

# FORENSIC EVIDENCE AND INTERNATIONAL COURTS AND TRIBUNALS:

*Why bother, given the present state of play in forensics?*

APA (Ton) Broeders, MA PhD

University of Leiden NL

Netherlands Forensic Institute, Rijswijk NL

## Abstract

Forensic science - more specifically, but not exclusively, forensic identification science or criminalistics - has come under fierce attack in recent years. Some of the graver miscarriages of justice that have come to light in several countries in the last decades were seen to be at least partly associated with inadequate standards of forensic expertise. What were long held to be tried and trusted forensic identification procedures like dactyloscopy and questioned document examination are now said to lack a sound scientific basis, and the traditional claims of forensic identification science have come to be dismissed as logically untenable. Studies like those by Evett & Williams (1995) and recent cases like those of Shirley McKie in Scotland and Sally Clark in England provide further evidence of the present crisis in the forensic arena. At the same time, forensic science is rapidly expanding. DNA profiling in particular may fairly be said to have revolutionized forensic science. It not only constitutes a powerful investigative and evidential tool in its own right, it is, ironically perhaps, also largely as a result of the growing familiarity with the scientific paradigm associated with DNA evidence that traditional identification science is now lying so heavily under siege. After a brief look at the underlying principles of traditional identification evidence which may go some way towards explaining the current confusion in the field of forensic identification, it is suggested that - owing to the enhanced understanding of the nature of scientific evidence that the critical scrutiny of traditional forensic science procedure is producing - forensic science will play an increasingly important role in the diverse criminal justice systems, including those relating to international courts and tribunals. Some practical information about the international organization of forensic experts as well as a brief discussion of some aspects relevant to work carried out by the NFI for various international tribunals concludes the contribution.

## 1 Recent developments in forensic science

There can be little doubt that the most significant forensic development of the 20<sup>th</sup> century has been the introduction of DNA-typing for the purposes of personal individualization. In the two decades that have elapsed since DNA analysis was first applied in a criminal case by Sir Alec Jeffreys in England, DNA evidence has not only revolutionized forensic identification science, it has also been instrumental in resolving countless old and cold cases by its power to categorically eliminate certain individuals as suspects - or, to put it more correctly, exclude them as donors of biological crime scene material - and to provide incriminating evidence against others. It has proved its investigative and evidential value in solving violent, high profile crimes as well as in tackling the rather more common type of transgression of the law that is nowadays collectively referred to as high volume crime. Over and above this, it has played an essential role in bringing to light grave miscarriages of justice in an ever widening range of countries including those which have long prided themselves on being among the nations with the best criminal justice systems in the world. It has had an unparalleled effect in increasing our understanding of the potential and actual dangers of relying too heavily on the use of eyewitness testimony and various types of forensic expertise in judicial fact-finding. Last but not least, the rise of forensic DNA analysis and the accompanying interest in the probabilistic model associated with it have sparked off a renewed critical interest in the interpretation and evaluation of other types of forensic identification evidence which was long overdue and whose full impact is as yet unclear.

## 2 Does forensic identification science qualify as science?

Almost inevitably, the brunt of the critical assault was initially borne by the tried and trusted traditional forensic identification disciplines like handwriting analysis, more commonly known as questioned document examination, firearm and tool mark examination, and morphological hair analysis. More recently however, the very icon of traditional forensic identification science, the fingerprint, has also come under attack, culminating in early 2002 in the Philadelphia-based Judge Louis H. Pollak ruling fingerprint evidence inadmissible only to - somewhat anticlimactically - reverse himself less than two months later. Even more so than earlier admissibility decisions like *US v Starzecpyzel*<sup>1</sup>, in which Judge McKenna ruled handwriting analysis not to be a science but something in the nature of a craft or a technical skill and as such admissible after all, Judge Pollak's decision sent shock waves through the forensic science community which extended all the way to the serious press.

