridge characteristics cataloged by researchers are really ridge junctions. Numerous unusual groupings of ridge details also occur.

yond doubt that they were placed on the object simultaneously. Contrary to some opinions, identifications made with a few points in each of several such impressions have been perfectly valid, although the "correspondence" of a single legible characteristic in one of such digits could hardly have probative value.

Another unusual situation involves the appearance of several fragments representing different areas of a single fingerprint on an object, no one of which in itself is sufficient for identification, but which as a group would show identity.

Function of an Absolute Standard

Ostensibly the purpose of an absolute standard would be to create uniformity in the quantum of ridge detail essential to establishing every identification. To achieve this, recognized fingerprint authorities would have to set a minimum standard to which there would be no exception. In other words, there would be no room for differing opinions on whether the available ridge detail either is or is not sufficient to establish fingerprint identity. If such a standard were adopted, one of the first controversies would be whether or not a fingerprint in question actually is legible enough to show the number of characteristics required by the standard. Thus, one expert would claim that the print contained eight characteristic points, while another would claim that he could see only six or seven. That this is possible is known through observing persons with various levels of experience in latent print work. The person of limited latent print experience is frequently not able to pick out as many fingerprint characteristics in impressions of limited legibility as the expert with many years of practice in such work. Thus, instead of a controversy concerning the number of points on which the identification would be based, the controversy would turn on how many points different experts could observe.

In the United States there is no requirement by the courts that an expert base his opinion of identity on any specific number of ridge characteristics, but, from published information, it is apparent that a number of localities or countries have adopted standards which enjoy traditional or legislative respect. If the standard used is unjustifiably high, the law enforcement agency cannot enjoy the full value of fingerprint identification. In many cases the experts can indicate to their investigative personnel that the latent impressions in a case are identical with the prints of a particular suspect. However, since the impressions do not contain the number of fingerprint characteristics de-

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manded by the standard, the fingerprint evidence cannot be presented in court for prosecutive purposes. Thus, the adoption of a standard which is not based on every conceivable ridge formation or does not account for limited practical circumstances (and therefore is not totally unassailable) would be a hindrance rather than a help to fingerprint identification.

The adoption of an absolute standard would not prevent "experts" of little training from testifying to identifications in court. In the United States, if a defense attorney doubts the competence of the expert or the adequacy or accuracy of his findings, the attorney is free to have the material examined by others in the same field, who can then testify to their opinions.

Practical Aspects

From the theoretical standpoint any fingerprint, when it is identified, needs to be distinguished from every other fingerprint existent in the world. A little reflection will show, however, that this greatly exceeds the practical aspects of identification, since in the average case a crime scene print is initially an investigative tool to identify a suspect who was in the same country, State, or locality at the time the crime was committed.

In the practice of fingerprint identification, there is no room for "probable" identity, and if a print is too fragmentary to be positively identified, it is of no value for identification.

In this connection, a great deal of attention has been given to mathematical calculations concerning the "probability" of the duplication of fingerprints. Some of these run to astronomical numbers. The intent of such calculations is not, contrary to the qualms of the uninitiated, to admit the possibility of duplication but to confirm the fact of nonduplication. Calculations of this kind would be meaningless had not the total observation of all fingerprint technicians established "nonduplication" as an incontrovertible fact. The objective in the practice of fingerprint identification then is not to prove "nonduplication"—this has already been proved—but to positively establish the identity of a questioned print with a known print. It is inherent in the conclusion that identification with a particular print excludes possible identity with any other impression. The importance of the unique nature of a fingerprint identification cannot be questioned, but common sense shows that it is not necessary to compare any given print with the fingerprints of everyone on earth in order to match it with the correct one.

To illustrate the practical narrowing of identification through circumstances, let us suppose a murder is committed on a ship which has 150 personnel and passengers aboard. A fragmentary print is found in blood on the murder weapon. This impression contains six or seven ridge characteristics which are present on a finger of only one person of the entire 150. Would not this constitute positive fingerprint identification?

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The Role of the Expert

It is unfortunate that occasionally

Distribution of Characteristics

Note characteristics do not occur uniformly throughout the fingerprint. They are closely grouped (clustered) in some areas and widely separated in others. Types and number of ridge details, as well as distribution, vary greatly in different prints.

some untrained or inept person, or even an impostor, has passed for or been accepted as a fingerprint expert, but a standard of practice which could be constantly questioned is not a panacea for such occurrences. The acceptance of an expert witness is a discretionary matter with the courts.

A fingerprint identification does not exist until it has been established by a fingerprint technician through observation of the physical impression. Many experts feel that the experience, training, knowledge, and judgment of the technician are just as important, and in some cases more so, as the physical data on which his finding is based. Thus, an evaluation of fingerprints containing a score of "points" in the hands of an unknowledgeable person could constitute a greater hazard to the science than a comparison of prints possessing relatively few points in the hands of a thoroughly experienced technician. Experience, therefore, is an indispensable factor in fingerprint work. And it would seem logical that perhaps adequate, continuous, and thoughtful practice of the science is a more vital factor in eliminating borderline or erroneous testimony concerning fingerprint identification than establishing a questionable technical standard. Although such a suggestion is occasionally broached, less attention is given to insistence on increased training and experience for the technician than to the effort to put the science into a mathematical straitjacket. Conversation with almost any recognized expert in any field will elicit the importance of continuous all-encompassing observation as a factor of equal weight with the physical facts. Longtime assignment to fingerprint duties alone does not necessarily breed an expert. There must be continuous comparison of fragmentary impressions, observation of peculiarities and variations, and thoughtful consideration of questions and problems associated with the field.

The adoption of a low minimum standard would tend to give people of limited training in the field confidence in establishing identifications on small numbers of characteristics which they would not otherwise have attempted. Should there be any type of error or criticism involved, the standard established by the "experts" would be immediately quoted as justification.

No one can object to the continued compilation of statistical data and their legitimate application to identification work, but conclusions based on inadequate data are destructive and must be diligently avoided. Fingerprint identifications cannot be made on an a priori basis. Each case requires actual observation and careful examination by the expert, whose ability to discern the truth must not be restricted by unsupportable statistical data or theories. Professional competence and personal integrity are the surest safeguards against malpractice.