FIRST GENERATION FORENSIC EVIDENCE AND ITS INFLUENCE ON LEGAL DECISION-MAKING – A SOUTH AFRICAN PERSPECTIVE

By

JO-MARí VISSER

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Promoter: Professor H. Oosthuizen
Co-promoter: Professor T. Verschoor

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DEDICATION

This study is dedicated to all police officers and legal practitioners who give a damn... May you never become tired.

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DECLARATION

I hereby declare that this research study: *First generation forensic evidence and its influence on legal decision-making – A South African perspective*, handed in for the qualification LL.D at the University of the Free State is my own independent work and that I have not previously submitted the same work for a qualification at/in another university/faculty. I also concede copyright of this work to the University of the Free State.

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CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

In August 2008, the Ministry of Justice reported to Parliament that the South African criminal justice system is wholly ineffective; that it is "fragmented, dysfunctional and contaminated with backlogs."[1] It was also added that the state of affairs with regard to crime in this country is so overwhelming that it has ultimately rendered the South African Government helpless.[2]

One need only peruse crime statistics published annually to find justification for the Ministry's grave concerns.

The governmental organs responsible for combating crime in South Africa are mainly the South African Police Service (SAPS) and the National Prosecuting Authority (NPA), the two entities that provide for the path that a criminal incident will follow from reporting to finalisation. Both these establishments are creatures of the Constitution of the Republic of South Africa of 1996.[3]

Annually, the SAPS and NPA publish statistics regarding the performance of their respective duties. The SAPS records the amount

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1 Ministry of Justice 2008:7.

2 Steenkamp 2008:1.

3 Section 199 and section 179 of the Constitution, respectively.

of criminal incidents reported at each police station in the country as well as the national aggregates. Similarly, the NPA records and publishes data on the amount of finalised cases (including the amount of convictions versus acquittals), the conviction rate, and the percentage cases withdrawn, postponed, and diverted.[4]

To assess the efficacy of the criminal justice system, and thus comprehend the Justice Ministry's anxiety, the statistics of both the SAPS and the NPA should be examined as a whole, and not in isolation.[5] It is therefore valuable to compare the number of convictions achieved by the NPA with the number of cases reported to the SAPS in a given financial year, to accurately ascertain the levels of success and co-operation achieved by these two divisions.[6]

During the 2009/2010 financial year of the SAPS, a total number of 2174741 crimes were reported to the police in all the precincts in South Africa.[7] This includes a staggering number of 16834 reported murder cases, 68332 transgressions of a sexual nature, and 113755 reports of robbery with aggravated circumstances.[8]

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4 National Prosecuting Authority of South Africa 2010:14.

5 Van Zyl Smit 2000:6.

6 Van Zyl Smit 2000:6.

7 South African Police Service 2010a. http://www.saps.gov.za/statistics/reports/crimestats/2010/totals.pdf. Accessed on 03/01/2010. In the 2011/2012 financial year, 2137378 crimes were reported to the SAPS – South African Police Service 2011a. http://www.saps.gov.za/statistics/reports/crimestats/2012/totals.pdf. Accessed on 30/12/2012.

8 South African Police Service 2010a. http://www.saps.gov.za/statistics/reports/crimestats/2010/totals.pdf. Accessed on 03/01/2010. The statistics for 2011/2012 include 15609 murders, 64514 crimes of a sexual nature and 101203 aggravated robberies - South African Police Service 2011a. http://www.saps. gov.za/statistics/reports/crimestats/2012/totals.pdf. Accessed on 30/12/2012.

During the same period, the National Prosecuting Authority (NPA) boasted with a conviction rate of 88,6%.[9] One could be forgiven for assuming that 88,6% of reported cases resulted in a finding of guilt, but this is not the position at all. It is only those matters that survive prosecutorial scrutiny, enrolled and then filtered to trial, that result in the high conviction rate.

Enrolment of case dockets for prosecution is subject to the prosecutor's discretion regarding whether there is sufficient evidence in that docket to ensure a conviction.[10] In the event that the prosecutor is of the opinion that certain outstanding investigations still need to be conducted, such instructions will be entered into the instruction diary in the docket and returned to the investigating officer for further investigations. The matter will not yet be enrolled. If the prosecutor is of the view that no reasonable prospect exists for conviction, a *nolle prosequi* certificate[11] will be attached and the docket will be finalised without ever having been enrolled for trial purposes.[12] The NPA's policy directives[13] maintain a strict "no case, no enrolment" rule and all case dockets must be screened in accordance with this principle.

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9 National Prosecuting Authority of South Africa 2010:14. In the 2011/2012 year, the NPA reported a conviction rate of 88,8% - National Prosecuting Authority 2011:27.

10 Joubert 2010:216.

11 *Nolle prosequi* literally translated means: "do not prosecute" – Joubert 2010:216. A certificate *nolle prosequi* is a written confirmation by the relevant director of public prosecutions that the content of the docket has been examined and that the NPA declines to prosecute the particular matter at the instance of the state – section 7(2)(*a*) of the Criminal Procedure Act 51 of 1977.

12 Joubert 2010:216.

13 National Prosecuting Authority of South Africa *sine annum*:9.

If, however, the public prosecutor considers the contents of the docket to represent a *prima facie* case, the matter is enrolled and will either be postponed to refine and conclude final investigations, or proceed directly to trial.[14]

In the 2009/2010 financial year, where 2174741 crimes were reported to the SAPS, only 1044346 cases contained sufficient evidence to be enrolled to court.[15] That means that only approximately 48% of reported cases had adequate evidential material to warrant sufficient prosecutorial interest to result in enrolment.

In 2000, the South African Law Reform Commission[16] performed a sample study on *inter alia* the low number of reported cases eventually proceeding to trial and advanced some reasons in explanation of this disturbing trend. The vast majority of these cases to never see the inside of a courtroom are cases deemed undetected.[17] In these cases the police were unable to identify a suspect, either due to an absence of evidence and information, or due to incomplete or inadequate police investigations.[18] Another disquieting phenomenon exposed during this study, was that the crime category with the lowest detection rate was

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14 Joubert 2010:216.

15 National Prosecuting Authority of South Africa 2010:14.

16 Van Zyl Smit 2000:11-12.

17 In the present study "detection" will be used in reference to scenarios where a suspect has been identified and a functional relationship established between the suspect and the particular crime – Van der Westhuizen 1966:359.

18 Van Zyl Smit 2000:11, 15.

incidents of violent crime, especially robbery with aggravating circumstances[19] and murder.[20]

The current statistics on crime reporting, case withdrawal and conviction rates would suggest that the situation has not improved over time.[21]

According to other studies, rape conviction rates are horrifyingly low due to the fact that police investigations are inadequate and forensic evidence is lacking.[22]

The South African Law Reform Commission study found that actual conviction rates of all cases reported to the police, amounted to a total of 2,99% for robbery with aggravated circumstances and about 10,57% for murder.[23] These numbers are especially daunting compared with the 49% murder conviction rate in the United States of America and 56% in England and Wales during the same period.[24]

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19 According to section 1(b) of the Criminal Procedure Act 51 of 1977, aggravating circumstances with reference to robbery includes the following:

(i) the wielding of a firearm or any other dangerous weapon;
(ii) the infliction of grievous bodily harm; or
(iii) a threat to inflict grievous bodily harm,

by the offender or an accomplice on the occasion when the offence is committed, whether before or during or after the commission of the offence.

20 Van Zyl Smit 2000:18.

21 See in this regard the most recent crime statistics as published by the South African Police Service – South African Police Service 2011a. http://www.saps.gov.za/statistics/reports/crimestats/2012/totals.pdf. Accessed on 30/12/2012.

22 Benson *et al* 2010:16.

23 Van Zyl Smit 2000:19.

24 Van Zyl Smit 2000:22.

Statistics published by the National Prosecuting Authority for 2009/2010 indicating a conviction rate of 88,6%, also indicated an amount of 242103 cases withdrawn from the roll.[25] This implies that where a meagre 48% of the 2174741 reported incidents of crime were initially enrolled by prosecutors, an additional 242103 cases were withdrawn prior to commencement of trial proceedings.[26] Reasons for withdrawal subsequent to enrolment extend from the benign, like withdrawal on request of the complainant after the parties engaged in pre-trial dispute resolution, to the more distressing, namely that sufficient evidence could not be obtained to support a convincing *prima facie* case against the accused, even after several requests for further investigation.

Police statistics for the 2009/2010 financial year revealed that of the 16834 murders reported to the police during this period, only 13,6% finally resulted in convictions.[27] The picture looks no less daunting for sexual offences, which saw a conviction rate of 14,6%.[28] The conviction rate for rape in England and Wales during the 2008/2009 year stands at 58%.[29]

It is within the arena of detection, extending from the time a crime is committed to the time a suspect has been arrested and an adequate

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25 National Prosecuting Authority of South Africa 2010:14.

26 This amount cannot accurately be expressed in percentage as it cannot be said to form part of all newly enrolled matters. Some withdrawn cases could be matters enrolled in the years prior to 2009 and continuously postponed due to incomplete or insufficient evidence to proceed with trial. It must also be taken into account that this number does not include the amount of cases removed from the roll by presiding officers for reasons such as unreasonable requests for postponement, and so forth.

27 Kohler-Barnard 2010:*s.p.*

28 Kohler-Barnard 2010:*s.p.*

29 Crown Prosecution Service 2008:*s.p.*

functional relationship established between the suspect and the crime, that a vacuum seems to exist into which a multitude of unlawful activity disappears with impunity.

The labyrinth that is the criminal justice system is initiated by the perpetration of a criminal act or the attempt thereto, and its subsequent reporting to the police. After the first responders to the scene of the crime have recognised that a crime has indeed been committed, the detective unit will proceed with the detection of the crime.[30]

During this period of detection, or more simply put, the investigation of the criminal incident, fundamental questions with reference to "who" committed the crime, "when", "where", "how" it was committed, as well as "why" it was committed, have to be addressed by the investigator and ultimately proved by the prosecution to secure a conviction.[31] To provide answers to these questions the police embark on a process of information gathering from both direct and indirect sources.[32] Direct sources of information gathered during a criminal investigation refer to the sensory experiences of a criminal incident by witnesses,[33] verbally described by such witness.[34] Indirect proof of facts in issue originates from circumstantial evidence, that is, evidential material that proves the circumstances of the offence.[35]

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30 Joubert 2010:214-216.

31 Van der Westhuizen 1996:5-6.

32 Van der Westhuizen 1996:4-5.

33 Witnesses here would include complainants, victims, eye witnesses, accused, accomplices, and others – Van der Westhuizen 1996:5.