Before we proceed, it may be good to pause for a moment to see what distinguishes *forensic identification science* from other forms of forensic science. Essentially, this difference can be described in terms of what Inman & Rudin<sup>2</sup> have termed the various forensic processes, *i.e.*, identification, classification, individualization, association and reconstruction.

Identification:	determination of physical-chemical composition ( <i>e.g.</i> , illicit drugs)
Classification:	determination of class, type ( <i>e.g.</i> , hair, fibres, blood type, DNA)
Individualization:	determination of unique identity of source ( <i>e.g.</i> , fingerprints) by means of <b>class</b> characteristics with <b>known frequency</b> in the <b>relevant population</b> and <b>individual</b> characteristics (also called <i>typica</i> )
Association:	determination of contact between two objects ( <i>e.g.</i> , fibres, glass)
Reconstruction:	determination of facts of the case: nature and place of events in time and space ( <i>e.g.</i> , murder, explosion)

Table 1: Different forensic processes

It is the individualization process, the inference of identity of source, that is the ultimate aim of all forensic identification science. Unfortunately, the various type of forensic identification science do not use the same scientific paradigm and – consequently - do not report their conclusions in the same format. The situation may be summed up as follows:

<b>Discipline</b>	<b>Type of conclusion</b>	<b>Example</b>
Dactyloscopy	categorical, <i>i.e.</i> , yes or no	finger trace does (not) originate from suspect
DNA:	probabilistic and quantitative	probability of random match (RMP) of profile suspect with that of cell material at crime scene
Remaining Ident <sup>3</sup>	probabilistic and verbal	material (very) probably does (not) originate from suspect

Table 2: Identification (identity of source): Individualization

Largely as a result of the growing familiarity with the scientific paradigm associated with DNA evidence traditional identification science, as exemplified by dactyloscopy and the remaining identification disciplines, is now lying heavily under siege. What is at issue here is nothing less than the scientific status of forensic identification procedures. Critics point to the lack of scientific rigour in the methodology applied, to the presence of various types of ex-

<sup>1</sup> U.S. v. Starzecpyzel, 880 F. Supp. 1027; S.D.N.Y. 1995.

<sup>2</sup> Inman, K. & Rudin, R. (2002) 'The Origin of Evidence', *Forensic Science International* 126, 11-16.

<sup>3</sup> Remaining identification disciplines, *e.g.*, handwriting analysis, hair, fibre analysis, firearms, toolmarks, impression marks.

aminer bias and to the prosecutorial orientation inherent in many traditional and well-accepted forensic procedures.<sup>4</sup> Elsewhere<sup>5</sup> I have argued that the ‘positivity doctrine’<sup>6</sup> subscribed to by the dactyloscopist community, whereby identifications are exclusively reported as absolute under penalty of excommunication from said community, may well have served to perpetuate fundamental misunderstandings about the nature of scientific evidence which – contrary to widespread belief - is essentially not of a categorical or deterministic but of a probabilistic nature.

Forty years ago, Paul Kirk held individualization to be the essence of criminalistics. Indeed, he defined criminalistics in exactly those terms:

‘Criminalistics is the science of individualization.’<sup>7</sup>

What Kirk saw as the central question of criminalistics, the determination of the *unique source* of an unknown physical trace, whether it be a finger trace, a tool mark, a hair, a cartridge or a signature, or the establishment of *identity of source* for a number of such traces is necessarily inferential in nature. As Kwan<sup>8</sup> and others have since pointed out, any form of individualization is an essentially inductive process. While forensic identification procedures may lead to *categorical elimination*, as again the example of DNA profiling demonstrates, unless the number of potential sources is limited and known, no forensic identification procedure can lead to a *categorical identification*. It is again forensic DNA analysis that, through the implicit example it sets as a forensic identification procedure with a solid scientific basis, is increasingly being referred to as a standard for other forensic identification procedures, which so far are seen to be failing to reach the standard of proper scientific procedure set by DNA.

