INTERPOL
EUROPEAN EXPERT GROUP on
FINGERPRINT IDENTIFICATION II
IEEGFI II

Method for Fingerprint Identification

Part 2;
Detailing the method using common terminology and
through the definition and application of shared principles

Index

Introduction by the chairman

INTRODUCTION

Plus de 100 ans après la première identification d'une trace papillaire retrouvée sur la scène d'un crime[1], la dactyloscopie demeure une technique de criminalistique d'une exceptionnelle efficacité mais dont les procédures d'analyse, de comparaison et de prise de décision restent l'objet de nombreuses discussions d'experts.

Une pratique quotidienne dans de nombreux pays, à laquelle s'ajoute la succession de colloques internationaux réunissant les meilleurs spécialistes européens voire mondiaux, n'ont pas permis jusqu'alors de fixer un standard unique, universel, qui règle définitivement la question fondamentale à laquelle doivent répondre, jour après jour, tous les spécialistes en dactyloscopie : « telle trace papillaire a-t-elle été laissée par tel individu ? ».

Autrement dit, à partir de quels éléments et selon quel processus peut-on établir avec certitude l'existence d'un lien univoque entre une trace papillaire, par essence fragmentaire, et un individu déterminé, sachant que de cette réponse, dépendra pour une bonne part l'issue d'un procès pénal ?

Ainsi posée, la réponse excède manifestement ce qui peut être, raisonnablement, laissé à l'appréciation d'un seul homme quelles que puissent être ses qualités professionnelles.

C'est bien cette problématique qui a été au cœur des travaux du groupe d'experts européens II d'Interpol sur l'identification par les empreintes digitales.

Si les solutions retenues au terme de discussions passionnées ne sauraient constituer *la formule magique* que tant appellent de leurs vœux, il m'apparaît que le groupe de travail s'en est beaucoup approché grâce à la mise en commun de la grande expérience professionnelle de chacun de ses membres qui, au-delà de leurs divergences se sont attachés à valoriser ce qui les unit.

Le document qui en résulte constitue le socle d'une approche commune, standardisée, de la comparaison dactyloscopique.
Il est le fruit d'un véritable travail de synthèse qui met en exergue des principes d'analyse, d'évaluation, de comparaison et de vérification, directement applicables par tous les services de dactyloscopie quel que soit leur système de référence actuel.

Ce document doit être mis en relation avec les résultats précédemment obtenus par les groupes de travail européens d'Interpol qui, au cours des 10 dernières années, ont traité de différents aspects de la dactyloscopie.

Il en est le complément indispensable et forme avec eux un ensemble cohérent d'une grande richesse.

J'ai personnellement éprouvé beaucoup de satisfaction à exercer la présidence de ce groupe

de travail, composé de femmes et hommes de grande valeur et dont l'action dans le cadre de l'OIPC, se devait nécessairement d'avoir une ambition particulière.

C'est dans cette perspective, au service de ceux qui n'étaient pas présents lors de nos réunions mais qui en attendent des résultats tangibles, que j'ai voulu conduire ces travaux.

J'ai la conviction que le chemin parcouru ouvre la voie vers la mise en œuvre de processus d'identification par les empreintes digitales plus rigoureux, mieux sécurisés et qui soient fondés sur des principes admis par tous les praticiens.

Enfin, je tiens à remercier chacun des participants à ce groupe de travail pour la qualité de sa contribution et tout particulièrement monsieur A. J. ZEELENBERG (1) chef du service national de dactyloscopie des Pays-Bas, dont l'engagement personnel a été déterminant dans les travaux ayant conduit à l'élaboration de la « méthode d'identification par les empreintes digitales ».

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1 Président du Groupe d'experts européens d'Interpol sur l'identification par les empreintes digitales1

1 Executive Summary

The Interpol European Expert Group on Fingerprint Identification II (IEEGFI II) was formed in May 2000 following a proposal supported by recommendations by the first working group on fingerprint identification, IEEGFI I which was put to and adopted by the 29th European Regional Conference, held in Reykjavik, Iceland.

The adopted proposal was an inherent progression and therefore, in essence, an extension of the work of IEEGFI I and as such was given the following terms of reference:

> **"To explore, define and establish common terminology concerning the content of the fingerprint identification process and the general application of this process to the detection, validation and comparison of ridge detail, so as to provide basis for communication and promote uniformity".**
>
> **"To define and establish recognised principles concerning the application of this process so that it can be standardised, controlled and made objective. This may cover aspects such as definitions, norms, standards, rules, guidelines and rules of thumb".**

IEEFGI II was augmented and enhanced by the inclusion of the delegation from Spain and met five times in total.

The IEEFGI II report, focused entirely on the terms of reference, is primarily comprised of two main chapters that may be seen as basic requirements for any forensic technique viz. a descriptive model and a decision making model. The IEEFGI II report also quotes directly from the IEEFGI I report and elaborating on related subject matter, a strong correlation is made with the original thus creating an entirely compatible procedure fit for the comparison and identification of finger marks.

Furthermore the report recognises and endorses the basic principles of fingerprint identification. It contains detailed guidelines for the analysis, comparison, evaluation, validation and verification of fingerprint detail, introduces common terminology , identifies certain areas of risk and advises upon the application of general scientific principles and methodology which can be readily translated to the field of fingerprint identification.

The report also expresses the need for a questionable identification procedure (QID) as a valuable extension of the verification procedure, an example of such a procedure is described in detail.

Consequently the methodology and entire process is transparent, rigorous, reproducible, and verifiable. Therefore it is expected that all fingerprint experts will understand, accept and endorse the content even if they were not directly participating in the working group.

In conclusion, the consensus of the Interpol European Expert Group on Fingerprint Identification II, concerning the content of the report, was both unanimous and unequivocal. It is the firm opinion of IEEGFI 11 that the terms of reference are met as practically as possible. The Interpol European Expert Group on Fingerprint Identification II commends the report to the European Regional Conference of Interpol.

2 Recommendations

The Interpol European Expert Group on Fingerprint Identification II makes the following recommendations to the European Regional Conference of Interpol:

- that the conference recognises the importance of this report and endorses it;

- that the General Secretariat of Interpol formalise and adopt the report;

- that the General Secretariat of Interpol place the report on the Interpol website;

- that the General Secretariat of Interpol send the report to all the European NCB's accompanied by a letter commending the report and advising members to read the report in conjunction with the original report of IEEGFI I and to forward the report to fingerprint experts in their respective countries;

- that the General Secretariat of Interpol also informs the NCB's that both reports are on the website and, as such, in the public domain and therefore likely to generate questions from fingerprint bureaux and / or towards fingerprint bureaux from other interested parties with respect to processes and procedures [or the lack of them] within specific fingerprint bureaux;

- that the "parenting" of the reports with respect to the promotion, monitoring and guidance of the implementation of the recommendations, the identification of possible constraints, flaws and further needs are laid in the hands of a permanent body, such as a standing committee.

The Interpol European Expert Group on Fingerprint Identification II submit that parenting is critical in order to gain full profit from the important work of the groups, to provide a safeguard against a charge of the work being counterproductive and to deflect criticism away from the General Secretariat of Interpol if bureaux and experts fail to implement these or other processes and procedures which may adversely affect the general image of the fingerprint profession if and when exposed.

3 Initiation and Installation of the Working Group

Based on the decision made by the 29th European Regional Conference held in Reykjavik, Iceland, in May 2000, the Interpol European Committee decided to endorse the report of the Interpol European Expert Group on Fingerprint Identification called "Method For Fingerprint Identification" and following the recommendations of this working group decided to extend the working group by giving it a new mandate and renaming it "the Interpol European Expert Group on Fingerprint Identification II"
Following the recommendations the General Secretariat was asked to arrange the meetings and to provide interpretation facilities into French and English.
During the meeting of the European Regional Conference Spain applied for membership of the working group, after some debate about the composition of the group the membership was willingly granted.
The Interpol SG who invited the delegations from France, Germany, Hungary, Norway, The Netherlands, Poland, Spain and the United Kingdom prepared the meetings for the IEEFGI.
The SG participated as well.

As a result the working group settled in the following constitution;

France	chair, draft, minutes
General Secretariat	organisation,?
Fingerprints Branch SG	
Germany	
Hungary	
The Netherlands	draft
Norway	
Poland	
Spain	
The United Kingdom	draft

The French delegation was elected chair during the first meeting. The French delegation also took up the task of taking the minutes of the meetings.

Meetings were held at the facilities of the General Secretariat in Lyon;

the 21st – 22nd	February	2001,	
the 18th – 19th	September	2001,	
the 3rd – 4th	October	2002,	
the 2nd - 3rd	July	2003,	(subcommittee)
the 31st March/ 1st	April	2004	

A draft report prepared by a subcommittee from France, the Netherlands and the United Kingdom was presented to the fifth meeting discussed, amended and approved.