34 Van der Westhuizen 1996:5.

35 Van der Westhuizen 1996:5.

Scientific evidence constitutes a vital component of circumstantial evidence.[36] Where the natural sciences, for example physics, biology, mathematics, and chemistry, are employed to recognise, collect, analyse, and interpret physical evidence from primary and secondary crime scenes, solutions to the "who", "when", "where", "what", "why" and "how" questions may be offered.[37] This kind of evidence is presented in court by expert witnesses, so-called because of their specialised knowledge, skill and/or experience.[38]

The vast majority of evidence presented in court in South Africa comes in the form of witness testimony,[39] whether direct or circumstantial in nature. Eyewitness testimony, however, is notoriously unreliable.[40] Buckhout[41] describes human observation as sloppy, uneven, and limited to the observer's own abilities, background, motives and beliefs. Regardless of the fallacy that witness memory is the most reliable of possible evidence, it is habitually the only evidence contained in case dockets. This compounds the importance of scientific evidence.

Since the advent of forensic science the observation of physical evidence in criminal cases has greatly improved the validity and reliability of the conclusions drawn by legal decision-makers.[42] Proof of

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36 Will 1982:152.

37 Shelton 2011:1.

38 Meintjes-Van der Walt 2005:34.

39 Institute for Security Studies 1998:4.

40 Buckhout 1975:171.

41 1975:171.

42 Eckert 1997:1.

facts depends more and more on inferences made by legal decision-makers, flowing from the application of findings in the natural sciences.[43] However, the natural sciences, specifically forensic science technology, has seen some rapid advances in recent years, severely enhancing the complexity of scientific principles regarding such evidence.[44] In addition to this, the tremendous capacity of forensic science to secure convictions and acquittals in criminal trials is being challenged and queried progressively more and more.[45] And while it remains important that the legal fraternity becomes familiar with the science used in courts, it is equally important that the investigative and policing forces become accustomed and comfortable with forensic evidence.

1.2 PROBLEM STATEMENT

From the examination of the crime statistics in South Africa, with due consideration to the rates of crime reporting, conviction and withdrawal due to lack of evidence, exacerbated by the Justice Ministry's report, it is apparent that no small problem exists in the evidence production ability of our investigative forces. Evidence, as currently found in case dockets, are just not up to the task of competing with crime perpetration.

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43 Kiely 2001:26.

44 Shelton 2011:2.

45 Pyrek 2007:1.

Evidence is the basis of justice[46] and yet the failure of non-scientific law enforcement personnel to master the concept of forensic evidence from the outset, compounded by the continued development of forensic technology, has paralysed our law enforcement agencies to its possibilities. Furthermore, legal practitioners suffer an understandable inability to distinguish between credible forensic experts and imitators.[47]

Forensic science is the only science employed in criminal dispute resolution and the resultant expectation thereof is immense.[48] DNA[49] analysis has had an astonishing impact on criminal justice systems across the globe.[50] The advent of a fully automated forensic DNA analysis system at the Forensic Science Laboratory of the South African Police Service has strategically placed South Africa at the forefront of forensic DNA technology.[51] Yet, despite this triumphant claim, South Africa struggles to effectively combat crime. This failure to reduce criminality is a direct function of a failure to deter potential perpetrators by proper crime detection and prosecution. Recent media coverage on murders would even suggest that the country's failure to adequately address problems in crime detection is resulting in foreigners entering the country to employ 'murderers for hire'.[52]

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46 Twining 1990:38.

47 Pyrek 2007:2.

48 Pyrek 2007:2.

49 Deoxyribunucleic acid. The principles of DNA analysis will be examined in Chapter 4.

50 Shelton 2011:2.

51 Heydenrych 2006. http://www.engineeringnews.co.za/print-version/south-africa-pioneers-automated-forensic-dna-analysis-2006-10-20. Accessed on 07/02/2011.

52 Joseph 2011. http://www.citypress.co.za/SouthAfrica/News/Dewani-effect-makes-SA-dial-a-hitman-land-20110205. Accessed on 07/02/2011.

1.3 OBJECTIVES OF THE RESEARCH

1.3.1 Main objectives

The primary considerations of the present study are to provide the reader with an overview of the historical development of science and law, as well as an inclusive exploration of the historical development of forensic science.

The study will also endeavour to delineate the definition, scope and nature of forensic scientific evidence, and in particular, first generation forensic evidence. The subject of first generation forensic evidence will be further scrutinised in an exploration of its fundamental scientific bases and problems relating to its current detection, analysis, interpretation, and presentation in court, including issues pertaining to laws of evidence and admissibility. Comparisons will be drawn with current 'real' scientific evidence, especially DNA evidence, as well as eyewitness testimony. The statutory frameworks within which these types of scientific evidence are managed will also be reviewed.

The influence of circumstantial evidence, with specific reference to first generation forensic evidence, on legal decision-making will be evaluated and discussed.

No thorough study of forensic science within a criminal justice system is complete without a comprehensive comparative inspection, thus foreign perspectives relating to scientific evidence in other jurisdictions will be examined.

An attempt will also be made to propose recommendations for the optimal harvesting, analyses, and presentation of first generation forensic evidence in South Africa, as well a possible solution to the problem of crime detection in this country.

1.3.2 Secondary objectives

Secondary research objectives include the provision of the findings of the research to the legal fraternity for possible employment in criminal investigation and litigation by serving as guidelines to investigators and litigators in the detection and presentation of forensic evidence.

The study may also be of assistance to expeditious case finalisation by informing presiding officers of the pitfalls and advantages that can materialise from scientific evidence.

1.4 RESEARCH METHODOLOGY

The current research will comprise a comparative legal literature study, conducted on a broad basis.

A comparative study, as systematic and specific method of acquiring new knowledge,[53] is performed throughout the research to establish thought patterns on the research problem by drawing parallels between the South African position and those of foreign jurisdictions.

[53] Venter *et al* 1990:209.

In accordance with the three spheres of comparative research, proposed by Venter *et al*,[54] the present study intends to peruse the applicable legal principles from each of the jurisdictions, viewed independently, with knowledge acquisition as main aim. Thereafter, each jurisdiction's legal principles will be studied in the milieu of its broader legal and community framework to properly understand its practical function.[55] This will then be followed by a thorough consideration of the parallels and dissimilarities between the various legal systems.[56]

The importance of legal comparative research can be found in its ability to stimulate thought on a specified legal problem.[57] This study can hardly presume to be an authoritative study on the subject without comprehensive knowledge on the relevant legal principles contained in foreign spheres and how our position is deficient or accomplished compared to that of others.

Sources employed in the present study include books, academic journals and newspaper articles, case law, relevant legislation and dissertations, reports, relevant international legal mechanisms, as well as electronic databases.

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54 1990:219.

55 Venter *et al* 1990:219.

56 Venter *et al* 1990:219.

57 Venter *et al* 1990:220.

Jurisdictions studied in this comparative research include developed countries such as England and Wales, as well as the United States of America.

Interest in the England and Wales legal system emanates from a shared common law origin and the substantial influences of English law on the development of the South African law of evidence.[58]

The United States of America was included in this research project as an additional example of a jurisdiction with substantial English common law influences in the development of its rules of evidence. Comprehensive consideration of American legal principles regarding the law of evidence is essential in light of the international influence of some Supreme Court rulings on admissibility of expert evidence.[59] In fact, Vuille[60] proposes that the influence of the American system of evidence law is progressively spreading across Europe.

1.5 CHAPTER OUTLINE

Chapter 2 will contain a discussion on the co-existence and historical development of science and law, and will proceed to extensively

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58 Zeffert *et al* 2003:5-9.

59 In 2005, the House of Commons Science and Technology Committee published a report in which it proposed that a test for expert evidence admissibility be created in the England Wales legal system that would echo the *Daubert* test as found in the United States of America – House of Commons 2005:76. See also: Vuille 2011:40.
The "*Daubert* test" refers to a set of criteria as can be found in the United States Supreme Court ruling of *Daubert v Merrell Dow Pharmaceuticals, Inc.,* 43 F.3d 1311 (9th Cir. 1995).

60 2011:40.

discuss the historical development of forensic science, law of evidence and expert testimony.

Chapter 3 contains some descriptions and elucidations on the definition, nature and scope of criminal investigations, forensic science, criminalistics and examines first generation forensic science specifically.

In Chapter 4, DNA evidence, sometimes referred to as ‘real’ scientific evidence, and witness testimony will be examined from a critical viewpoint. Constituting the mass of evidence available to prosecutors, these types of evidence often provide revolutionary evidence in criminal trials. Unfortunately, its steadfast reliability is a fallacy and some dangers of these types of evidence will be discussed.

Additionally, eyewitness testimony will be examined in light of its value and reliability in criminal adjudication. Preceding these discussions will be an overview of the process of fact-finding in criminal proceedings.

Chapter 5 aims to discuss issues pertaining to proof of fact and burden of proof before proceedings to an examination of the problems and concerns regarding the disciplines of traditional forensic science, including fingerprint evidence, bloodstain pattern analysis and trace evidence. These disciplines will then be discussed in some detail, including the proposed science behind these disciplines, and its employment in criminal proceedings. Issues regarding admissibility of first generation forensic sciences will be touched upon. Comparative considerations will also be included in the chapter.

Chapter 6 will contain extensive discussions on the legislative framework in South Africa and other countries pertaining to the employment of forensic evidence in criminal prosecutions. Possible need for legislative reform will also be discussed. The concept of ‘legal decision-making’ will be defined and expanded upon. The influence of forensic science on legal decision-making from a South African perspective will be delineated, in conjunction with discussion on legal decision-making from the viewpoint of foreign jurisdictions.

A pertinent decision has been made to keep the comparative studies of each focus area chapter specific. No chapter dedicated exclusively to comparative research has therefore been included, which is considered to be conducive to a more prudent analysis and comparison of the different jurisdictions.

Chapter 7 will see conclusions drawn from prior discussions in the study, followed by some recommendations for future research and development in the arenas of scientific evidence in criminal investigations and prosecutions.

CHAPTER 2

HISTORICAL DEVELOPMENT OF FORENSIC SCIENCE AND ASPECTS OF THE LAW OF EVIDENCE

2.1 INTRODUCTION

Marked interaction between science, with specific reference to forensic science, and law, is by no stretch of the imagination a novel concept. In truth, it is the relationships between the fundamental spheres of science, law, religion, and philosophy that ultimately gave birth to Western civilization.[61]

Despite this, legal historians have been criticised for cultivating an inclination to place continued importance on the autonomous quality of legal thought at the expense of discovering how law fits in with the intellectual, social and political existence of the time.[62] It has been suggested[63] more recently though, that scholars not disengage themselves from attaining knowledge on these relationships, as this would ultimately be detrimental to the acquisition of comprehensive and penetrative insight into a preferred sphere.