### 3 The traditional approach in forensic identification

This is not to say that the results reported by traditional forensic identification scientists are necessarily always wrong. What it does mean is that the conclusions are not logically tenable, as in the case of categorical fingerprint identifications, and that they typically have a subjective element, which makes it difficult to assess their validity in an objective fashion. Traditional forensic identification science, which distinguishes itself from other types of scientific endeavour in that it is almost exclusively practiced in the context of the criminal law, in so far as it does not meet the requirements of the scientific method, may be more aptly described as a ‘Science Constructed in the Image of the Criminal Law’, as one of its most vociferous critics put it.<sup>9</sup> Because the method used does not meet the scientific standard, there are no safe-

---

<sup>4</sup> Saks, M.J., Risinger, D.M., Rosenthal, R. & Thompson, W.C. (2003) ‘Context effects in forensic science: A review and application of the science of science to crime laboratory practice in the United States’, *Science & Justice* 43(2), 77-90. An almost identical version of this article appeared earlier as Risinger, D.M., Saks, M.J., Thompson, W.C. & Rosenthal, R. (2002) ‘The Daubert/Kumho Implications of Observer Effects in Forensic Science: Hidden Problems of Expectation and Suggestion’, *California Law Review* 90, 1-56.

<sup>5</sup> Broeders, A.P.A. (2003) *Op zoek naar de bron: Over de grondslagen van de criminalistiek en de waardering van het forensisch bewijs*, Kluwer: Deventer.

<sup>6</sup> The positivity doctrine is perhaps best illustrated by the following quotation: ‘Friction ridge identifications are absolute identifications. Probable, possible, or likely identification are outside the acceptable limits of the science of friction ridge identification.’ (TWGFAST) Proposed Guidelines’, *Journal of Forensic Identification* 47(4), 432 (1997).

<sup>7</sup> Kirk, P.L. (1963) ‘The Ontogeny of Criminalistics’, *Journal of Criminal Law, Criminology and Police Science* 54, 235-238.

<sup>8</sup> Kwan, Q.Y. (1977) *Inference of Identity of Source*, PhD Thesis, University of California, Berkeley, CA.

<sup>9</sup> Saks, M.J. (1998) ‘Merlin and Solomon: Lessons from the Law’s Formative Encounters with Forensic Identification Science’, *Hastings Law Journal* 49 (4), 1069-1141.

guards against the potentially pernicious effects of observer bias and cognitive illusions, which are not only known to present powerful threats to human observation and judgment in general but have now also been demonstrated to provide some of the contributing factors to the conditions in which grave miscarriages of justice may occur.

To the extent that traditional forensic identification science may be said to have a theoretical basis, this would appear to comprise at least Locard's classic *Exchange Principle*, or principle of transfer, popularly summed up by the dictum 'Every contact leaves a trace' but in fact phrased in rather more graphic language by Locard himself.<sup>10</sup>

*'Nul ne peut agir avec l'intensité qui suppose l'action criminelle sans laisser des marques multiples dans son passage, tantôt le malfaiteur a laissé sur les lieux des marques de son activité, tantôt par une action inverse, il a emporté sur son corps ou sur ses vêtements les indices de son séjour ou de son geste.'*

More recently Inman & Rudin<sup>11</sup> proposed the concept of the *divisibility of matter*, which explains how traces may arise in the first place:

*'Matter divides into smaller component parts when sufficient force is applied. The component parts will acquire characteristics created by the process of division itself and retain physico-chemical properties of the larger piece.'*<sup>12</sup>

Between them these principles or premises provide a principled account of the origin of traces. But while they may provide an explanation for the occurrence of traces, they do not in and of themselves provide a logical basis for the *unique identification* of traces, which is the major claim of the fingerprint identification, or for the more modest and realistic goal of 'inference of identity of source', as Kwan sees it.<sup>13</sup>

There are two major principles underpinning classical forensic identification science. The first is the *principle of uniqueness*, summed up in the phrase 'Nature never repeats itself', which is almost invariably - but as far as I have been able to establish with little justification<sup>14</sup> - attributed to the Belgian Quételet, and is echoed in claims like 'All fingerprints/ears/voices are unique'. The second is the *principle of individualization*, which says that every trace can be related to a unique source.