4 Terms of reference

The terms of reference suggested by the first working group and adopted by the Interpol European Committee Meeting read as follows;

> **"To explore, define and establish common terminology concerning the content of the fingerprint identification process and the general application of this process to the detection, validation and comparison of ridge detail, so as to provide basis for communication and promote uniformity".**
>
> **"To define and establish recognized principles concerning application of this process so that it can be standardized, controlled and made objective. This may cover aspects such as definitions, norms, standards, rules, guidelines and rules of thumb".**

5 Introduction to the report.

5.1.1 This report is a follow up of, and an addition to, the report of the first IEEGFI working group called "Method For Fingerprint Identification" and is best understood in conjunction with it.

The first report mainly focused upon the outlines of the identification process and formulated recommendations to the organization, the procedures, the experts, training, the working environment and standards of behaviour.

5.1.2 Although some definitions were given it is the aim of this report to further detail common terminology and establish shared principles. If necessary definitions of the first report will be quoted in order to elaborate upon them.

5.1.3 A conclusion of the first report was that experts can only draw a positive conclusion about identity if a certain, coinciding, volume of information is established. Whether this volume is predetermined or not is dependant of the adopted approach.

5.1.4 This report focuses upon the ingredients the volume of information comprises of, and the process of decision making around it.

6 The report

6.1.1 To arrive to a minimum volume required for a positive identification, be it either by expert judgment on a case by case basis, or with reference to an empirical standard, requires an assessment of the information present, the validation of it, the decision making regarding its genuineness, and the decision about whether the whole of it together is sufficient.

6.1.2 Any communication or discussion about standards of decision-making is bound to fail if we don't talk about the same things. In fact standards can only be judged and compared in conjunction with the processes/procedures.

6.1.3 A basic requirement for a scientific method is repetition/replication; experts looking at the same material, applying the same procedure and standards will arrive at the same conclusion.

With the detailing of the methods and procedures and the fixation of them the method is made transparent and controllable. Furthermore it facilitates the transfer of it through generations thus promoting empirical value.

6.1.4 In sharing the principles one promotes uniformity and facilitate the exchange of opinions upon individual cases.

Regardless whether a standard based on minutiae is applied or not, if one applies roughly the same rules one would be able to indicate the number of coinciding minutiae if a case is transferred from one organisation to the other (leaving the final judgement to the receiving partner)

6.1.5 In order to further structure the process of validation, comparison and decision-making the basic requirements for forensic identification suggested by van Koppen and Crombag are adopted.

Prof dr. P.J. van Koppen from the universities of Leiden and Antwerpen, and prof.dr. H.F.M. Crombag from the university of Maastricht have analysed all types of forensic evidence and formulated the common, basic, requirements in an article in the Dutch Journal for Lawyers in January 2000 as follows;

- **1.** The expert has a descriptive model at his disposal that describes the relevant characteristics for comparison and identification of the mark found at the scene of crime with the characteristics of the defendant;
- **2.** There is sufficient variation between different persons regarding these relevant characteristics;
- **3.** The relevant characteristics change so little over time that even after some time comparison is still feasible;
- **4.**The expert has a method with which the relevant characteristics can be established unequivocally/unmistakably;
- **5.** The expert has rules of decision making at his disposal with which he can decide about identification based upon the comparison.

6.1.6 It can be concluded that fingerprints meet all the requirements set. The indefinite variation (or uniqueness) is proven by the origin, statistical analysis, and decades of empirical findings in particular related to the level two detail of fingerprints (2). The requirement of permanence (3) is also met and the basic properties of characteristics remain the same even under adverse conditions (4) so they can be established with certainty, provided the fingerprint is "readable".

6.1.7 In addition the requirements for a descriptive model and a decision making model have to be met and those will be addressed in this report. In practice the descriptive system and the decision-making system intertwine; i.e. in establishing whether a dactyloscopic point is present/absent, that it is significant, and is coinciding with the comparison print, is a result of applying the descriptive model and making a string of small decisions. So the decision-making model does not restrict to the decision whether or not the volume is sufficient.

6.1.8 The "volume" of information consists of three main elements; the quantitative aspects, the quality aspects and the degree of resemblance/similarity.

6.1.9 The methodical steps described in the first report e.g.; the information phase, the comparison phase, the evaluation or balance phase, the conclusion phase and the verification, are the backbone of a scientific process. The descriptive model and the decision model supply additional "tools and rules" that can be applied through all of the methodical steps. In the information phase and during comparison the descriptive model is prominent. Decisions are made throughout all the steps.

6.1.10 In this report the common principles, rules and guidelines for the detection, validation and comparison of ridge detail are formulated.

First the descriptive model is discussed and explained including decision making rules relevant to it. Secondly the decision making rules used in the all the phases are described.

7 The descriptive model.

7.1.1 Fingerprint information is disseminated in three levels, in the first report this was stated in chapter 12.2 to 12.4 of the holistic approach as follows;

> ***"First Level***
> ***- overall pattern configuration.***
> ***- this does not have sufficient uniqueness to individualise.***
>
> ***The pattern formation is probably the first aspect that an expert will use in the identification process, however this is very rarely mentioned in explaining the identification. Example would be; if an expert compares an arch pattern mark with a whorl pattern and if the two items being compared are the same pattern, this is the first step in the identification process.***
>
> ***Second Level***
> ***- specific friction ridge path/flow of the ridges.***
> ***- specific path of accidental features, such as scars, subsidiary ridges and flexion creases.***
> ***- the location and type of ridge characteristic.***
> ***Identifications are currently processed on the number and sequence of the ridge characteristics. Although ridge characteristic on subsidiary are sometimes used, the fact that subsidiary ridges appear in two impressions is by itself an aspect that could be used in the identification process. Fingerprint experts would state that scars and flexion creases are never used in the identification process. However most experts would agree that they are used in the searching and the initial stages of the identification process. All these are aspects of the identification process. All experts use the number of characteristics and the coincident sequence to explain and demonstrate an identification, however the fact that ridges appear with no characteristics is not mentioned, this again is another unique feature of the ridge system. (It is worth recording the Americans also use the "dot" as a characteristic that is a single pore ridge).***
>
> ***Third Level***
> ***- third level detail are small shapes on the ridge (edgeoscopy).***
> ***- including ridge unit thickness, thinness and relative pore location (poroscopy).***
> ***- third level detail is always used in agreement with second level detail.***
> ***This is the additional aspect that experts are expected to look for. As mentioned above it is used with the aspects in the second stage. It includes the items mentioned above and adds strengths to explain and demonstrate identifications and/or non-identifications with a limited number of characteristics."***

7.1.2 The first level has little meaning for identification purposes. Since the number of patterns is limited and numerous people may even have the same ten classifications, the ridge flow cannot identify a donor. With identical twins the ten print classification can be very similar and even misleading. Furthermore since it is not productive to compare fingerprints with different patterns one only compares similar patterns to begin with, or in the case of disturbed and/or distorted prints, the patterns could be similar. Classification is however very helpful in the rough selection of patterns to be compared or excluded.

7.1.3 Exclusion based on first level detail.

Based on classification possible donors can be excluded definitively, even with bad prints, if classification differs. If one would have a mark with three adjacent fingerprints of one hand showing three whorls then all donors with loops in the same fingers can be excluded, even if the quality of each individual print is unfit for comparison of details.

In this report first level detail is only discussed as far as it has influence on second level detail, the focus is on second and third level detail.

7.2 *Definition of a dactyloscopic point*

7.2.1 The first report states in paragraph 10.6 and 10.7;

> ***"Features can be described as minutiae and other ridge formations.***
> ***A minutia is an event that occurs in a regular flow of papillary ridges. The event is a natural/biological disturbance to the normal parallel system of the ridges (e.g. a ridge stops or starts).***
>
> ***The value of the event is given by the rarity of the occasion taking into account the type of direction, relations to other points and the position in the pattern. The quality value is related to clarity and the presence of ridge detail."***

7.2.2 Characteristics and minutiae are general terms used for all sorts of fingerprint detail even for formations of so called points. In order to avoid confusion the term dactyloscopic point is introduced. These are points that are nominated during analysis to be significant and demonstrable, so the definition is refined to;

> ***A dactyloscopic point is a notable event that occurs in a regular flow of papillary ridges that is subject of analysis. The event is a natural/biological disturbance to the normal parallel system of the ridges (e.g. a ridge stops or starts), and is significant.***

7.3 *Value of points*

So dactyloscopic points are events that occur in a regular system of papillary ridges. The value of the events is settled by aspects disseminated in two categories; 1.The **location properties** and 2. The **quality.**

Location properties are; place of the event, relation to other events, flow of the individual ridge, direction and type (ending ridge or bifurcation). Quality relates to clarity and the readability of ridge-detail.