Interactions between science and law can be dated back as far as 9000 B.C. to 3000 B.C., to a time known as the Neolithic age.[64] This period is

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61 Wecht and Rago 2006:3.

62 Shapiro 1969:728.

63 Wecht and Rago 2006:3-4.

64 Wecht and Rago 2006:5.

recognised, less for its specific location in history, but more for its behavioural and cultural features such as the domestication of animals and plants, establishment of organised government, technological development and writing, not only in general but specifically the recording of commercial, legal, medical and astronomical events.[65] It is this very textual development that enables the tracing of the first interactions between scientific and legal domains.[66]

Astronomers were the scientific pioneers of the Neolithic age and the first to demonstrate interaction with law.[67] These earliest scientists were meticulous in recording their astral observations and from the recorded data the concept of calendars was born.[68] Continuous observations of the tides and structures of the astronomical universe served as birthplace of the idea of order, and consequently, of law and order.[69]

With the dawn of the age of Enlightenment, Isaac Newton schooled the world in the laws of motion and gravity that direct nature into order.[70] The idea of 'Newtonian governance' described the natural system of strict order and regularity, presided over by the laws of nature and gravity.[71] Newtonian philosophy, with its emphasis on law and order, had great influence on legal thinking, specifically property law in the

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65 Wecht and Rago 2006:5; Columbia Electronic Encyclopedia 2010:1.

66 Wecht and Rago 2006:5.

67 Wecht and Rago 2006:5.

68 Wecht and Rago 2006:5-6.

69 Wecht and Rago 2006:5-6.

70 Wecht and Rago 2006:7; Duncan 2002:784.

71 Wecht and Rago 2006:7.

seventeenth century,[72] as well as the development of Hohfeldian jurisprudence[73] in the early twentieth century.[74]

By the seventeenth century, great scientific contributions by, amongst others, Copernicus, Galileo, Newton, and Boyle affected the way the world was viewed and what methods were most appropriate for finding the truth[75] and, specifically, altered the thought processes of the entire literate English society, including English jurists.[76] In fact, Shapiro[77] suggests that legal academics and members of the bar at this point in time not only engrossed themselves in this new science, but viewed science and law as very much compatible, drawing from the same pool of thought.

It was during this time, the 1600's England, that the professions of law and science simultaneously arrived at the same two great scholarly paradigms. The first was the compulsion for systematic arrangement and presentation of existing information into scientifically organised groups. The second, and most relevant to the current research, was the explosive proliferation of concern by both the spheres of science and

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72 Duncan 2002:784.

73 Hohfeldian jurisprudence refers to a system consisting of eight fundamental legal relationships identified by Wesley Newcomb Hohfeld in the early 1900's in an effort to simplify legal thinking. These relations were grouped into those that cannot exist together (opposites), and those that must co-exist (correlatives) – Andrews 1983:471; Hohfeld 1913:30. The Hohfeldian view includes the philosophy that these legal relations are interconnected in a system of cause and effect – Wecht and Rago 2006:7.

74 Wecht and Rago 2006:7.

75 Shapiro 1969:728-729.

76 Shapiro 1969:728-729.

77 1969:729.

law, for *probability of truth*, not the certainty of it.[78] In science and in law, the search for absolute truth was replaced by probabilistic hypotheses and assessment of evidence to achieve truth beyond a reasonable doubt.[79] Robert Boyle, one of the most renowned scientific minds of his time, described probability in assessing witness evidence as follows:

> For though the testimony of a single witness shall not suffice to prove the accused party guilty of murder; yet the testimony of two witnesses though but of equal credit, that is, a second testimony added to the first though of itself never a whit more credible than the former, shall ordinarily suffice to prove a man guilty; because it is thought reasonable to suppose, that though each testimony single be but probable, yet a concurrence of such probabilities (which ought in reason to be attributed to the truth of what they jointly tend to prove) may well amount to a moral certainty, i.e., such a certainty as may warrant the judge to proceed to the sentence of death against the indicted party.[80]

Scientists adjusted their approach to the truth. Scientific method was widely reconsidered and a movement away from deductive scientific method was noted.[81] Sir Francis Bacon,[82] whose contributions to both science and law are not often adequately commented upon,[83] contended that the pursuit of proper scientific method would ultimately

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78 Shapiro 1969:730.

79 Shapiro 1969:729-730.

80 Boyle R 1772 *Some considerations about the reconcilableness of reason and religion,* 4 Works 182 in Shapiro 1969:753.

81 Shapiro 1969:732.

82 Bacon was a leading figure in natural philosophy and lawyer in the time between the Renaissance and early modern era, and generally thought to be the father of inductive reasoning. He made vital contributions to the area of scientific methodology and his contributions to legal thinking were closely connected to his scientific views – Stanford Encyclopedia of Philosophy 2003. http://plato.stanford.edu/entries/francis-bacon/. Accessed on 06/02/2012; Shapiro 1969:736.

83 Shapiro 1969:736.

lead to the generation of knowledge *for use in society*.[84] This includes seeking the truth beyond reasonable doubt in law.

Bacon held the opinion that law should obey the rules of nature and reason, and for him, the relationship between law and natural science was by no means coincidental. He was adamant that the appropriate method of gaining knowledge was "...the same for all areas of inquiry and that law was simply one branch of knowledge."[85]

Many jurists followed Sir Bacon's example. The Royal Society of London,[86] a society of the world's most renowned scientists (and today the oldest scientific academy in continuous existence) was partly founded by lawyers and judges who fostered great interests in science.[87] Even well into the eighteenth century membership of the Society was significantly occupied by legal practitioners.[88]

The proximity of science and law has decreased as modernity in thought demanded not only greater specialisation in the profession and its subdivisions, but also a greater autonomy of legal thought and reasoning. Practitioners, scholars and authors[89] held the view that legal reasoning is, and should remain, separate from scientific reasoning.[90]

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84 Shapiro 1969:732.

85 Shapiro 1969:737.

86 The Royal Society 2012. http://royalsociety.org/. Accessed on 07/02/2012.

87 Shapiro 1969:738.

88 Shapiro 1969:738.

89 For example, H.L.A. Hart as is found in *Causation in the Law* by H.L.A. Hart and A. Honoré – Shapiro 1969:727.

90 Shapiro 1969:727.

This disconnect between science and law has cultivated some tension in the struggle between analytical jurisprudence on the one hand, and sociological jurists and judicial realists on the other.[91]

Shapiro[92] expertly formulates the issue:

> That debate very frequently comes down to the question of whether law is a separable intellectual enterprise or a facet of general social thought in a society permeated by science.

The demise of Newtonian predictability and order was met with the arrival of the great Einsteinian epoch of relativity and unpredictability, and along with it, the burgeoning societal decay and subsequent multiplication and complication of legal rules and regulations.[93] In simpler terms, as science became more intricate, so did the law.

2.2 THE DEVELOPMENT OF INDIVIDUAL TRADITIONAL FORENSIC DISCIPLINES

2.2.1 Introduction

No discipline or profession is prevented from participating in the process of crime investigation or the arena of criminal justice. Along with the already discussed historical relationship between law and science, a plethora of varying scientific disciplines have been employed

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91 Shapiro 1969:727.

92 1969:727.

93 Wecht and Rago 2006:8.

in specifically the criminal justice milieu. Fingerprint evidence, for example, was identified and has been used since earlier than 700 B.C.

In 44 B.C., a Roman physician, Antistius, used his knowledge of medicine to offer perhaps one of the first recorded forensic autopsy reports by declaring that of Julius Caesar's 23 stab wounds, only one dealt the fatal blow.[94]

In the 1000's A.D., Quintilian, an attorney in the ancient Roman forums, employed bloodstain evidence to prove the innocence of a blind man charged with his mother's murder.[95]

Although the term 'forensic' was officially recognised and recorded in 1659, little consensus exists amongst authors and academics regarding the exact birth of the concept of forensic science. Experts on the subject, however, mostly agree that it originated from sixth century China, where the first known reference to forensic medicine was discovered in the publication, *Ming Yuen Shih Lu*.[96]

Since the publication of this ancient Chinese text, the concept of forensic medicine enjoyed continuous progression, with numerous scripts being published and formal lectures being presented across Western Europe by mid-seventeenth century.[97]

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94 All-about-forensic-science.com 2007. http://www.all-about-forensic-science.com/history_of_forensic_science.html. Accessed on 15/01/2010; American College of Forensic Examiners *s.a.* http://historyofforensics.com/. Accessed on 9/02/2012; Meyer 1999:2; Pyrek 2007:7.

95 Inman and Rudin 2001:329.

96 National Museum of Crime and Punishment 2008. http://www.crimemuseum.org/library/forensics/origins.html. Accessed on 9/02/2012.

97 Pyrek 2007:7.

Since the dawn of the age of forensic science and as developments and specialisation in the forensic science disciplines increased, historians have progressively improved the documenting of the applications and usefulness of the individual forensic disciplines.

The mid-nineteenth century saw great technological advances in modern forensic sciences and their practical application.[98] These advances, however, were not uniform throughout the world or throughout the range of disciplines. Forensic pathology, for example, did not only develop rapidly in this era, but also in the one preceding it.[99]

The concept of criminalistics[100] was also born in the nineteenth century when Austrian judge, Hans Gross, managed to provide the system of chaotic crime detection with a systematic and scientific foundation.[101] He described how physics, chemistry, fingerprinting and many other natural and applied sciences could be utilised to solve crime.[102] Since then, criminalistics have undergone a variety of descriptions,[103] some authors favouring the idea of criminalistics being the application of only the natural sciences[104] to criminal investigation, while others prefer a

98 Eckert 1997:11.

99 Eckert 1997:11.

100 Criminalistics refer to the application of forensic science to criminal matters – Fisher *et al.* 2009:3. In-depth discussions of this term will follow in later chapters.

101 Van der Westhuizen 1996:9.

102 Pyrek 2007:8.

103 Van der Westhuizen 1996:8.

104 Reference to 'physical sciences' would include *inter alia* physics, mathematics, biology, and so forth

broader definition to include a variety of policing techniques.[105] For this reason, individual forensic sciences based on the natural sciences, for example DNA[106] profiling, as well as forensic sciences specifically developed for use in criminal investigations, for example fingerprint analysis, will be discussed in the present study. For purposes of the historical study, however, only certain traditional forensic sciences will be discussed, namely fingerprint evidence, bloodstain pattern analysis and trace evidence.