The main problem here lies in the second of these assumptions. While the first principle, that every object is unique, is an unproved assumption which - in a philosophical but forensically trivial sense - is both necessarily logically true and impossible to prove, it is the second principle that is largely responsible for methodological problems surrounding forensic identification science. The real question is not if all physical traces are unique and therefore theoretically capable of being uniquely identified with a particular source but whether they can always be so identified *in the forensic context and using the methods and procedures employed by the forensic scientist*. That is also, or rather should be, the central question in the currently raging fingerprint debate. What the traditional individualization procedure entails is formulated by Huber as follows:

<sup>10</sup> Locard, E. (1923) *Manuel de technique policière*, Payot: Paris.

<sup>11</sup> Inman, K. & Rudin, R. (2000) *Principles and Practice of Criminalistics: The Profession of Forensic Science*, CRC Press: Boca Raton FL.

<sup>12</sup> Inman, K. & Rudin, R. (2002) 'The Origin of Evidence', *Forensic Science International* 126, 11-16.

<sup>13</sup> Kwan, Q.Y. (1977) *Inference of Identity of Source*, PhD Thesis, University of California, Berkeley, CA.

<sup>14</sup> I have been unable to find it, *i.e.*, its French equivalent) in the source that is most frequently given, *i.e.*, Quételet, Ad. (1870) *Anthropométrie ou Mesure des Différentes Facultés de l'Homme*, Muquardt: Bruxelles.

‘When any two items have characteristics in common of such number and significance as to preclude their simultaneous occurrence by chance, and there are no inexplicable differences, then it may be concluded that they are the same, or from the same source.’<sup>15</sup>

As recently as 1993, Tuthill similarly indicated that individualization, or unique identification, can be achieved:

‘...by finding agreement of corresponding individual characteristics of such number and significance as to preclude the possibility (or probability) of their having occurred by mere coincidence, and establishing that there are no differences that cannot be accounted for.’<sup>16</sup>

The problem here of course lies in the basis on which chance occurrence of shared features can be excluded and differences can be deemed to be explicable. This requires reference to an indefinitely large set of alternative potential sources whose size cannot normally be defined with any precision and whose feature composition is not really very well known. A more authoritative handbook of forensic science describes the process as follows, invoking the distinction between *class characteristics* and *individual characteristics* that is commonly made in the forensic identification context:

‘*Class characteristics* are general characteristics that separate a group of objects from a universe of diverse objects. In a comparison process, class characteristics serve the very useful purpose of screening a large number of items by eliminating from consideration those items that do not share the characteristics common to all the members of that group. *Class characteristics do not, and cannot establish uniqueness.*

*Individual characteristics*, on the other hand, are those exceptional characteristics that may establish the uniqueness of an object. It should be recognized that an individual characteristic, taken in isolation, might not in itself be unique. The uniqueness of an object may be established by an ensemble of individual characteristics. A scratch on the surface of a bullet, for example, is not a unique event; it is the arrangement of the scratches on the bullet that mark it as unique.’<sup>17</sup>

While this sounds plausible, there is still a major logical problem. Sometimes that problem is rather easily glossed over as by Tuthill, when he says:

‘... we look for **unique characteristics** in the items under examination. If we find a sufficient number of characteristics to preclude the possibility or probability of their having occurred by coincidence in two different objects, we are able to form a conclusion of individualization. It’s as simple as that.’<sup>18</sup>

But in fact the definition of individual characteristics is essentially circular: individual characteristics are defined as characteristics that are – frequently in combination – capable of establishing uniqueness. But uniqueness is defined by an ensemble of individual characteristics. Whether characteristics – either by themselves or collectively – are unique is an inductive question, which raises the classical induction problem: we can never be sure that

---

<sup>15</sup> Huber, R.A. (1959-1960) ‘Expert Witnesses’, *Criminal Law Quarterly* 2, 276-296

<sup>16</sup> Tuthill, H. (1994) *Individualization: Principles and Procedures in Criminalistics*, Lightning Powder Company: Salem, Oregon, p. 21.