7.4 *"Location properties"*

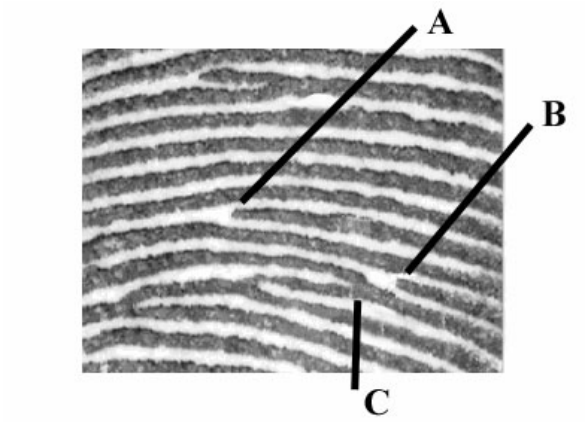
7.4.1 Dactyloscopic points become meaningful if they are related to other points in the print and the location is determined. The relations to other points are established through counting ridges in defined directions. Two verifiable relations are the minimum to fix a point in the two dimensional domain. It is good practice however to relate all dactyloscopic points in a studied print to each other. After all it is the constellation or formation of the points that defines uniqueness.

7.4.2 An event happens more or less at random, is therefore rare and becomes significant. Certain types of points are found more frequent on certain locations so their rarity may differ.

Some points have more value some less; chance (how random is it) decides rarity and rarity decides value of the location aspects.

7.5 *Compensation*

In figure 1 one sees a piece of a palm print. Point A happens without any obvious cause and therefore (relatively) has a very high value. The points B and C form a formation, the occurrence of point B seems to induce point C or at least gives way to it. The disturbance of the regular system of parallel lines by one event is compensated by the other, in a way restoring the balance. This phenomenon is called compensation.



Location A. A true random event with high rarity value.
Location B the same type of event. The event at C is compensating for the disturbance at B and is therefore considered to be less random.

figure 1

7.6 *Pattern force*

7.6.1 The presence of a pattern often forces lines to stop or start in a certain area, this is lifting randomness in a way and predictive for a number of events. This is called pattern force.
The first report read in paragraph 10.13;

> ***"The value of the location and direction of "pattern forced" minutiae is lower since the event is regarded to be more dependent from surrounding events than to be random.***
> ***In certain areas of common patterns in fingerprints we see minutiae that more or less originate by this pattern. For instance in the core of a multiple spiral pattern all ridges flow in the same direction (e.g. clockwise) and since there is no room for them to continue in the core the type of event (ending ridge), direction (ending towards the core) the location (core area) are similar and more forced than random. On the contrary an ending ridge in an area without a distinct pattern is judged to be a more random event regarding the aspects of direction and location and by nature to be of a higher value."***

7.6.2 In general the difference in value of the location aspects balances out in the total of the formation of all the coherent points, provided a meaningful number is taken.
This is different if the whole cluster of minutiae is highly dependant of the pattern (pattern force). Some examples are discussed;

7.6.3 In a diminishing area a number of lines tend to end in the same direction around the same location because the pattern does not allow for them all to continue (figure 2). Direction and location are less random in this area and therefore have lesser value.

figure 2

Pattern force in a diminishing area;
Location and direction are similar and forced by the pattern. Type of points; mostly an ending ridge instead of a bifurcation. Relations are also less significant.
Upward ending ridge in opposing direction very significant.

7.6.4 In so called central pocket loops (figure 3) the pattern force, in particular in the core area, is significant. Type and location of the minutiae can be very similar and relate strongly to the given pattern.

figure 3

Pattern force in the core of a central pocket loop
Classification dominant towards second level detail.
In comparing the same pattern there is a risk for look a likes.

7.6.5 Not only the individual points but even the whole formation of all the points around the core may look similar as a result of the given pattern. The chances of hitting a look alike are relatively high since there is a specific curved pattern in a small area that is dominant towards type and location of events.

The first report defined a look a like in paragraph 10.10 as follows;

> ***"Look alike; look a likes are fingerprints from different origin that show an unexpected level of similarity that has the potential danger of a false conclusion about identity."***

7.6.6 From complex spiral cores (figure 4) it is known that all ridges tend to flow and end in the same direction towards the core, the location is hard to define in relation to all neighbouring ending ridges.

figure 4

Spiral core;
Dominance of pattern towards second level detail. Direction and location of points similar.
Relations are harder to define and less rare.

7.6.7 It is known from manual searches and the verification of AFIS searches that it takes longer to eliminate the candidates due to this effect.

In these occasions it is of paramount importance to verify and check all the locations and relations in the comparison phase with extra care. Tolerances should be tight. Also third level detail should be checked carefully and may be decisive in establishing dactyloscopic points in agreement and in the final judgement of identification. This is further discussed in chapter 8.

7.7 *"Quality"*

7.7.1 In practise the overall quality of a print is decided by the absence of; distortion, overlaid prints and background noise, and next by the clarity and contrast of the ridges. Second level detail can be of good quality without showing (the right) third level detail, this happens e.g. with fingerprints taken with life scan devices, wet prints, detail taken from the second skin or the inside of the skin with deceased, xerox copies of cards etc..

7.7.2 The quality of third level detail of a print is dependent on the accuracy with which the ridge detail is represented in the print. Since the ridges are three dimensional and prints are merely a two dimensional image of it, this is hard to check. As a reference therefore an ideal inked print is taken. A good quality mark is very close to this and this is possible e.g.with latents developed with metal deposition. The degree to which third level detail can be seen is a very important measure for quality.

7.7.3 Third level detail comprises all that is seen of the basic properties of a ridge; the size and shape of pores and the edges of ridges. There is a direct link to quality, only good prints can show third level detail. The presence of it can be a very powerful contribution to each individual point and the whole of a print, but is very dependent of clarity. Quality of third level detail varies not only from print to print but also within one print, only a small part may show pores. So this type of quality is decided upon on a point by point basis.

The location of third level detail is decided in relation to the second level detail.

7.7.4 Overall good quality does not guarantee there is (accurate) third level detail but the presence of third level detail means that (part of) the print is of high quality. As a result quality and third level detail are almost treated as synonymous within this report.

7.7.5 For each individual dactyloscopic point the quality may differ. If a point is clear and shows ridge detail the value of it is significantly higher than points that fail to have these properties.

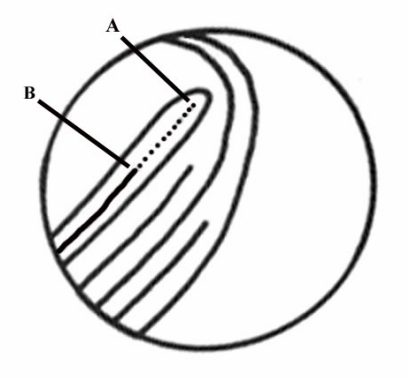
7.7.6 In short; the value of a point is decided by rarity and quality.

7.8 *Defining the dactyloscopic points*

7.8.1 For the determination of value based on rarity expert knowledge and experience form the primary basis.

7.8.2 During the marking of points it is imperative to establish their **existence,** their **relations** and their **significance**.

Third level detail can significantly contribute to the value of a point, if present it can boost the value of a point and make it significant, even if the location aspects are regarded to be of insufficient value. For instance an ending ridge in the core of a loop has very low value because the event, the location and the direction are almost inevitable and predictable, and thus not rare (figure 5).



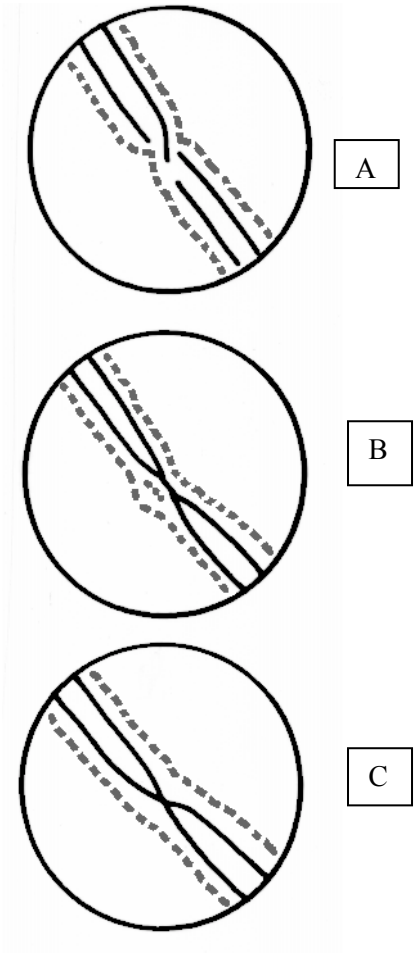
If a core loop possesses an inner line the type and location of the "event" are given; an upward ending ridge in the core area (A). The two dimensional relations of the two upward ending ridges and the core is already given and does not gain much weight with the ending ridge in the core.
If the core ridge stops at B this is significant because this event is rare.

figure 5

Third level detail could however promote such a point to make it a meaningful event if and when during a comparison process it is found similar.