2.2.2 Identification sciences (*Who?*[107])

2.2.2.1 *Fingerprint evidence*

Fingerprints are as old as mankind itself and its importance have been appreciated long before these unique human features were employed in law enforcement. In the Neolithic time around 7000 B.C., thumbprints of bricklayers were deposited on bricks in ancient Jericho.[108] From 1955 to 1913 B.C., fingerprints were used to seal contracts in ancient Babylon.[109] Kia Kung-Yen, a Chinese historian in ancient times, revealed that China too enjoyed the advantages of using fingerprints in

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105 Van der Westhuizen 1996:9. A thorough discussion of the term 'criminalistics' will follow in subsequent chapters.

106 Deoxyribunucleic acid.

107 '*The who'* question refers to the identification (or rather, the individualisation) of *who* the person was who caused the criminal event to occur. Fingerprinting, handwriting, hair analyses and DNA profiling are just some of the scientific investigations launched to answer '*the who'* question – Shelton 2011:1.

108 Hawthorne 2009:4.

109 Hawthorne 2009:4.

contracts and legal documents from the time 600 to 700 A.D.[110] At this point in history, the individualising[111] features of fingerprints were not yet understood.

It was during the 1680's that scientists made giant leaps in comprehending the scientific foundations of fingerprints. Physicians like Nehemiah Grew and Marcello Malpighi, researched and commented upon the ridge formations on fingertips. In 1788, German scientist, J.C.A. Mayer, became the pioneer to suggest that the ridge formations on fingertips was unique to every individual and never repeated in another.[112] Unfortunately, despite the immense value of these findings, they were not appreciated in the eighteenth and early nineteenth centuries.[113]

Henry Faulds, medical missionary from Scotland, was the very first to identify fingerprints from a crime scene in 1880, and the idea was born that fingerprints may be employed in criminal investigation.[114] After being called to a crime scene where a thief had struck, Faulds identified the "clear sooty impression" of a fingerprint the thief had left at the scene, and after careful examination could exonerate the man suspected by the police.[115] Faulds later attempted to entice Scotland

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110 Hawthorne 2009:4.

111 Individualisation refers, broadly, to classifying a piece of evidence as coming from a particular known source, to the exclusion of all others, for example, fingerprints or DNA evidence belonging to a specific person – Inman and Rudin 2001:114-151. This concept will be discussed in greater detail in subsequent chapters.

112 Hawthorne 2009:5.

113 Morton 2001:8.

114 Morton 2001:19.

115 Morton 2001:19.

Yard with the advantages of fingerprinting, but without success. Dejected, he continued his studies privately.[116]

Around 1882, Alphonse Bertillon, French criminalist and clerk in the Paris Police Identification Bureau, introduced the world to modern means of identification in criminal investigation through, *inter alia*, fingerprinting comparisons.[117]

Four years later, in 1892, Sir Francis Galton was responsible for the first scientific publication on fingerprints.[118] It was Galton who developed a scientific method of classifying fingerprint patterns into arches, loops, and whorls.[119] This classification is still used today, 120 year later.

In addition to this, Galton was the father of other very important aspects regarding fingerprints. He designed a method for lifting prints from surfaces and described ridge characteristics found in fingerprints,[120] an aspect vital in performing fingerprint comparisons.[121] Galton's work provided the forensic science community with a lasting legacy. In honour of his contributions, "Galton details", as it is known today, refer to these ridge characteristics present in each person's fingerprints.[122]

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116 Morton 2001:21.

117 Hawthorne 2009:6; Morton 2001:9.

118 Hawthorne 2009:7. In this publication, *Finger Prints*, Galton submitted that an individual's fingerprints are permanent and remain unchanged throughout his life.

119 Hawthorne 2009:7.

120 Hawthorne 2009:7.

121 An in-depth examination of the anatomy of fingerprint evidence will follow in later chapters.

122 Hawthorne 2009:7.

Trial applications of fingerprint comparison results were not lost on the police fraternity. In Argentina around 1893, a police inspector discovered bloody fingerprints on a crime scene where two young children had been murdered. These fingerprints were compared with those of all persons of interest in the case, and, in contrast to expectations and suspicions, the mother of the two victims emerged as the guilty culprit.[123] Such a discovery would have been impossible without the advantage of fingerprint analysis of the crime.

South Africa followed suit in its recognition of the value of fingerprint impression evidence and established a fingerprinting division in the South African Police in 1900.[124] This office was so successful that by 1925, several fingerprinting offices had been set up across the country.[125] In line with the tendency of unification of both the South African colonies, as well as the police service in 1910, the fingerprint offices were unified under the South African Criminal Bureau,[126] which expanded its expertise by also appointing experts in *inter alia* forensic photography and handwriting analysis.[127]

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123 Hawthorne 2009:9.

124 South African History Online (SAHO) 2012. http://www.sahistory.org.za/organisations/south-african-police-sap. Accessed on 21/02/2012.
It is interesting to note that the South African Police Service as it exists today was largely disbanded in 1900 due to the involvement of its members in the Anglo-Boer War raging at the time. Despite this, police authorities in the then Natal colony had the foresight to establish a fingerprint office in Pietermaritzburg.

125 South African History Online (SAHO) 2012. http://www.sahistory.org.za/organisations/south-african-police-sap. Accessed on 21/02/2012.

126 Today, this division in the SAPS is known as the Criminal Record Centre.

127 South African History Online (SAHO) 2012. http://www.sahistory.org.za/organisations/south-african-police-sap. Accessed on 21/02/2012.

Following Henry Faulds' folded attempt to enthuse Scotland Yard into embracing fingerprinting as investigative tool, Sir Edward Henry, in 1901, succeeded where Faulds had failed. He introduced Scotland Yard to fingerprinting as tool in criminal identification and made first official use of fingerprints for this purpose. Thanks in large part to his enterprise, manual fingerprint systems have been developed and implemented, not only in the United Kingdom, but also in many other countries.[128]

In the meantime, Alphonse Bertillon continued with his work in fingerprint identification and in 1902, he participated in a high profile murder case in Paris, France. Fingerprints were discovered on the crime scene where the deceased victim was found and these prints were sent to Bertillon for comparison with those in the fingerprinting database he managed to accumulate over many years. Bertillon's report read:

> As this search was conducted with the greatest care it led to the discovery of a record card concerning one Henri Leon Scheffer, age 26, measured last March 9 as he was charged with theft and swindle, and whose fingerprints match remarkably those discovered at the crime scene.[129]

Scheffer was arrested and convicted of the murder the following year.[130] Rationale for the admission of fingerprint evidence in England came in 1909, when the English Court of Criminal Appeal accepted the testimony of a fingerprint expert in a case of burglary as the sole ground of identification.[131]

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128 Hawthorne 2009:7.

129 Hawthorne 2009:10.

130 Hawthorne 2009:10.

131 *In re: Castleton* (1910) 3 Cr.App.R. 74.

The first American criminal court case[132] in which the admission of fingerprinting evidence was endorsed, was heard in Illinois in 1911.[133] It is interesting to note that during this trial no objections were submitted regarding the accuracy or merits of the novel fingerprint evidence. The court's judgment also does not reflect on the basis of expertise of the expert witnesses who testified on the fingerprint evidence and discusses no scientific principles on which the witnesses based their testimony.[134] Instead, objections on its admissibility were fervently offered but ultimately rejected, and the justification for fingerprint admissibility was finally established in the United States.[135] It is also in this case that fingerprint impression evidence, its classification and identification, were identified as a 'science',[136] reaffirming its status as prodigal law enforcement tool of the time.

Canada saw its first conviction based on fingerprint evidence in 1914.[137] Then, in 1924, the United States of America became entrenched in its support of fingerprint impression evidence. The Federal Bureau of Investigation (FBI) founded an identification division and imported fingerprint files from police precincts from across America. In 1933, the

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132 *People v Jennings,* 96 N.E. 1077, 1083 (III. 1911). This was a murder case in which the accused person's fingerprints were discovered in wet paint on the peripheral crime scene.

133 Epstein 2002:605.

134 Saks 1998:1101-1102.

135 *People v Jennings,* 96 N.E. 1077, 1083 (III. 1911):546 and 550; Saks 1998:1101.

136 *People v Jennings,* 96 N.E. 1077, 1083 (III. 1911):550; Epstein 2002:605. This statement of the scientific status of fingerprint evidence has since received global support – Epstein 2002: 605.

137 Hawthorne 2009:9.

FBI established a latent fingerprint division in which fingerprint examinations are conducted on an individual basis.[138]

Since the mid 1920's the FBI has amassed the largest store of fingerprints in the world.[139] This achievement was no doubt facilitated by the introduction of the Automated Fingerprint Identification System (AFIS) in 1977.[140] This pioneering scheme computerised the entire fingerprinting process and individualisation in criminal investigations by means of fingerprint comparisons reached a massive scale.

Eventually, automated fingerprinting identification systems developed the world over and the arduous task of filing, searching and comparing fingerprints were greatly accelerated and are now performed in minutes.[141] With the dawn of the twenty-first century, fingerprinting have become one of the most efficient tools in identifications in criminal investigations and the speed and accuracy of automated fingerprinting systems across the world have increased dramatically.[142]

In 2011, the Council for Scientific and Industrial Research (CSIR) in South Africa released an eagerly anticipated media report confirming that a structural fingerprint classifier had been designed that can

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138 Hawthorne 2009:8.

139 Hawthorne 2009:8.

140 ForensicDNA.com 2002. http://www.forensicdna.com/Timeline020702.pdf. Accessed on 1/05/2011.

141 Hawthorne 2009:8-9. The F.B.I. upgraded its automated fingerprint database in 1999. The Integrated Automated Fingerprint Identification System (IAFIS) permits paperless submission, storage and examination of all fingerprint samples in the national database, retained at the F.B.I. – ForensicDNA.com 2002. http://www.forensicdna.com/Timeline020702.pdf. Accessed on 1/05/2011.

142 Hawthorne 2009:9.

successfully and accurately classify fingerprints with partial information only.[143] It is expected that this ground-breaking technology will achieve great progress in declining the great numbers of backlogged cases awaiting fingerprint analysis in South Africa,[144] and holds great benefit for law enforcement globally.

2.2.3 Bloodstain pattern evidence (*How, What?*[145])

Some legal practitioners and criminal investigators err in their belief that bloodstain pattern analysis is a new form of medico-legal investigation.[146] As the following discussion aspires to prove, the concept of observing blood on a crime scene to understand the dynamics of a criminal event, is by no means a novel one.

Since time immemorial the presence of blood on a scene of death has been considered proof of criminal treachery.[147] When Abel was slain by his brother, it was blood that betrayed Cain's guilt.

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143 Council for Scientific and Industrial Research 2011. http://ntww1.csir.co.za/plsql/ptl0002/PTL0002_PGE013_MEDIA_REL?MEDIA_RELEASE_NO=7524479. Accessed on 21/02/2012.