<sup>17</sup> Thornton, J.I. & Peterson, J.L. (2002) ‘The General Assumptions and Rationale of Forensic Identification’ § 24-2.0-2.1, in D.L. Faigman, D.H. Kaye, M.J. Saks & J. Sanders (red.) *Modern Scientific Evidence: The Law and Science of Expert Testimony*, West Publishing Co.: St. Paul, MINN.

<sup>18</sup> Tuthill 1994, p. 27.

all swans are white as long as we have not seen all swans. Similarly, we can never be sure that a feature or combination of features is unique, until we have observed all relevant objects. What practitioners of traditional forensic identification sciences really do is perhaps best described by Stoney, who used the image of the ‘leap of faith’ as the mechanism whereby the forensic scientist actually establishes individualization:

‘When more and more corresponding features are found between the two patterns scientist and lay person alike become subjectively certain that the patterns could not possibly be duplicated by chance. What has happened here is somewhat analogous to a **leap of faith**<sup>19</sup>. It is a jump, an extrapolation, based on the observation of highly variable traits among a few characteristics, and then considering the case of many characteristics. [] In fingerprint work, we become subjectively convinced of identity; **we do not prove it.**’

Dactyloscopists, and all other traditional forensic identification scientist are ultimately making a subjective decision in reaching a categorical decision about the identity of source of two traces. They become convinced that the unknown trace and the reference material have the same origin. But there is no logical basis for this type of conclusion, as Tuthill points out:

‘At the present time, in most jurisdictions, an opinion of certainty is the only acceptable opinion when dealing with the individualization of a fingerprint impression. This is not a rule that has been laid down by the courts (who will deal with any opinion offered) but rather by the fingerprint examiners. There is no scientific basis for the rule. It is simply one of the aberrations that have developed within the discipline of fingerprint identification.’

Quantification of the frequency of the characteristics involved is often difficult but even if it is possible - as again pre-eminently in the case of nuclear DNA typing - and no matter how infrequent we estimate the combined occurrence of the characteristics to be, it will not allow us to individualize, as Stoney so aptly expressed in the title of his 1991 paper, ‘What made us ever think we could individualize using statistics?’.<sup>20</sup> The estimated frequency of the profile of the crime scene sample and that of the reference sample of suspect may be vanishingly small, there is still no logical basis on which the forensic scientist could pronounce them to have the same origin. DNA characteristics are essentially class characteristics, which, as Thornton & Peterson put it ‘...do not, and cannot establish uniqueness’.

#### 4 How does this affect the forensic science community

It is the growing awareness of the subjective nature of the conclusions of the traditional forensic scientist coupled with a better understanding of the relevance of the induction problem that is at the heart of the crisis in traditional forensic identification science. It has raised experts’ awareness of their susceptibility to context effects, including the notion of the malleability of subjective opinions, and has underlined the importance of quality assurance systems in forensic laboratories. These were not unknown but tended to be primarily associated with forms of forensic science where classification rather than individualization of physical traces is undertaken, as in the chemical analysis of suspected illicit drugs or in toxicology.

Forensic laboratories frequently enjoy a virtual monopoly as providers of forensic services to police and the judiciary, and especially when it comes to identification sciences, they are not normally subject to the mechanisms of the commercial marketplace, thereby lacking an important incentive to improve standards. Combined with the atmosphere of secrecy in which forensic work takes place – which is partly inevitable but is sometimes cultivated

---

<sup>19</sup> Bold APAB.