7.8.3 The definition of a point is basic; it does not discriminate between bifurcations or ending ridges. In fact the difference between those in latents is mostly decided by quality and third level detail. (see also 7.9)

Due to moisture, pressure or even over (or under) inking a true ending ridge may show as a bifurcation and vice versa. Those differences are within normal tolerances and have no fundamental relevance, i.e. they don't conflict possible donor ship as with all level two detail (figure 6).



Due to moisture, pressure or over/under inking ridge detail A could show as B and C. (black lines)

In C there are two events (bifurcations that join as a crossing)

Differences in appearance between A and C may be explained but only true similarities count.

The presence of the flanking ridges (dotted grey lines) would assist with the determination of the type of characteristic.

figure 6. A.B.C.

7.8.4 If however third level detail in both compared prints is present, differences in this detail should not lightly be ignored and be regarded as indications that prints might come from a different source.

7.8.5 Overlapping event/points count for one, the first report stated in paragraph 10.7;

> ***"Two or more points that coincide/overlap count for one point/event only. [For example two or three lines that come from different directions which join at the delta point]."***

A basic rule is that points that overlap count for one. In the delta area for example two or three lines may end connecting with each other but are regarded to be just one point as a maximum.

figure 7

Delta area shows three ending ridges in the centre of the delta.
Overlapping points count for one.
Because place and direction are forced, ending ridges at the delta point have very low location value.
There are no prominent relations within the formation of the delta.

The underlying reasoning is that the significance of points is mainly determined by the relations with other neighbouring points. With overlapping points those relations are virtually absent, one dimensional and not meaningful.

7.9 *Events and formations*

7.9.1 Many names are given to minutiae that are obvious deviations of the regular. The working group adopted three basic minutiae that may be discriminated in an **inked** print; **the ridge ending, the bifurcation and the dot.** All other minutiae in effect are **formations** of two or more of the basic type sometimes combined with a notable change in the individual flow of a ridge.

7.9.2 The basic nature of the definition of a dactyloscopic point as an event cuts short the discussion about types of minutiae. Some aspects of second level detail (flow of an individual ridge) but predominantly quality and third level detail allow us to disseminate e.g. between bifurcations and ending ridges. Since marks not always reveal this type of detail, and may have been distorted by pressure or moisture, the difference between a ridge ending and a bifurcation may remain undecided. In the analyses of marks at second level detail however it is sufficient to establish the event in accordance with the definition.

7.9.3 An example (see figure 12);
A short ridge has two ends (second level) if it joins on both ends with the same neighbouring ridge bending slightly curved (third level) the **formation** may be called an isle or eye, this is just semantic. Whether both end joins or not is often uncertain in scene of crime marks and is dependent on the clarity and of third level detail.
The significance lies in the fact that there are two basic events with a relation.

7.9.4 One seems to notice rare formations of points that are close together much better than

formations that are wide spread. Eyes, isles and dots appeal to us and are rare formations, one is therefore inclined to assign a higher value. One has to be careful though for a number of reasons;

- One ignores the possible higher value of spread minutiae that are less notable;
- Small formations do all ready count for two events;
- Close formations often occur in specific area's (eyelets in shoulder area of loops, see figure 8);
- The relation between the two events is not very specific, i.e. almost one dimensional (no specific direction and no ridge count;
- Some individuals seem to have more of those formations than others and one would only compare individuals that show them.

figure 8

Eyelet;
Often found in same area, near shoulder of core loop.

7.10 *Mirroring*

If one regards an eyelet to be rare, two eyelets would in theory boost the value of a print. Around cores it is observed however that **mirroring** occurs. This means that close formations such as eyelets or short ridges are present on both sides of the core in a similar relation to it, just as if they were mirrored. See figures 9 and 10. This suggests that when the first formation is given the occurrence of the second formation is less rare than the first.

Since two eyelets already represent 4 events one should be careful in adhering extra weight to the formations on top of that.

figure 9

Example of mirroring formations around the core of a loop.

Another striking example of mirroring

figure 10

Mirroring also occurs with minute detail from incipient ridges, see figure 11.

figure 11

Mirroring of incipient ridge detail

7.11 *Dot or ridge, eye or isle ?*

7.11.1 In applying the basic definition and the "overlap rule" the discrimination between a dot and a ridge becomes easier. It is generally accepted that if a portion of a ridge is longer than the width of the adjacent ridges, it is a true ridge with a beginning and an end. (organic measure based on the print at hand) If the ridge portion is shorter, the points overlap and count for one, the detail is regarded to be a dot. See figure 12.

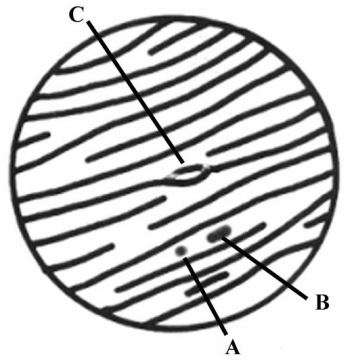


figure 12

Dot or ridge ? See A and B
One could use an organic measure. If a ridge is longer than the width of the ridges it is a real ridge, points do not overlap.
If shorter; points overlap, there is just one event.
The presence of third level detail i.e. a number of pores and/or pore units may also assist in the discrimination.

C is another type of a short ridge. Third level detail determines whether the formation is an eye or an isle.

7.11.2 Third level detail should be decisive in the assessment whether there is a true event or just noise. The presence of a pore and the bending of neighbouring ridges, giving space to the dot, may demonstrate its existence.

7.12 *Incipient ridges*

Incipient, subsidiary or false ridges may be absent in prints during youth and come up with ageing and growth. They may print one time and fail some time later. So their presence, appearance and permanence are not guaranteed. Their presence or absence does not change the system of parallel lines, i.e. an incipient ridge is not changing a ridge count between points. Within the Empirical Standard Approach incipient ridges are not regarded as dissimilarities during comparison but, as a logical consequence, are no basis for dactyloscopic points either.
The rule is therefore; if the absence of information creates no fundamental dissimilarity, their presence provides no basic similarity to assign dactyloscopic points.
As extra third level detail it can be very informative and contributing (if present and similar).

7.13 *Scars and creases*

7.13.1 Scars

Scars are damages of the original structure of the skin. The healing of a deep wound that damaged the epidermis created scar tissue. Scars can be recognized by the unnatural disturbance of the ridge flow which disturbance has an independent shape more or less representing the original wound. The papillary ridges are interrupted by the scar and the original flow of each individual ridge is affected in an unnatural way, this becomes apparent when the lines are virtually reconnected. The ridge endings towards the scar are often particular because they show bends, sudden change in the width of the ridges and connections. Small independent parts of ridge units may also show.

Figure 13

Scars cause some difficulty in the analyses and comparison of fingerprints. The vital relations between minutiae are lost as a result of the interruption of the scar. Although it can be argued that the ridge endings caused by the scar are also random they are not regarded as dactyloscopic points because they are not events of a biological nature in a regular system of papillary ridges.
Scars become permanent after total healing of the skin. The shape and position of the scar can be regarded as random. This type of randomness is however not part of the domain of the fingerprint expert and has to be judged and weighed with prudence in that respect. Scars on the other hand may also contribute to the value of a print if location and appearance are similar. Guidelines that apply to "separated prints" (see chapter 10) can be used with scars too. It is important that scars are permanent and that spatial relations are intact.
Identification is only performed using a comparison print that shows the same scar. Earlier versions of prints without the scar may be used for comparison but in order to reach the conclusion of identification new prints have to be taken in order to verify the presence, location and similarity of the scar.

7.13.2 Creases

There are two types of creases. Flexion creases are found between movable parts of the hand (and foot). Those creases are embedded in the skin and mostly fit natural in the ridge flow. The flexion creases are permanent and may show particular skin shapes such as “crow feet”. Creases cause the same type of difficulty during comparison and identification as scars. The difference is that eventual features in the crease are of a biological nature. A complication is that often the shape of the skin is not reproduced in the print so that an interruption of the pattern remains.

Other creases are just “skin folds”, their presences increases by the ageing of the skin. The papillary ridges are lower for the course of the crease causing the ridges not to print and leaving a white line without information,. They are therefore also called “white lines” White lines can be recognized by their shape and position. There is no relation between the ridge flow and the direction of the crease. The creases are mostly narrow. White lines show mostly similar over time but are not permanent. Due to their cause they may come but also go (use of chemicals, thumb sucking, illness).

Those creases may hinder the comparison significantly because they disturb the relations between minutiae. They can also be handled as described in chapter 10 about separated prints. In establishing relations it is advised to try to pass the crease at least at one side and to check the position this way with ridge count. The second dimension of the relation may be checked by their spatial relation.

7.14 *Tracing*

7.14.1 Sometimes the presence of an event is hard to define because of distortion or a blurred area. An ending ridge is suspected but the exact place is difficult to see. Through tracing the presence of such a point can be demonstrated in the analysis phase. In tracing one follows the adjacent lines parallel to the suspected ending ridge. If the ridge-count between the two traced lines goes down during the course it is proof that a line in between has stopped.