144 DefenceWeb 2011. http://www.defenceweb.co.za/index.php?option=com_content&view=article&id= 19810:sa-achieves-fingerprint-recognition-first&catid=90:science-a-technology&Itemid=204. Accessed on 21/02/2012.

145 *'The what'* question refers to the events that occurred during the offence. Forensic pathology is traditionally the scientific process best known for producing answers regarding this question. Bloodstain pattern analysis has played an increasingly important role in reconstructing a crime and obtaining information regarding the circumstances of a criminal event – Bevel and Gardner 2002:3.

146 Bevel and Gardner 2002:4. Reference is made in this source to the erroneous belief offered by Craig Lewis in *Blood Evidence* in 1992: "The science of bloodstain pattern analysis, a field in which the only textbook in existence was written by MacDonell, was little known" – Bevel and Gardner 2002:4.

147 Bevel and Gardner 2002:5.

> Then the Lord said to Cain, where is your brother Abel? And he replied, I don't know! Am I my brother's guardian?
> But the Lord said, what have you done? The voice of your brother's blood is crying out to me from the ground![148]

Early Germanic law, too, saw publications underlining the importance of bloodstain evidence. During the period 1220 to 1235, proof in support of innocence for acting against an offender 'caught in the act' required proof of criminality on the part of the offender. This proof of criminality, for instance, included a criminal caught red-handed, that is, caught with blood on his hands.[149]

The potential of bloodstain evidence was not lost on literary greats. William Shakespeare[150] and Sir Arthur Conan Doyle[151] created characters in some of their most renowned works that understood and appreciated to insinuations of bloody evidence.

The nineteenth century was saturated with developments in medicine and pathology, specifically the chemistry and physiology of blood.[152] During the period 1850 and 1940, medical scholars and pathologists started noticing blood spatter patterns on crime scenes and included

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148 Holy Bible, Genesis 4:9-10.

149 Bevel and Gardner 2002:5. It is from this practice that the saying 'caught red-handed' emanated. This piece of tribal code was originally described in the *Sachsenspeigel*, a document representing records of Saxon custom – Bevel and Gardner 2002:5. Although this does not amount to legitimately scientific bloodstain pattern analysis as it is practiced today, it certainly supports the idea of blood evidence as criminal investigative tool.

150 In *Macbeth*, Act II, Scene II, the main character speaks: "What hands are here! Ha! they pluck out mine eyes. Will a great Neptune's ocean wash this blood Clean from my hand?"

151 In *A Study in Scarlet*, Doyle introduces us to the blood spatter examining Sherlock Holmes, one of the greatest literary characters of our time.

152 MacDonell 1992:3-8; Bevel and Gardner 2002:7. In the treatise *Elements of Medical Jurisprudence* by Beck and Beck, the authors identify the main authorities in the arena of blood chemistry as J.B Lassaigne, Jean-Baptiste Chevalier and Mathieu Orfila, Spanish-born, French physician.

these observations in their reports and publications. In 1863, Beck and Beck,[153] two American physicians, reported on the observations of several medical examiners of a scene of death where a young woman was found with her throat cut.[154] Descriptions of the deceased woman's hand, "only spotted with blood", were made, and a nearby wall was described as having "many spots of blood, apparently the sprinkling from a wounded artery."[155] These, together with additional observations regarding bloodstains on the victim's feet, her wound anatomy and the position of the suspected weapons, led investigators to eventually arrive at the conclusion that, contrary to initial suspicions, she did not commit suicide, but was murdered.[156] This was one of the very first texts to document the use of bloodstains and spatter in drawing inferences on what occurred during the criminal incident.

Physicians and pathologists from across the world have researched and commented upon the features of bloodstains and information to be inferred from it. In 1871, Schmidt[157] published an essay on the external physical characteristics of bloodstains and included in his discussions information on how stains may be destroyed, the colour of bloodspots, its origin, and other aspects relating to serological stains.

153 1863:134-139.

154 1863:134.

155 Beck and Beck 1863:134.

156 Beck and Beck 1863:134-139.

157 MacDonell 1992:6.

English Professor, Charles M. Tidy, authored *Legal Medicine* in 1882. In this comprehensive work Tidy provides an advanced coverage of stains in general and their value to criminal prosecutions:

> ...few things hold so important a place as, or involve investigations of greater nicety, than determining the precise nature of various spots or stains found on fabrics, instruments...[158]

Tidy[159] suggests, with specific reference to bloodstains, proper methods of observing and recording stains and informs the reader of the physical characteristics of blood spots, including the features of ageing bloodstains and spots.

Hans Gross, generally considered to be the father of criminalistics,[160] supplemented the existing literature on bloodstain pattern analysis with his work, *Handbuch für Untersuchungs* in 1893.[161]

But it was Viennese Eduard Piotrowski who, in 1895, produced a watershed treaty on bloodstain pattern analysis.[162] Dr. Piotrowski designed specific scientific experiments in the study of blood, its dynamics and characteristics, and applied proper science to his observations of bloodstains in a manner unequalled by preceding

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158 Tidy 1882:184.

159 Tidy 1882:184-5.

160 Inman and Rudin 2001:10.

161 MacDonell 1992:8.

162 *Uber Entstehung, Form, Richtung und Ausbreitung der Blutspuren nach Hiebwunden des Kopfes (Concerning origin, shape, direction, and distribution of bloodstains following blow injuries to the head)* – Bevel and Gardner 2002:8; James *et al* 2005:3. This important paper has been translated to English thanks to the efforts of another great contributor to the science of bloodstain pattern interpretation, Dr Herbert MacDonell of New York, U.S.A. – James *et al* 2005:3.

researchers.[163] He realised the significance of the dynamic nature of blood evidence and as a result of this cognisance and his careful observation of the results of his experiments, he clarified issues such as radiating blood spatter, the causation of cast-off stains, and stain directionality.[164] Dr. Piotrowski submitted that:

> It is of the highest importance to the field of forensic medicine to give the fullest attention to bloodstains found at the scene of a crime because they can throw light on a murder and provide an explanation for the essential moments of the incident.[165]

Since the pioneering works of Dr. Piotrowski, many researchers have issued works on the intricacies of bloodstain pattern analysis. Dr. W.F. Hesselink, for instance, published his work in 1931 on the features and implications of dried bloodstains on crime scenes.[166]

The modern era of bloodstain pattern analysis[167] saw the contributions of two great minds in science. The first of these, Dr. Paul Leland Kirk,[168] offered comprehensive descriptions on the application of bloodstain pattern analysis to criminal investigations in his book, *Crime Investigation*, published in 1953.[169] It should be borne in mind that up to this point in time, inferences based on bloodstain pattern analysis was

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163 Bevel and Gardner 2002:8; MacDonell 1992:9. Piotrowski's work, though incredibly valuable to the development and efficacy of bloodstain pattern analysis, is cloaked in controversy. He is known to have beaten small animals, for example rabbits, in his search for understanding of the behaviour of blood spatter – MacDonell 1992:9.

164 Bevel and Gardner 2002:8.

165 James *et al* 2005:3-4.

166 Bevel and Gardner 2002:11.

167 Post-1940 era.

168 Dr. Kirk was an American professor of criminalistics and biochemistry who also practically consulted with law enforcement organisations in the mid-twentieth century.

169 Bevel and Gardner 2002:14.

mostly contained in pathology or medical examiner reports. Dr. Kirk was neither a forensic pathologist, nor medical examiner and dedicated his focus primarily to the science of bloodstain pattern analysis.[170] In 1954, he filed an affidavit in the defining criminal court case in the United States of America, *State of Ohio v Samuel H. Sheppard,*[171] in which he inferred the relative positions of the perpetrator and the victim at the time of the deadly assault by interpreting the bloodstain evidence on the scene.[172] Although his reconstruction of the events based on the bloodstains on the crime scene suffered some criticism,[173] rationale for the admission of blood evidence was solidified.

Classification of bloodstains based on their mechanism of creation, as well as the importance of the surface on which a particular stain has been formed, were two of the most essential concepts addressed by Dr. Jozef Radziki around 1960 in *Slady Krwi w Praktyce Sledczej (Bloodstain prints in the practice of technology).*[174]

In 1970, the blood evidence domain saw the rise of Herbert MacDonell, arguably the most influential of all researchers in bloodstain pattern analysis and considered by many to be the father of modern bloodstain pattern interpretation.[175] His publications reflect in-depth, methodical

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170 Bevel and Gardner 2002:14.

171 Court of Common Pleas, Criminal Branch, No. 64571, 26 April 1955.

172 James *et al* 2005:4.

173 Bevel and Gardner opines that Dr. Kirk incorporated a great deal of subjective information into his affidavit, making his reconstruction of events difficult to defend – Bevel and Gardner 2002:15.

174 Bevel and Gardner 2002:15.

175 Bevel and Gardner 2002:16.

and comprehensive research and have resulted in great advancements in the practice and science of bloodstain pattern interpretation. In addition to this, MacDonell has been the first to launch formal training courses in the interpretation of bloodstain evidence.[176]

2.2.4 Trace evidence (*How, What, Where?*[177])

Being a predominantly observational discipline, forensic trace evidence analysis enjoyed much of its development because of advances in microscopy.[178] In 1590, Zacharias Jansen conceived of the first compound microscope, which eventually led to the first truly detailed examinations of fingerprints.[179] Robert Hooke boasted with an improved version of the compound microscope in 1665,[180] while William Nichol created the first polarised microscope in 1828.[181]

With the invention of the comparison and electron microscopes in the early twentieth century, scientists were empowered to observe with tremendous detail the smallest of items, hair, fibres and other material for purposes of forensic comparison and identification.[182]

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176 James *et al* 2005:4.

177 These questions refer to investigators' aspirations to solve the problems of *where* the offence occurred, *how* the body (in the case of homicide investigation) got into the position it was discovered in, and *what* the source of the deposit of trace evidence was – Wecht and Rago 2006:324. The latter problem may lead to the identification of the offender, or at least his habitual surroundings.

178 Kiely 2001:95.

179 Owen 2000:12.

180 Owen 2000:12-13.

181 Inman and Rudin 2001:330.

182 Owen 2000:13-14, Eckert 1997:26.

The potential value that may be awarded to a criminal investigation by the examination of minute physical evidence and the information that may be inferred from such evidence, were advanced from a theory that underlies the very principle of forensic science. This theory, namely that it is impossible to come into contact with a location without changing it in some small way, either by adding something to it or removing something from it,[183] was formulated by Edmund Locard in 1920,[184] and is called the Locard Exchange Principle.[185]

Wecht and Rago[186] describe the Locard Exchange Principle as essentially entailing the transfer of evidential material from one person or object to another person or object. In this manner, scientists in Frankfurt, Germany, were able to examine evidence left at a murder scene in 1904, and match it to trace amounts of soil, minerals and powder on the suspect, who, when confronted with the evidence, pleaded guilty to a charge of murder.[187]

Edmund Locard himself participated in a watershed criminal case in which a woman was murdered in 1912, Lyon, France. Locard himself collected fingernail scrapings from the suspect. By means of thorough examination of the material he collected, Locard was able to match the

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183 Fisher 2000:26, 161. In the interests of conciseness this theory can also be formulated to read: 'every contact leaves a trace' – Platt 2003:88.