<sup>20</sup> Stoney, D.A. (1991) ‘What made us ever think we could individualize using statistics?’, *Journal of the Forensic Science Society* 31(2), 197-199.

unnecessarily, can easily degenerate into secretiveness and does not tend to encourage scientific accountability – this lack of competition potentially amounts to a recipe for disaster. Even large organisations like the FBI are regularly found to show shortcomings which may well be related to the inward-looking orientation that the confidential nature of investigative work inevitably breeds.

Partly because they realize that ultimately their long-term continuity is at stake if the quality of their expertise is seen to be below standard, forensic science laboratories are increasingly facing the responsibility they have in ensuring the quality of their forensic casework. In Europe, this work is taken forward within ENFSI, the European Network of Forensic Science Institutes, which was formally established in 1994 and seeks to promote education and training of experts, the introduction and enforcement of quality assurance systems and the harmonization of methods and techniques in the various forensic disciplines. Laboratories like the Forensic Science Service in Britain, SKL in Sweden, NBICL in Finland and NFI, my own laboratory, to mention just a handful, have certified some of their forensic examinations with nationally operating, external and independent laboratory certification boards, such as UKAS in the United Kingdom and the Council for Accreditation in the Netherlands, and are continuing to do so. An increasingly important role in this context is being played by the ENFSI Expert Working Groups which were set up in the last decade. Like their American counterparts, such as the Scientific Working Group for Materials Analysis (SWGMA) and the Scientific Working Group for Document Examination (SWGDOC) working under the auspices of the FBI, and similar groups in Australia and New Zealand, such as the Scientific Advisory Groups (SAG) operating within the context of SMANZFL (the Senior Managers of Australian and New Zealand Forensic Science Laboratories), many of the ENFSI Expert Working Groups, such as the Drugs, Fibers, Paint, Firearms and DNA Groups are actively involved in drawing up best practice manuals, setting up collaborative tests and education and training programs and working towards increased harmonization and standardization of methods and techniques.

## **5 Forensic expertise and international courts and tribunals**

As a laboratory which is situated in the city that likes to present itself as the legal capital of the world, the Netherlands Forensic Institute (NFI) has had the benefit of acquiring considerable experience in carrying out forensic casework for international tribunals, most notably for the ICTY (the International Tribunal for the Former Yugoslavia) and more recently with the international Tribunal for Sierra Leone. Initial contacts with the third international criminal court in The Hague, the ICC (International Criminal Court) have recently been made. Although the nature of the forensic work is not necessarily very different, questions relating to chain-of-custody of trace materials, the collection of reference material, interpretation of the findings and presentation of the results frequently introduce new challenges. With ICTY, a long-term arrangement has been entered into, which streamlines some of the formal procedures surrounding the execution of forensic casework. I have personally had the pleasure of appearing twice for the ICTY-tribunal and reporting in one other case. Although the tribunal is essentially of an adversarial type, I have not so far been aware of admissibility questions relating to forensic expertise. I am referring here to the well-known difference between the two major judicial systems as concerns the role of the judge in determining the admissibility of evidence, including evidence of a forensic nature. In Common Law, adversarial type systems, evidence could be said to be subject to a form of *input control*. The judge plays an important role as gatekeeper to stop irrelevant or misleading information reaching the jury. On the other hand, Continental or Civil Law systems tend to use a form of *output control*.





beginning to show some very positive results, as in the case of DNA typing, where throughout Europe, the same markers are used, thereby ensuring that results from different countries are fully comparable. While it is clear that convergence is probably much easier to bring about on the forensic level than in the criminal justice system as a whole, success in the forensic area may well have a modest if positive effect on the larger effort, that of promoting convergence of the various criminal justice systems to which this conference is hoping to make a contribution.