What is demonstrated then is that there is an event of which the direction (ending to the left) is known and between which two lines. One does not know the exact location neither the type of event and third level detail is covered and/or absent.

7.14.2 Whether the point is demonstrable and significant depends on the print at hand. Tracing can be used in the comparison phase to prove that there is (no) dissimilarity between two prints. In general marking traced points as true dactyloscopic points is restricted.

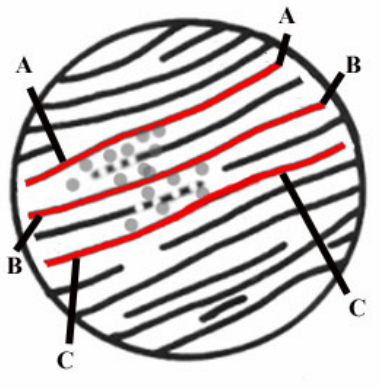


figure 14

Tracing the lines A and B to the left reveals that the ridge count drops from 1 to 0. This demonstrates an ending ridge in the blurred area.

Tracing the lines B and C to the right does not deliver proof of an ending ridge.

Minutiae might be present however in the blurred area.

8 Decision making model

8.1.1 In the discussion of the descriptive model a lot of decision-making rules are already given. This is demonstrating that the assessment of points according to the descriptive model and decision making upon them heavily intertwine. The evaluation of a latent in the information phase consists of a string of assessments and small decisions such as;

- What is the quality of the print ?
- Is the mark distorted and how is this demonstrated ?
- Is a point demonstrable ?
- Is it significant, determined by location aspects, the relations and third level detail ? (**quantitative and quality aspects**)
- Are points overlapping ?
- What is the rarity of the point ?
- What is the significance of the total volume of the coherent cluster ?
- etc.

8.1.2 This chapter concentrates on the decision making in relation to the comparison and evaluation phases. What is found in the mark, and what initially is validated in there, is compared with the comparison print. The prints are analyzed and compared at the two levels (level 2 and level 3).

The important aspects of second level are the quantitative elements that keep their basic properties even under adverse conditions. Third level detail is not always present and often distorted so there is a strong relation with quality.

8.1.3 Quantitative elements relate to the size of the print, the number of dactyloscopic points present and the location aspects of those points e.g. direction, relation (to other points) and variation.

Quality aspects relate to the clarity of the print and the degree of which third level detail is at hand. With the establishment of resemblance certain tolerances are applied.

8.2 *Comparison and evaluation*

8.2.1 In comparison another chain of observations and decisions follows regarding similarity, dissimilarity, the application of tolerances and finally the assessment whether the similar volume found is sufficient in order to decide upon identification.

8.2.2 In general location aspects (second level detail) MUST be the same in compared prints, only one dactyloscopic point of difference (see chapter 8.5) prevents a conclusion of identification. This is used in the elimination process with candidate lists from AFIS systems and/or in eliminating witnesses of the crime or possible suspects. If in a certain area of which the location is established towards a core or delta, some points are present they can be used to quickly filter through the list. Even if a latent is judged to be of insufficient value for individualization, exclusion based on only a few different points is possible.

8.2.3 Third level detail CAN be the same, and if so, may add up to the value and the significance of each individual point and the total. If different or absent however it does not prevent identification because it cannot be expected to reproduce the same in the latent and the inked print due to its minute detail, its three dimensional properties (of the source) and the most of the time less ideal conditions during printing.

8.2.4 It is important to compare second level detail step by step and to define similar points, if these are found one can start comparing and checking the relations and the third level detail.
First a definition of a point that is in agreement between compared prints is required.

8.3 *Definition of a point of agreement*

8.3.1 A definition was given in the first report in paragraph 10.9;

> ***"A point of agreement is a point in compared prints where location and appearance has a similarity that meets a specific value and where that similarity falls within the ruling tolerance."***

This is slightly modified into the definition for a dactyloscopic point of agreement;

> **A dactyloscopic point of agreement is a dactyloscopic point in compared prints of which location and appearance has a similarity that meets a specific value and where that similarity falls within the ruling tolerance.**

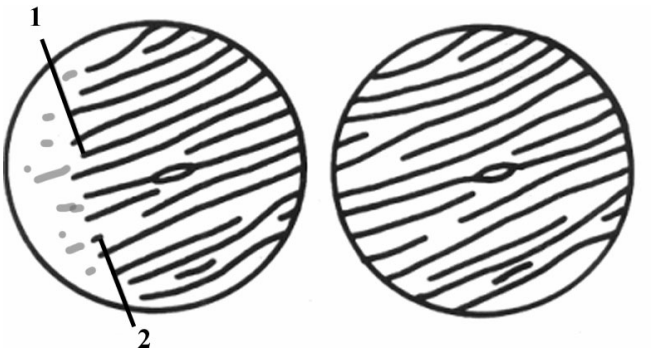
8.3.2 When points are assigned to be valid (demonstrable and significant) their position is related to all other points. This is a very important part of the analysis and comparison of fingerprints since the formation of the relations determines uniqueness. The relations are established by following lines, counting ridges and determining relative positions towards neighboring points taking direction, angles, height and length into account.

8.3.3 In the comparison phase all those relations are meticulously checked and compared. Relations have to be the same in prints from the same source; in particular ridge counts between points have to be exact. Through pressure and the flexibility of the skin the constellation of points may be stretched or compressed like a spiders web but the relative positions and the ridge counts stay the same.
The first report read in paragraph 9.6;

> ***"Every single detail is checked as to whether location aspects and relations are similar with the detail in the corresponding locations of the comparison print. Differences should be detected, checked and noted. Any explanation of differences found should preferably be related to observations done in the information phase. All details are related to each other. Parts of a print that are distorted or damaged and show differences as a result of this distortion may be ignored if the distortion is consistent and demonstrable."***

8.4 *Marking dactyloscopic points in agreement*

See figure 15. In the example the mark (A) is at the left, the comparison print (B) at the right. Should point 1 and 2 be marked as dactyloscopic points? In the mark there is no certainty that point 1 is an ending ridge to the left. In the information phase one would have noticed other lines that stop short to the contour. Neither would one be certain that at point 2 there is an incoming ridge. This could also be caused by noise at the left side of the print. One only becomes aware and/or certain of those points when taking the comparison print into account and assuming this is the original and from the same origin. (also see next chapters about fair reasoning)Marking these as similar dactyloscopic points on this basis is incorrect.



No certainty about the existence of point 1 and 2 in the information phase.
Marking those based on the comparison print is incorrect.

figure 15 A B

8.4.1 If the mark would look like the next image (figure 16) this is different. In the information phase one could argue that there is an incoming ridge because the surrounding lines make room for it showing it to be genuine. It can be demonstrated. The ending ridges at point 1 and 2 are demonstrable because level three detail shows that the ridges are really ending.

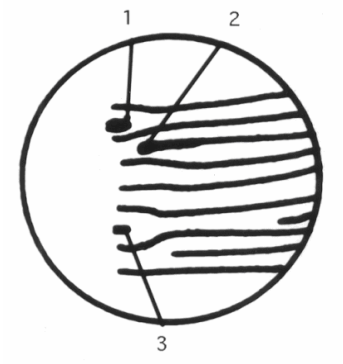


figure 16

Third level detail (thick ending ridge and blank space in front) proves the existence of point 2.
Second (ridge flow) and third level detail prove existence of points 1 and 3.

If these minutiae are similar in the comparison print these are points of agreement, if not these are distinct dissimilarities.

8.5 *Dissimilarities and dactyloscopic points of difference*

8.5.1 Compared prints will never look exactly the same so there will always be dissimilarities between prints from the same donor. If there is only one different dactyloscopic point between prints identification is excluded. The first report read (paragraph 10.5);

"Identifications require sufficient coinciding information between two prints, if features are present in one print and absent in the other and there is no rational explanation based on findings and facts, a statement of identification should not be given in principle.

8.5.2 How does one discriminate between dissimilarities and different dactyloscopic points ?

A different dactyloscopic point is of second level nature; the location, the direction or (one of) the relations differ. The basis for identification is the hypothesis that dactyloscopic points keep there properties even under adverse conditions. One has to be very prudent to leave this position if one bumps into a dissimilarity that it is not in agreement with the supposed original because this affects our principles.

One **may** explain differences if they can be contributed to distortion formulating the following guidelines and rules;

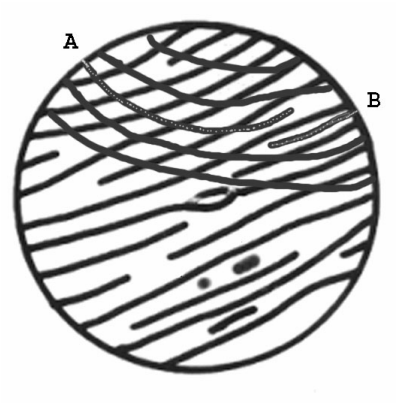
- One explains differences because one **can,** not because one **must**.
- our profession is not the art of explaining "unwanted" differences.
- the explanation of a dissimilarity must be based on facts and circumstances that are demonstrable.
- one has noted the distortion in the information phase.
- the comparison print should not be leading.
- explained dissimilarities do not become similarities.
- after "reconstruction" (see 8.6) the whole constellation should be redefined and checked. for its relations.