184 Frenchman Locard (1877 – 1966) studied both medicine and law and founded his own police laboratory when he was just 33 years old and dedicated his entire life to the application of science to criminal investigation – Platt 2003:88.

185 Wecht and Rago 2006:323.

186 2006:323.

187 Rogers 1992. http://web.mst.edu/~rogersda/forensic_geology/Geoforensics%20Case%20Histories.htm. Accessed on 05/03/2012.

composition of a pinkish dust from under the suspect's nails with the similarly coloured powder that the victim had used. This powder was prepared especially for her by her chemist, and thus comprised a unique composition, allowing for significant evidential value when discovered under the accused person's nails.[188]

The United States of America saw a defining case on fibre analysis in 1984 in the case of *Williams v State*.[189] In this case, the accused person was convicted on overwhelming trace evidence submitted to the court. Carpet fibres from the accused person's home, fibres from his bed linen, as well as hairs from his pet animals were found on all of several murdered young boys' bodies.[190]

It should be borne in mind that fibres are just one of many types of materials that fall under the umbrella of trace evidence. Hair analysis[191] and microscopic analysis of paint flakes, glass fibres, dust particles, plant material, and soil samples are just some of the plethora of materials that may be transferred between an offender, scene and victim.

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188 Rogers 1992. http://web.mst.edu/~rogersda/forensic_geology/Geoforensics%20Case%20Histories.htm. Accessed on 05/03/2012.

189 *Williams v State*, 251 Ga. 749, 312 S.E. 2d 40 (1984). Kiely calls this the "best-reasoned" fibre case in the United States – Kiely 2001:105.

190 *Williams v State*, 251 Ga. 749, 312 S.E. 2d 40 (1984); Platt 2003:92-93. Due to the complexity and intricate nature of the evidence in this case, details will be discussed in chapters to follow.

191 Hair analysis, for purposes of this study, refers to the process of examining and comparing the morphological features of hair shafts, and not to DNA analysis from DNA-containing material in hair. Where-ever reference is made to hair analysis within the context of DNA profiling, it will be clarified.

2.3 THE DEVELOPMENT OF EXPERT EVIDENCE AND SCIENTIFIC TESTIMONY IN THE CRIMINAL JUSTICE SYSTEM

2.3.1 Introduction

As far back as the sixth century A.D., the unique nature of experts giving testimony in criminal cases was recognised by the emperor Justinian, when he elevated medical doctors above the position of mere ordinary witnesses. He proclaimed physicians to be witnesses who offer "judgments" instead of the usual testimony.[192]

In the mid-sixteenth century England, Justice Saunders was ahead of his time in declaring:

> If matters arise in our law which concern other sciences or faculties, we commonly apply for the aid of that science or faculty which it concerns. Which is an honourable and commendable thing in our law. For thereby it appears that we do not despise all other sciences but our own, but we approve of them and encourage them as things worthy of commendation.[193]

Golan[194] suggests that ongoing developments in the English legal system from the late eighteenth century ultimately resulted in the idea of the modern expert witness as it is recognised today. Expert testimony is governed by rules of the law of evidence, and since English law of evidence serves as common law of the South African counterpart, these developments are directly relevant to the South African expert.[195]

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192 Tilstone *et al* 2006:3. See also Meintjes-Van der Walt 2001:13.

193 *Buckley v Rice Thomas* (1554) 1 Plowden 118: 124. Also referenced in Golan 2008:881; Meintjes-Van der Walt 2001:1.

194 2008:879.

195 Schwikkard and Van der Merwe 2009:2, 24-25.

2.3.2 History of scientific expert testimony in the English criminal justice process

Witnesses with special skill and knowledge were being called upon to assist trial courts in England from the sixteenth century onwards.[196] Unsurprisingly, it was also during this period that the admission of opinion evidence was delineated and confirmed.[197] But it was much later, by the end of the eighteenth century, when the expert witness, as it is recognised today in adversarial processes, was introduced.[198]

Golan[199] defines four vital developments in the use of expert witness testimony. The first of these developments relates to the expert's position in the courtroom and was a product of the Adversarial Revolution in the late eighteenth century England.[200] Although the necessity of experts in court had been recognised by that point, no formal or statutory procedures had been formulated to define their place or scope of function in criminal proceedings. This resulted in one of three procedural options being employed by court to obtain the expertise of these witnesses: firstly, the experts could be nominated as advisers whose advice the court would embrace or reject at will.[201] Secondly, experts could also be called as jurors in criminal cases and

196 Meintjes-Van der Walt 2001:33.

197 Meintjes-Van der Walt 2001:33-34.

198 Meintjes-Van der Walt 2001:34.

199 2008:879.

200 Golan 2008:879.

201 Golan 2008:882.

assess evidence from this perspective. The great benefit of this system was that experts enjoyed an immense degree of impartiality in their offering of expertise.[202]

An alternative to these options was that expert witnesses could be called by either of the parties to the case to provide testimony on their behalf. The predicament this caused was that these witnesses, providing court with their "expert" opinions, did not qualify for special status based on their special knowledge and skill and were therefore not legally distinguished from lay witnesses. Soon a situation developed where lay witnesses were also allowed to provide their opinions on matters of the case.[203]

The Adversarial Revolution introduced the infiltration of legal practitioners into the trial arena. Up to the late eighteenth century legal practitioners were not participants in criminal trials.[204] Proceedings were subject to the control of presiding officers who regulated the harvesting of evidence by directly conducting questioning of the parties and witnesses in a case.[205] It has been lamented that, although this procedure allowed for speed and simplicity, it was corrupted with hearsay evidence and opinion evidence by lay witnesses.[206] In addition to this, objections to testimony given were overruled and the issue

202 Golan 2008:882.

203 Golan 2008:882.

204 Golan 2008:883.

205 Golan 2008:883.

206 Golan 2008:883.

directed to considerations about the weight of the evidence, rather than making a judgment upon the admissibility of such testimony.[207]

Legal practitioners were allowed to trespass onto the court room battle ground by 1730.[208] Still prevented from addressing the court in formal argument, these lawyers at least facilitated witness examination and cross-examination, and greatly increased the frequency of objections regarding evidence admissibility, compelling presiding officers to consider evidence with greater circumspection, which ultimately lead to better deliberated decisions.[209]

These recurrent attacks on evidence admissibility by lawyers necessitated the birth of the hearsay and the opinion doctrines by the end of the eighteenth century.[210] While the hearsay doctrine regulated the provision of testimony based only on personal, direct observation, the opinion doctrine endowed expert witnesses with special permission to offer testimony based on expertise and knowledge.[211]

This occurrence did not come without its dilemmas. The impartiality with which experts were crowned in the court-appointed system disappeared into a mist of uncertainty as to how to guarantee reliability in expert testimony in an adversarial process in which two opposing parties

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207 Golan 2008:883.

208 Golan 2008:883-884.

209 Golan 2008:883-884.

210 Golan 2008:884.

211 Golan 2008:884.

become embroiled in a criminal trial.[212] This is not an unfamiliar problem today.

The second development during this time involved changing the nature of expert testimony in the wake of the Adversarial Revolution. A sadly neglected part of the historical study of the development of expert testimony, this era saw changes in what was considered expertise in criminal trials at that point in time.[213]

Up to the late eighteenth century, court experts were highly skilled professionals who were expected to comment on the facts at hand based on direct individual and empirical observations familiar to the expert's training and experience. These experts held theoretical explanations in contempt and much preferred testifying on own direct examinations and experiments.[214] Changes in scientific thought brought about a refocus of science to a more practical approach to scientific knowledge, enhancing scientific texts with experiments and debating on the possibilities offered by the laws of science.[215] Golan[216] refers to this new brand of expert as "proto-scientist":

> ...who functioned like a skilled professional but cogitated like a natural philosopher.

The admissibility of the testimony of this new generation of partisan expert witness was addressed in the case of *Folkes, Bart v Chadd and*

212 Golan 2008:885.

213 Golan 2008:879.

214 Golan 2008:886.

215 Golan 2008:879, 886-887.

216 2008:879.

Others.[217] In the court of first instance, the testimony of one of several experts called was rejected on the grounds that as mere theoretical explanations, it amounted to an opinion and not proper grounds for a verdict on facts.[218] The appeal judge, Lord Mansfield,[219] held the following in reference to the rejected opinion evidence:

> That opinion, however, is deduced from facts which are not disputed... His opinion, deduced from all these facts, is, that, mathematically speaking, the bank may contribute to the mischief, but not sensibly.... In matters of science no other witnesses can be called... I have myself received the opinion of Mr. Smeaton respecting mills, as a matter of science.[220]

In his decision, Lord Mansfield solidified the adversarial concept of calling partisan expert witnesses in an adversarial legal battle before a jury. Noted American jurist, John Henry Wigmore,[221] suggested that this decision created precedent for expert opinions to be submitted without the expert's personal involvement in, or knowledge about the facts of the case.[222] In addition to this, noted English jurist, Jeremy Bentham, opined that testimony in its entirety should be admitted into evidence and that it should be left to the presiding officer to attach probative value and weight to the admitted evidence.[223]

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217 (1782) 3 Doug 157, 99 Eng. Rep. 589.

218 *Folkes v Chadd* (1782) 3 Doug 157, 99 Eng Rep. 590. See also Golan 2008:887.

219 Lord Mansfield was Chief Justice of the Royal Court of King's Bench at the time of deciding this matter – Golan 2008:887.

220 *Folkes v Chadd* (1782) 3 Doug 157, 99 Eng Rep. 590. Also discussed in Golan 2008:897-898 and Rix 1999:71.

221 Wigmore played a formative role in the creation of rules of evidence in the United States of America and published *A Treatise on the Anglo-American System of Evidence* in 1904.

222 Golan 2008:887.

223 Meintjes-Van der Walt 2001:34-35.

The case of *Folkes v Chadd*[224] resulted in a plethora of experts from different disciplines being allowed to enter the witness box and offer their opinions. Scientific technology advanced at a staggering rate and men of science were needed to illuminate for the court the intricacies of scientific evidence by offering their theoretic knowledge and experimental results. The court was then enabled to apply this knowledge and hypotheses to the facts of the case.[225]

The adversarial nature of the criminal process, however, facilitated the growing number of partisan experts contradicting each other in their testimony.[226] This shrouded the experts themselves and their disciplines in a veil of doubt and disillusionment inevitably followed.[227] Clearly, a need evolved for regulations to monitor expert testimony for reliability.