Note also the citations in paragraph 8.3.3 and 8.10.

If a difference of second level nature cannot be explained one has to regard this "unexplained difference" as a different dactyloscopic point. Identification of the compared prints is prohibited.

8.6 *Reconstruction*

8.6.1 The ridge flow of a mark may be distorted such that the pattern is disrupted, this may be caused by pressure, a disturbance in the surface upon which the mark was found, or by an overlaying print.



Reconstruction may demonstrate the ending ridges A and B to be part of the overlaying print.
Reconstruction is acceptable;
- outside identifiable area
- if it is demonstrable (not assumed)
- to explain dissimilarities, not to create similarities

figure 17

See figure 17. It is obvious that the comparison print will not look like the mark even if it were from the same donor. The ending ridges A and B could be part of both patterns causing (potential) dissimilarities. Through reconstruction of both patterns one can assume, or even demonstrate, that the differences are caused by the disturbance/overlay. This reconstruction applies to level one and level two detail mainly and we are therefore dealing with differences that could be fundamental. Overlaying prints are dealt with in the information or analysis phase before the comparison.

8.6.2 There is a more subtle type of reconstruction, that is all ready touched before, that deals with reconstruction of third level detail. For example whether an event is a true bifurcation or a ridge ending. Once in a while this ridge ending appears to be on the left side in the mark and on the right side in the comparison print. When counting ridges one has to reconstruct the position slightly and then to check the relations of all the other points towards the assumed position. It depends from the

case at hand whether one reconstructs second level or third level detail.

It should be avoided to make the comparison print leading in this process.
The citation in paragraph 8.5 used as illustration for "fair reasoning" is also relevant to reconstruction.

8.6.3 In general the following rules are adopted and applied;

- reconstruction of first and second level detail is feasible if there is an independent identifiable area and the reconstruction takes place outside that area;
- the disturbance was noticed in the information phase, is not assumed afterwards and can be demonstrated. (it should be avoided to make the comparison print leading)
- reconstruction may explain dissimilarities, reconstruction does not create similarities. (explained differences don't become similarities.)
- reconstruction of third level detail is acceptable within the coherent cluster of the identifiable area as long as dissimilarities can be contributed to lack of quality, background noise and/or pressure.

8.7 *Fair reasoning*

8.7.1 Fair reasoning is an important aspect of any applied science and methodology. Logic, objectivity and sound thinking are the vehicles that may guide us to fair and solid conclusions.

A few examples and guidelines were already given in the first report in paragraph 10.11;

> ***"As a rule the quality of the differences (e.g. explained by distortion) should not be higher than the quality of the similarities or in other words***
> ***When a dissimilarity is "explained away," by arguing that the information is too bad and not valid, then similar information with equal quality should also not be regarded as valid.***
> ***In certain cases, compared prints show minutiae of which appearance and even location differ. If these differences are attributed to a demonstrable distortion this would not withhold the possibility of identification. Typically the latent will be reconstructed virtually (to correct the assumed distortion) in order to establish whether no principal differences remain (e.g. different ridge count or number of events). After such a process, corrected minutiae should not be used as true and valid. Since the data looked different in the first place and reconstruction has taken place on the basis of the assumed original this would be scientifically false. This is condensed in the following rule of thumb; "explained differences are no similarities"***
> ***If a certain area is blocked out because of distortion neither differences nor similarities in the same area should be accepted."***

In the next paragraphs a few examples of fair reasoning are given and elaborated upon.

8.8 *Invert the argument*

A good way to practise fair reasoning is to invert the argument or to "play the advocate of the devil"; Or in practise ask; what if it was the other way round ?

- One finds a similarity in a blurred area and there could be an inclination to mark it; if there appears to be a dissimilarity in the same area would one regard this to be genuine as well ?
- Would our conviction about donor ship be different if one knew the supposed donor has a twin brother ?
- This is such an important case with severe consequences for the defendant (and fingerprints) so one should consider to apply a higher standard. (experts should act as if capital punishment could follow)

8.9 *Circular reasoning.*

8.9.1 Circular reasoning is a scientific fallacy and has to be strictly avoided.

A scientific method follows a step-by-step procedure with the aim of an unbiased objective conclusion. With circular reasoning a prejudgement is, more or less apparent, steering the process to the wished and preset outcome.
In other words an assumption is the basis for a conclusion and then this conclusion proves the assumption to be right, this is a scientific fallacy.
See the first report paragraph 10.12;

> ***"The pitfall is that a premature assumption of donor ship leads to transplantation of data from the "original" into the blur of the latent. It is circular reasoning like; this print comes from this donor, prints are unique thus all data must be the same and subsequently all differences are not real"***

Circular reasoning is often hard to detect, examples in fingerprinting are;

- "If I ignore this difference it is a perfect match, so the difference cannot be real and must be caused by distortion"
- "Different dactyloscopic points between prints from the same source don't exist"

(Generally true as a factual statement and the basis for fingerprinting, but a fallacy if used during a methodical forensic procedure of proof)

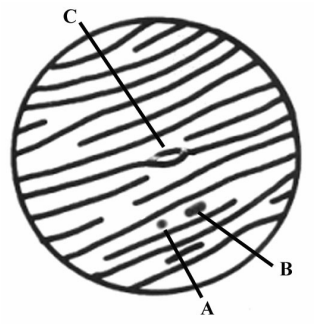


figure 18

Circular reasoning in comparison;
The type of formation at C is decided from the information of the comparison print, assuming before hand it is identical.

8.9.2 As an example the formation at C in figure 18 is given. There is no certainty whether the formation is a short ridge, a spur or an eyelet because the mark fails to show sufficient quality.

If the **comparison** print shows an eyelet and one concludes than the formation in the **mark** is an eyelet too one puts the information found in the comparison print into the mark. Effectively one assumes before hand that the mark is identical. This is another, more subtle example of circular reasoning.

8.10 *Tolerances*

The statements in the first report in paragraph 10.12 require no further elaboration;

> ***With identifications proven to be mistaken it became clear that the involved experts have ignored the differences. Evaluation of those comparisons often contain a long list of excuses why the print does not look like how it should, disguised as demonstration of the skill and experience of the expert. "***

> ***"A difference in appearance between compared fingerprints (or details of them) that is contributed to normal variations with printing can be tolerated.***
> ***Tolerances should be applied consistently and honestly. Experts should be aware of the paradox that one may be inclined to accept more differences in bad prints under the umbrella of distortion than one would accept in better quality prints. Distortion not only limits the perception of the similar but also from the dissimilar.***

> ***The rule is therefore that; Tolerances should not vary dependent on the quality of the impression."***

Simply put the paradox is "the worse the print the larger the tolerances". Mistaken identifications can often be contributed to this effect. One starts to assume similarity because one is unable to check it.

8.11 *Example of reasoning*

8.11.1 In order to practice the described rules and guidelines the example of figure 19 is given, see the line A. The line is interrupted at 4 places and ends upwards.
What could the relevant considerations be ?

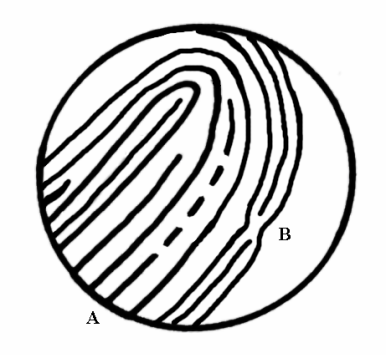


figure 19

Example to practise reasoning; what are the considerations ?

What is the value of the formations in line A ?

Compare with event B

- Each of the interruptions is a deviation of the parallel system of lines causing in principle two events per interruption.
- The formation they form together is rare.
- Although there is a **deviation** of the system of lines there is little **disturbance** of it.
- The surrounding lines don't show, or confirm, the events.
- The existence is decided by third level detail rather than second level detail.
- The interruptions in a mark (and even in an inked print) could be caused by defects in printing, visualisation, the back ground, or damage after printing, so it is not certain that they are from a **biological** nature.
- If the comparison print would not show an interrupted line would one regard it to be dissimilarities?
- The relations between the points are one dimensional, there is no possibility to express the relations (typical and most important properties) to each other in ridge count and direction(s).

8.11.2 Compare the differences with the event at location B; the surrounding lines bend on **both** sides, second level detail is confirming the existence here.

The final conclusion will always be different relevant to the case. Although the phenomenon (the formations of the interrupted line) is rare, there are a lot of considerations that point into the direction of less reliable points with lower value.

8.12 *The decision; to identify or not;*

8.12.1 In what is described as the conclusion phase a specific type of decision making is performed relevant to individualization with regard to a particular print. This is the last phase before verification that is to say if the expert decides to propose identification.

8.12.2 One should bear in mind that the process that is executed is <u>comparison</u> of fingerprints, that is our profession. Identification <u>can</u> be a conclusion of this process as good as a non identification. Very

often identification is regarded to be a positive result and a non-ident negative, at least with our "clients". A process that is orientated toward identifications is bound to be subjective and nonscientific by nature. So the final decision about identity has to be conscious, balanced, objective and verifiable.

8.12.3 After the comparison phase the expert balances what he has found, this regards all the information about similarity and eventual dissimilarities and possible explanations. One dissimilar dactyloscopic point between compared prints prevents a conclusion of identification.

The first report read in paragraph 10.4 and 10.5;

> ***"Identification is; A the conclusion of an expert that two fingerprints show sufficient information in agreement, and no principal differences, in order to point one donor as the sole source, and whose conclusion is verified and confirmed by another independent expert" .***
>
> ***"Identifications require sufficient coinciding information between two prints, if features are present in one print and absent in the other and there is no rational explanation based on findings and facts a statement of identification should not be given in principal."***

8.12.4 The decision whether the total volume is sufficient for individualization may differ according to the approach. It is not the calculation of a number of points that automatically leads to identification. It is the total constellation of all the information, as a coherent complex of which the relations are the same, and the details, as far as present, fit within tolerances, which constellation is weighed and referenced with individual knowledge with or without an empirical standard. (figure 20)

figure 20

A coherent constellation of demonstrable points each with significant value of which the web of relations determine uniqueness.
The compared print should show the same constellation with all minutiae within acceptable tolerances, different points **prevent** identification. Similar third level detail contributes to significance. Dissimilar third level detail **can** be decisive for non-identification.

8.12.5 It is appreciated that the value of dactyloscopic points and the value of the similarity with the points in the compared print vary, this is of minor importance. Those differences are balanced out in the total constellation of a number of points. Secondly the value of the total volume is decided by the rarity of the formation and the relations in it.

8.12.6 Expert judgment remains an important cornerstone for identification not only in deciding what is sufficient but also what is insufficient i.e. if it is his opinion that the total of the volume is relatively low due to pattern forced points.

The expert is never obliged to identify if the outcome is "sufficient". He is allowed to, and may identify if he is convinced and satisfied at the same time that an identification is sound and solid. The first report stated in paragraph 9.8;

> ***"The found volume of similar information is measured against the standard that is in force.***

If that is met, or exceeded, the conclusion of identification is possible but not obligatory. The expert has to judge himself whether he/she is entirely satisfied and whether the conclusion of identity is solid and all risks excluded. If satisfied with the identification, the case should be passed on for verification. It is not proper (or acceptable) if in doubt to leave the conclusion to the verifier, and to adapt/ accommodate to his/her opinion later".

8.12.7 The scientific problem that the fingerprint expert is facing is to single out the donor of the print out of a potential of over 60 billion fingerprints (world population times ten fingers). For that a secure method, as described, is vital. With the decision of identification the expert should be consciously aware that he functions within this method and he should have the notion of not just including one, but excluding so many.

In comparing a latent print with a print of a possible donor the logic of the situation is that they either have the same origin or not. ("its him or not") There is a distinct danger that the scientific problem (60 billion : 1), without being perceived, is replaced with a kind of black or white question. In stead of answering the scientific problem, with which society has entrusted him as an expert, he answers a question towards himself that comes up during the comparison process; "do I <u>think</u> it's him or not " This question is irrelevant at this stage and the (intuitive) answer cuts short the whole of the methodical process and the decision making that should have an expert conclusion as an <u>end result</u>.

8.13 *"The gravity standard"*

8.13.1 The "I know its him, but" frustration is known between experts. One tends to forget about the "but…". One gets satisfaction an appreciation from positive outcomes and one needs a prescribed methodology to arrive to them, but sometimes it is hard to handle a "negative" result of the process. The "conviction" is there and may be fuelled by information from the investigation process.

This is a decisive moment whether one chooses to be part of the scientific community or to be part of law enforcement. Science is not looking for one type of result only. Our basic job is to compare fingerprints, products cannot be negative or positive, they are outcomes of a predefined methodical process. (see the citations in paragraph 8.12.3)

8.13.2 There is however a distinct tendency in severe crimes to lower the standard of identification because it is an important case. This is called the "gravity standard". The seriousness of a case (the gravity of the crime) is used as an argument to incidentally put the ruling standard aside. In those cases the normal standard never goes up but always down (gravity). This is not only **not** scientific and not objective, it is also with regard to the responsibility to society questionable. One could instead argue that with severe crimes the standard should be higher because the consequences of a possible mistake are bigger.

8.13.3 The gravity standard is also an example of circular reasoning, "I know its him so the standard is to high". Whether this is a fixed empirical standard or a personal one within the holistic approach is irrelevant, to change it with an eye at the nature of the case is scientifically wrong.

It is also in conflict with the basic rules of independence and objectivity as laid out extensively in the report of the first working group.
With this respect paragraph 5.3 and 5.4.1, 5.4.2 and 5.4.3 from this report are also repeated;

> ***"Fingerprint evidence should only be stated as absolute and positive conclusions.***
> ***There is no basis for <u>likely or probable conclusions</u> neither based on statistics nor upon personal judgement. If sufficient information is present, a positive conclusion about donor ship is always possible. If there is insufficient information disclosed to enable a decision to be made concerning identity, the print will be determined as being of no value for positive identification. There can be no basis for speculation as to identity in such prints since the chances of being wrong are unknown.***

Environment

"Mistaken identifications have some common causes. The (latent)fingerprints being examined were of bad quality, the expert was biased and there was pressure involved. The expert(s) was sure he/she was right and could most of the times not be convinced of the opposite. Independent experts investigating the print later most of the times judged the prints to show insufficient detail for identification or even for comparison. Real verification did not take place."

"False identifications are human errors but errors are human. If man were able to judge independently and free of bias, mistakes would be virtually impossible.
The fingerprint expert is working in a "field of force" that generates pressure towards results. Open pressure but mostly hidden, pressure from outside but also from the inside. The need for result can be big in high profile cases. The longing for result leads to guided perception and biased evaluation. More subtle is the mechanism of subconscious deciding while comparing. If one has found 6 points in agreement and gets the "warm feeling" the perception and validation is guided often leading to upgrading information, ignoring differences and stretching tolerances".

"Everything should be undertaken to keep the pressure off the investigating process.
It is the responsibility of the management to create an open and sound culture in the first place. A sound culture starts with proper goals for the organisation. The goal for forensic specialist is not generating results but scientifically sound conclusions regardless who "profits" from them.
The organisation should not be involved in the judicial system as a party and express verdicts in terms of winning or losing. "

9 Verification

9.1.1 A cornerstone for a scientific process is replication or repetition; a second expert applying the same methods and standards is supposed to arrive to the same conclusion. If one adopts experts experience and knowledge as the basis for our conclusion one effectively states to society; "that our conclusion is solid in a particular case because we have never been wrong doing it the same way". In general verification is used to check whether it is done the right way and to assure that human error is excluded. Verification is not confirmation but has the nature of scrutiny, the first report read in paragraph 9.9;

> ***"The proposition for identification is presented neutral to the verifier. All kinds of comments and even the most subtle signals about the nature of the case or conclusion are avoided. The verifier has the assigned task and knows his responsibility. He has to make up his own mind freely and impartially.***
>
> ***Discussion and consultation in this phase is not desirable because it influences the bare detection and validation of the facts and the forming of an opinion. Discussion and consultation may take place only after one has made up his mind about what he has seen. The subject of the discussion is not the conclusion and who is right but must centre on the facts, the validation and the application of the rules.***
>
> ***The nature of the verification phase is scrutiny not confirmation. Mistaken identifications suffer almost always from absence of real verification due to haste, blind confidence, pressure for result or a premature broadcasted success."***

9.1.2 An identification is effective only after verification by a qualified expert. The expert is not just confirming the outcome of the proposer but is repeating the whole process in an objective and independent manner and may arrive to the same conclusion.

To be able to do that a prescribed process and an accepted scientific method are needed. Detailed rules, guidelines and norms are essential, and instrumental both, in checking whether it is done the right way (the very nature of verification). The guidelines given in this report could function as such. Discussion of questionable prints becomes feasible only if the same "language and grammar" are used. If conclusions differ and one cannot discuss the underlying reasoning and procedures the risk is to end up in frustration and a stalemate of different conclusions.