The third noteworthy development in expert testimony in the English legal system related to the further expansion of scientific technology during the Industrial Revolution that also extended to the United States of America.[228] During the nineteenth century the expert became an even more essential part of proceedings, but also became more problematic.[229]

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224 *Folkes, Bart v Chadd and Others* (1782) 3 Doug 157, 99 Eng. Rep. 589.

225 Golan 2008:904-905.

226 Golan 2008:905-915.

227 Golan 2008:905-915.

228 Golan 2008:880.

229 Golan 2008:880.

Golan[230] describes the growing disenchantment with expert testimony in English criminal trials in the nineteenth century, competing with the mounting realisation that it would be imprudent to suggest that courts could do without expertise in the witness box. Scientists' opposing testimonies not only created uncertainty with legal decision-makers, but were also greatly perturbing to the scientific community, fearing the growing mistrust in scientific integrity.[231] According to Golan,[232] disagreements among expert witnesses were principally attributed to the inadequacy of the adversarial process in managing scientific expertise, but that some members of the scientific community gave recognition to the possibility that scientific opinions might legitimately differ but that these differences would be incomprehensible to a presiding officer.

Golan[233] describes the twentieth century as the period in which the fourth vital development took place that established expert testimony as it is known today. The growing professionalisation and dependence on science and scientific technology started compelling courts to regulate to a greater extent the admission of scientific evidence in courts in an attempt to prevent jury exposure to unreliable evidence.[234]

2.3.3 History of scientific expert testimony in the American criminal justice process

230 2008:911-913.

231 Golan 2008:912-913.

232 2008:913.

233 2008:880.

234 Golan 2008:880.

The proliferation of partisan expert testimony throughout the American legal process exploded with zeal in the same manner, and due to the same adversarial accelerant, as in the English system. The result was that, despite the differences in the legal systems and scientific communities of the two countries both suffered the same dilemmas regarding opposing partisan expert testimony.[235]

By 1870, the credibility of scientific experts had suffered to the extent that presiding officers were attaching a decreasing amount of probative value to expert evidence.[236] Like their English peers, the American scientific community was affronted by the attacks on scientific credibility and also aired their discontent with the adversarial nature of the criminal justice process.[237] It was clear, however, that juries needed to be protected from defective and confusing testimony, but it was less clear what rules would effectively prevent incompetent experts from giving evidence in trials.[238] The only available guideline was 800 years old and stipulated that expert witnesses must be:

> ...qualified to speak as experts who possess special training and experience in the subject in question.[239]

In a report published in the United States of America in 1870,[240] an attempt was made to describe the character of expert witnesses:

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235 Golan 2008:915.

236 Anonymous 1871:227-228. See also Golan 2008:916.

237 Golan 2008:916.

238 Golan 2008:917.

239 Golan 2008:917.

240 Anonymous 1871:227.

> ...it is the custom to call such persons as, from their special training and experience, may be deemed competent to instruct the court and jury in regard to those matters requisite to a just determination of the questions in issue... Hence arises the exception in the law of evidence, that skilled witnesses may state not only the general facts of the science, art, or trade, of which they profess to be masters, but are also allowed to give their opinions in evidence.[241]

Predictably, the article also makes mention of the difficulty in rendering judgments on evidential value where multiple experts vehemently express contrasting opinions in court cases and the resultant tendency of judges to rely on expert evidence less and less.[242] At the same time, however, the increasing importance of expert evidence in criminal trials is described:

> The assistance of such persons in the administration of justice is nevertheless as imperative as ever, since it is simply impossible for ordinary men to decide upon questions of abstruse and recondite learning or of technical skill without the aid of *experts*.[243]

The author offers an explanation for this phenomenon:

> It would seem, therefore, that the little esteem in which such evidence has come to be held is due rather to the method in which it is obtained, than to the nature of the evidence itself.[244]

The American legal system, like its English counterpart, was inadequately geared to discriminate between competent and incompetent expert witnesses, with the only guideline being that the witness must have specialised training and experience in the relevant

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241 Anonymous 1871:227.

242 Anonymous 1871:228. See also Golan 2008:916.

243 Anonymous 1871:228.

244 Anonymous 1871:228.

discipline.[245] All additional considerations of evidence admissibility were left to the discretion of the presiding officer.[246]

Evaluating an expert's qualifications in this time period was no easy task, as scientific qualifications in the nineteenth century was not as telling and well understood as it might be today. As a result, presiding officers in court proceedings allowed almost all offered evidence and left the evidential validation to cross-examination and jury consideration.[247]

A feature of the American justice system that disabled its capacity to judge scientific evidence as compared to its English equivalent, was the dominant role of the jury. In the English system, the presiding officer was allowed to enter the arena of the trial and examine the witnesses, thereby assisting the jury in its assessment of the evidence. Where cases relied on the submission of prominent scientific evidence, those cases were referred to courts without juries, in other words, where only the judge was exposed to the opinion evidence. The United States had no such advantages and relied heavily on lay juries in assessing evidence.[248]

The legislature in the United States of America offered some attempts in improving the situation.[249] One such attempt was to prevent expert

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245 Golan 2008:917.

246 Golan 2008:917.

247 Golan 2008:917.

248 Golan 2008:918.

249 See discussion in Golan 2008:919-920.

witnesses from offering an opinion on the ultimate factual issues of a case.[250] Unfortunately, the ultimate factual issue was often all an expert was called to testify to, leading to the exclusion of expert evidence where it was needed most.[251]

The 'hypothetical question' doctrine followed, which allowed experts to testify in broad terms whether a causative link existed between a cause and result. It was then left to the jury to decide on the truth. To achieve this, the doctrine endeavoured to pose hypothetical questions to the expert which he then answered and thus deliver his opinion on a matter. Including all the facts in a question resulted in agonizingly long questions, yet as soon as particular facts were selected to pose questions on, the expert delivered biased theories. Soon, this doctrine also fell out of favour.[252]

By the twentieth century the commotion surrounding expertise in the courtroom had reached its pinnacle.

> ...the admission of expert opinions did more than any other rule of procedure to turn trials into a state of legalized gambling.[253]

A failed attempt at reviving some aspects of the inquisitorial system[254] solidified an adversarial approach to expert acquisition. Attention then

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250 Golan 2008:921.

251 Golan 2008:921.

252 Golan 2008:921-922.

253 Statement made in the early 1920's by John H. Wigmore in the *Model Code of Evidence* published by the American Law Institute, widely considered to be the father of modern law of evidence in the United States of America – Meyer 1999:3.

254 Michigan State enacted legislation in 1905 that would empower courts to acquire their own specialists, along with each party choosing theirs. The Michigan Supreme Court declared

became directed towards improving the rules of admissibility of expert evidence, even though previous attempts were unsuccessful. The substitution of the individual specialist with scientists who belonged to a community of experts who shared common standards of scientific values, provided hope for the success of such rules through the ethical self-regulation of these professionals.[255]

During the early twentieth century courts in America relied on the "proxy of general acceptance" of the expert's particular discipline by laypersons in the marketplace, referred to as the 'marketplace test.'[256] If the expert in question could make a living selling his knowledge in the marketplace, thus if it had commercial value, then seemingly expertise existed.[257] The courts determined expertise by inquiring from the proposed expert whether he was a member of a profession that had generally gained acceptance in the marketplace.[258]

In 1923, an appeal court in the United States delivered a defining judgment that attempted to offer the first step towards a solution to the chronic problem of expert evidence admissibility.[259] In *Frye v United States,*[260] an appeal following criminal proceedings where the

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this provision unconstitutional, holding that court-appointed experts would likely impose on an accused person's right to a fair trial – Golan 2008:925-926.

255 Golan 2008:926.

256 Imwinkelried 2011:8-9.

257 Imwinkelried 2011:8.

258 Imwinkelried 2011:8. It has been argued that courts' rationale for using this test could have been the hypothesis that if knowledge was of value in the marketplace, where citizens spent their hard earned money, it would also be of value in the courtroom - Imwinkelried 2011:9.

259 Golan 2008:927.

260 (1923) 54 App. D.C. 46, 293 F. 1013, 34 A.L.R. 145.

admissibility of lie detector evidence was rejected, the Court of Appeals for the District of Columbia had to pioneer rules for the admission of scientific evidence. This could have been no easy task, as the traditional rules of evidence admissibility[261] did not properly justify the exclusion of the lie detector evidence.[262]

The court formulated a rule that redirected the assessment of evidence admissibility to the science behind scientific knowledge that was offered in testimony:

> ...courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained *general acceptance* in the particular field in which it belongs.[263] (Own emphasis)

This *general acceptance* test, also referred to as the *Frye* test, recognised the jury as the primary triers of fact, as well as each party's right to acquire its own specialists. What the judgment managed to change was judicial ability to regulate the evidence which the jury would be exposed to by assessing the expertise rather than only the expert.[264] Merely being a specialist in a specific sphere of science no longer guaranteed admissibility of testimony.

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261 The traditional rules applicable to all kinds of evidence, included: "logical relevancy" of the specific evidence, the extent to which the evidence would assist the trier of fact, as well as the qualifications of the witness – Golan 2008:927-928.

262 In this case, the expert that testified to the reliability of the lie detector test was more than qualified to offer his opinion on the matter of questioning; the evidence would have clearly assisted the court in reaching a decision, and was undoubtedly relevant to proceedings – Golan 2008:928.

263 *Frye v United States* (1923) 54 App. D.C. 46, 293 F. 1013, 34 A.L.R. 145:1014. Also discussed in Golan 2008:928.

264 Golan 2008:929.

Although this precedent was only followed in a few court cases following the decision, it gained popularity and application in most American States after the conclusion of World War II.[265] By the 1950's the *Frye* test was the primary requirement for scientific evidence admissibility, and it was fiercely applied in the latter part of the twentieth century when a plethora of novel scientific disciplines, for example, voice prints, gunshot residue evidence, *etcetera*, was offered as evidence in criminal proceedings.[266]

The test, however, was not without its detractors. The enormous power afforded to the presiding officer in deciding which evidence would be submitted and which withheld from the juries, suffered great criticism. The test was also accused of being too vague, too narrow and subject to multiple interpretations.[267] Berger[268] describes additional causes for concern in using the *Frye* standard:

> ...it fails to explain how to determine what is the relevant field...it counts the noses of experts rather than looking at the validity of their opinions...it leads to self-validating experts who claim that their particular subspecialty is the relevant field.