9.2 *The need for a questionable ID procedure.*

The process of verification in theory has the same possible outcomes as the normal comparison process. In an ideal situation the verifier should be unaware that a possible identification is checked. This is practically impossible for several reasons of which two are given. First; the verifier has to be aware of the specific assignment as verifier. Secondly; the prints to be compared and presented to him show similarities to a degree that this can only mean a possible identification. Seemingly the options of the verifier are reduced to supporting the identification or not. If there is no provision for the situation that the conclusions of the proposer and the verifier differ then this suggests that difference of opinion will not occur. This generates pressure towards confirmation and affects verification. It is therefore of vital importance that a questionable ID procedure is in place as a "third road" for the verifier to choose freely if he is not satisfied with any aspect of the mark/and/or the comparison. An example (used in the Netherlands) of such a procedure is given in chapter 11.

10 Separated prints or parts

10.1.1 Specific complications arise when a finger mark is divided in two or more parts addressed to as separated prints. The problem is that the vital relations between the minutiae are lost. There is again a risk of circular reasoning; "if one takes the two parts together the whole is in agreement with the comparison print therefore it belongs together". (examples figure 21, 22 and 23)

10.1.2 The proper way is to prove that the parts belong together and, when possible, to compare the total with the comparison print. Even the term; "separated print" is not fully correct because it bears the suggestion that one deals with one print that is separated and that is exactly what one had to prove first.

10.1.3 The risk of separated prints is twofold; one is that a conclusion is drawn that is not sustainable, the other is that a conclusion is drawn that is wrong because two insufficient prints together accidentally created a look alike.

10.1.4 Proving that two parts belong together can be done in two main ways;

The first way is using (forensic) techniques such as image enhancement, filtering, counterfoil investigation (two pieces of glass) etc. in order demonstrate that the two parts are or were one.
In general this is outside the domain of the fingerprint experts. The delivery of the evidence in those cases would be a joint enterprise of the forensic expert that delivers proof of the coherence of the separate parts and than the fingerprint expert may treat it as a whole print.

The second way is to prove within the fingerprint domain that the two parts belong together.

Most of the time this is a matter of making it plausible by evaluating a number of aspects that may be present or absent;

- the parts together have a natural contour
- the parts together show a logic and natural ridge flow and/ or pattern
- the absence of other surrounding marks
- the parts possess the same properties such as "colour" and structure of the ridges
- the spatial relations between minutia are similar

10.2 *Substantial Dactyloscopic Unity*

10.2.1 If in one part of the print there is a significant coherent cluster of information that is meaningful on its own merit i.e. a good quality cluster of 8 points (this is called a Substantial Dactyloscopic Unity or SDU) and in the other part one finds the same for example a SDU of 10 points one could act as follows;

10.2.2 If in one part this cluster is present in the comparison print we can assume the location is right. If we move to the second part applying the spatial relation and in following the ridge flow as good as possible through the gap one can establish the position of the points of the other SDU in that part of the comparison print. If this SDU can indeed be found and checked and is similar than this is a strong indication that this originates from one print.

10.3 *The nature of the gap*

10.3.1 Another aspect to be studied is the nature of the gap;

Are ridges just unreadable because of a known or random background e.g. a printed line on a bank cheque, figure 21) or is it a physical gap. Are parts of the print missing etc. etc?
The nature of the gap determines to a certain degree the likelihood of the two parts being from one source (finger) and one occasion (placing) and on the other hand the chance of a double placement

showing as one print. If there is a physical gap this chance is much bigger as with a visual interruption of a known background such as a printed line.

figure 21

21. Separated parts 1 divided by printing line, check;
- structure and colour
- ridge flow, connection and significance
- spatial relations
- natural contours
- SDU's (next paragraph)
- nature of the gap
- risk of double setting (tip... bottom)

figure 22

22. Physical gap of undefined nature
Compare with fig.21
- proof of unity within domain fingerprint expert is questionable
- connection less significant
- double setting less likely (left ...right)

figure 23

23. Compare with 21 and 22.
- colour and structure different
- contour affected
- nature of gap matters
- continuation ridge flow doubtful
- SDU in left part only
- NO lending of minutiae in right part

What one should NOT do is lend some features at the other side of the gap in order to prove our assumption of identification to be true.

10.3.2 In the analysis, comparison and evaluation one can use these rules to achieve an objective judgment. The general rules do also apply; is it demonstrable (what is seen in the information phase) is it significant etc.

Fair reasoning could be; if one judges the parts to belong together than differences with the comparison in either part must are as genuine as similarities.

11 Questionable Identification procedure. (as currently used in the Netherlands)

11.1 *Verification freely performed.*

If the outcome of the verification process can only be a confirmation or rejection this leaves no room for a difference of opinion about what is sufficient and it suggests that no different assessment would be possible if one meets particularities. If there is no expectation of difference of opinion this may induce confirmation because the alternative, total rejection, is not the accurate response to the situation. Discussion between proposer and verifier is also undesirable as described in chapter 9.9 of the first report.
Independent scrutiny calls for the ability of challenge and a critical attitude that is functional and required by the situation. This should not be affected by a provision that allows for a bilateral discussion offering the opportunity to tune opinions. This is against the nature of verification and scrutiny. Disagreement may lead to emotion or discomfort, if not addressed it may become inducements to compromise or on the other hand cause a clouded relationship that may affect future decision making. All organisations should therefore have processes and procedures in place that addresses questionable identifications.

11.2 *The procedure; the initiation*

In all situations that a verifier does not reach the conclusion of identification the comparison is put in the questionable ID procedure (QID). The first expert who compares the print can, and should, also put a case forward to be handled this way in some instances. For both experts this may be the case if the ruling standard is not met or if in their opinion it is a border line case. All other particularities that require further analyses and/or debate or which are not covered by known rules and procedures are reasons to start a QID procedure.
In some situations the QID procedure is prescribed beforehand such is the case with multiple prints (procedure not described in this document) and separated prints.

Once a QID procedure is called for, identification of the same mark through normal procedures is prohibited.

11.3 *The process*

The case is presented to (at least) three other experts that have not dealt with the same mark before. All experts individually process the case using the normal methodical steps; the information or analyses phase, the comparison phase, the evaluation or balance phase and the conclusion phase.
In the information phase notes are taken of all observations, a form is used as an aid to walk through certain categories with which the mark is evaluated and judged. Qualifications are given to quality and quantitative factors. Distortions and other problems are described and an opinion given about the nature. Dactyloscopic points are established and an opinion is formed about the value of the relations and the total constellation of the mark. The notes are taken in order to be able to compare judgements when the mark is discussed later and in order to prevent a silent shifting of opinions.
When the information phase is concluded the expert decides consciously whether or not the mark is fit for the comparison phase. If the mark is seen as insufficient the experts stops his process and he enters the discussion with a veto. If not the comparison phase is started as described in chapter 9.6 of the first report. Again observations are noted and the similarities marked up and validated. If dissimilarities are explained the explanation is written down, reference to observations in the information phase is given. In this phase it is important to avoid conscious or subconscious decision making about the possibility of identification because this may influence the validation of similarities and the handling of dissimilarities. If this phase is concluded the expert enters into the balance phase, in this phase observations and pro's and con's are listed and definitive judgement is given.

The expert decides whether or not he wants to discuss certain aspects of the mark and comparison and what effect this might have upon his judgement.

The expert than draws a final conclusion, a veto for identification may be assigned or decided that the mark to his opinion is unfit for identification, the reason is formulated. A conclusion of identification is also noted with an indication of the degree to which the standard is met.
The total time the procedure has taken is noted.

11.4 *The discussion*

When all three experts have executed this procedure individually and without any consultation or indication revealing there opinion upon the print, the discussion follows.

This discussion takes place in a separate, quiet room where all necessary equipment is available. In principal there are no onlookers. Only if necessary for educational purposes other fingerprint experts are allowed to attend. They are instructed to keep distance and not to interfere in any way.
The number of three experts (as a minimum) is chosen to promote discussion.
One expert has the role of process leader. He leads the discussion, makes sure the procedure is fulfilled and he guards the process. The process leader has responsibilities but he has no higher authority. In the discussion only arguments count. The process leader has the tasks to keep the discussion pure and factual, to grant every expert the same possibilities to express himself and to avoid feelings and emotions to hamper objective discussion. If any of this occurs, if any unforeseen complication arises, or if he judges this necessary with respect to the quality of the process he may stop the procedure at any given time.

During the discussion every expert reads out his findings in the first phase and views are exchanged. Notable differences between observations have to be discussed and explained. If all agree to move to the comparison phase this phase is discussed next, this may be done in conjunction with the next phases and the provisional conclusion because the opinion is already fixed. If one expert launches a veto the process is stopped, there will be no identification.
If not the process continues. The process leader checks if all experts agree about the same dactyloscopic features in agreement, if not views and arguments are exchanged.

11.5 *The conclusion*

If all agree about the same features and the total of those features in agreement meet the required volume of the ruling standard an identification is possible. If all experts express that they are satisfied with an identification and commit to that the identification is formal.
If <u>one</u> expert is not satisfied an identification is not possible because identifications are presented with the notion that all experts using the same method should be able to arrive to the same conclusion. (The requirement of repetition/reproducibility).