In 1975 the American legislature promulgated the Federal Rules of Evidence.[269] This Act did not take the *Frye* test into consideration and formulated rules for expert evidence admissibility in the broadest sense possible:

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265 Golan 2008:930.

266 Golan 2008:930-931. The *Frye* test is still used in some states in the United States of America, for instance, New York, California, and Illinois – Berger 2005:S60; Pyrek 2007:343.

267 Golan 2008:931-932.

268 2005:S60.

269 Golan 2008:932.

> If scientific, technical, or other specialized knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of opinion or otherwise.[270]

This piece of legislation does not require scientific evidence to be generally accepted by the science community and also returned much of the weight of responsibility of assessing scientific evidence admissibility to the jury (as the trier of fact). Rule 702 represented a more relaxed threshold in scientific evidence reliability.[271] In addition, it provided a more flexible approach in allowing expertise in trials, but since it did not pertinently repeal the use of the *Frye* test, the latter remained popular as criterion in assessing specialist evidence.[272]

Conflicting expert opinions in the vastly expanding sphere of civil litigation in the 1970's America, again echoed the same English fears as to whether proper science was being admitted in courts. Golan[273] describes the concern existing at the time that American courts were being inundated with "junk science".[274]

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270 Federal Rules of Evidence of 1975: Rule 702. Discussed in Golan 2008:932; Baker 1992:328-330.

271 Baker 1992:329.

272 Golan 2008:933.

273 Golan 2008:933.

274 The term "junk science" was coined and popularised by Peter Huber in 1991 in his treatise: *Galileo's revenge: Junk science in the courtroom.* Although the term is still shrouded in mystery and controversy to a large extent and will be discussed in more detail at a later stage, it may be defined here as a description of scientific evidence that is either inherently unreliable, or that is being stretched well beyond its limitations – Bernstein 1996:124; Edmond and Mercer 1998. http://stlr.stanford.edu/STLR/Articles/98_STLR_3. Accessed on 20/06/2012.

A possible solution to this problem was offered in 1993 in the civil decision of *Daubert v Merrell Dow Pharmaceuticals, Inc*.[275] In this class action the court of first instance rejected the scientific evidence proffered by the applicant, as it did not, so the court held, comply with the requirements of peer-review and general acceptance in the scientific community, and did therefore not pass the *Frye* test for admissibility.[276] On appeal, the applicant argued that the Federal Rules of Evidence displaces the *Frye* test and that, in accordance with the statute, the jury should have evaluated the scientific evidence, not the judge. The Supreme Court, in carefully analysing the deficiencies in both the evidence legislation and the *Frye* test, offered what was dubbed at the time a breakthrough in courts' approach to scientific evidence. It established a bilateral test for admissibility, namely reliability and relevancy.[277] Testing for reliability requires the consideration of four non-exclusive pillars of expert evidence: testability, peer review and publication, standardisation and general acceptance.[278] For evidence to pass the relevancy test, it must deal with a matter in issue.[279]

Berger[280] argues that perhaps the most significant transformation brought about by the *Daubert* decision was the recasting of the role of

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275 (1993) 509 U.S. 579.

276 *Daubert v Merrel Dow Pharmaceuticals, Inc.* (1993) 509 U.S. 579:575. Discussed in Golan 2008:934-935.

277 Berger 2005:S60.

278 Golan 2008:934-935. The *Daubert* judgment will be discussed in some detail later in the present study.

279 Berger 2005:S60.

280 2005:S60.

the presiding officer in admissibility considerations. Although judges have always had the power to exclude improper evidence, many were only too happy to leave these matters to the juries. The *Daubert* decision compelled presiding officers to screen scientific evidence for reliability and relevance prior to being admitted.[281]

The *Daubert* decision has taken a definite step towards an exclusionary attitude to scientific evidence, almost inviting the presiding officer into the arena of a trial, monitoring the reliability of scientific evidence.[282] This decision solidified judicial scrutiny of scientific evidence and represents the most important tool for assuring the filtering of 'junk' science in American courts.[283] In recognition of the progress the *Daubert*-decision represented in quality control of expert evidence, the House of Commons in England suggested that rules for the filtering and admission of expert evidence be developed in line with the *Daubert*-decision.[284]

But as much optimism as the *Daubert*-judgment offered the science and law community in the late twentieth century, it still failed to curb all the dangers of unreliable science being submitted in criminal trials going into the twenty first century.[285]

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281 Berger 2005:S60.

282 Golan 2008:936.

283 Golan 2008:936.

284 House of Commons 2005:76. This suggestion is contained in a report following an official investigation into the practice of forensic science in England.

285 Berger 2005:S61-S62; Bernstein 2008:453; Shelton 2011:19.

2.3.4 History of scientific expert testimony in the South African criminal justice process

Since the English law of evidence serves as the common law of the South African law of evidence,[286] much of the concepts and rules regarding expert testimony in South Africa were inherited from the English system, including adherence to the adversarial system of criminal procedure.[287]

In 1822,[288] two years after the arrival of the British settlers in South Africa, and some sixteen years after the second British colonisation of the Cape, a commission of inquiry was finally established to investigate the local legal system as it existed at the time.[289] Proposals were submitted for the Anglicisation of the legal system, including the institution of English law of evidence as the foundation for the South African version.[290] Most of the submissions were adopted,[291] resulting in the gradual incorporation of English influence in the local justice system, including the full substitution of Roman-Dutch law with English law as foundation for the law of evidence.[292]

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286 Schwikkard 2009:2.

287 The jury system, although followed in England, was abolished in South Africa in 1969 through the promulgation of the Abolition of Juries Act 34 of 1969. Many features of a jury system, however, were retained in South African law of evidence, including many rules regarding the assessment of evidence – Schwikkard 2009:5.

288 Research regarding the employment of expert evidence in the era prior to the landing of the British is necessary.

289 Meintjes-Van der Walt 2001:20.

290 Meintjes-Van der Walt 2001:20.

291 These proposals were enclosed in the First Charter of Justice in 1827, which also directed a renovation of the system of courts as it existed at the time – Meintjes-Van der Walt 2001:20; Zeffertt *et al* 2003:5.

292 Meintjes-Van der Walt 2001:20.

Subsequent to these changes, the laws of criminal procedure and evidence were regulated by Ordinance 72 of 1830,[293] containing several evidentiary law rules applicable in early nineteenth century England and effectively replacing the inquisitorial system of criminal procedure with the English accusatorial system.[294]

By the time the Union of South Africa came into existence in 1910, the law of evidence in many colonial laws were all based on English law.[295] Since the four colonies existing in South Africa at the time, the Cape Colony, Natal, Transvaal and the Orange Free State, were now united on national and legislative planes, the rules of the law of evidence were entrenched in the Criminal Procedure and Evidence Act 31 of 1917.[296]

Act 31 of 1917 contained several references to the English law[297] and the uncertainty as to whether English decisions were still binding on South African courts was settled in the case of *Surmon v Surmon*[298] in 1926:

> ...the English law must be applied.[299]

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293 Meintjes-Van der Walt 2001:20; Zeffertt *et al* 2003:6; Schwikkard and Van der Merwe 2009:25.

294 Meintjes-Van der Walt 2001:21. It must be kept in mind that while the English law of evidence wholly replaced its South African counterpart, Roman-Dutch law remained the common law of South Africa – Meintjes-Van der Walt 2001:21.

295 Meintjes-Van der Walt 2001:22.

296 Meintjes-Van der Walt 2001:21-22; Schwikkard van Van der Merwe 2009:26.

297 For example, section 320 of the Act stipulated that certain considerations in the admissibility of evidence should follow the English law – Meintjes-Van der Walt 2001:22.

298 1926 AD 47. Also discussed in Meintjes-Van der Walt 2001:22; Zeffertt *et al* 2003:8. See also *R v Van Schalkwyk* 1938 AD 543.

299 *Surmon v Surmon* 1926 AD 47:48.

> The evidence was, therefore, inadmissible in the English courts, and should not have been received in the present case.[300]

In 1955, several amendment statutes were enacted which ultimately replaced Act 31 of 1917, including the Criminal Procedure Act 56 of 1955, in which multiple references were made once more to English law of evidence,[301] but in which the application of English legislation was also excluded where South African law made provision for a specific matter regarding law of evidence.[302]

In 1961, South Africa attained its independence from the British Commonwealth. The Criminal Procedure Amendment Act 92 of 1963 was enacted and ensured that from that point onwards, South Africa relied on its own statutory provisions regarding law of evidence as it stood on 30 May 1961.[303] English legislation would no longer be binding in the Republic.[304] Only where South African legislation and case law were silent on a matter would English decisions have persuasive effect.[305]

Today, the Criminal Procedure Act 51 of 1977 and the Civil Proceedings Evidence Act 25 of 1965 contain the vast majority of

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300 *Surmon v Surmon* 1926 AD 47:51.

301 Meintjes-Van der Walt 2001:22.

302 Schwikkard and Van der Merwe 2009:26.

303 Schwikkard and Van der Merwe 2009:26.

304 Meintjes-Van der Walt 2001:23. English legislation in force before and at the time the country became a republic would still be enforced.

305 Schwikkard and Van der Merwe 2009:25.

regulations and stipulations regarding criminal procedure and law of evidence in this country.[306]

The mid-twentieth century saw some maturation in the classification and admission of expert evidence into criminal trials.[307]

Zeffertt *et al*[308] bemoans the development and, ultimately, the co-existence of essentially two schools of thought on the admission of opinion evidence in South African courts. The first, generally referred to as "the traditional formulation", demands the exclusion of all opinion evidence based on irrelevance, as it is the duty of the court, and the court alone, to form opinions in trials.[309] May[310] properly defined this theory:

> The general rule is that the evidence of opinion or belief of a witness is irrelevant because it is the function of a court to draw inferences and form its opinion from facts; the witnesses give evidence as to the facts, the court forms its opinion from those facts.[311]

To further delineate the 'general rule', it becomes necessary to distinguish between 'fact' and 'inference'.[312] The witness may only attest

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306 Meintjes-Van der Walt 2001:23; Schwikkard and Van der Merwe 2009:24.

307 With reference to case law: *R v Cele* 1943 AD 123; *R v Theunissen* 1948 (4) SA 43 (C); *R v Mbongwe* 1954 (3) SA 1016 (T); R *v Vilbro and Another* 1957 (3) SA 223 (AD); *Ruto Flour Mills Ltd v Adelson* 1958 (4) SA 235 (T).

308 2003:289.

309 Zeffertt *et al* 2003:289.

310 Henry John May, author of *South African Cases and Statutes on Evidence.*

311 Zeffert *et al* 2003:289, taken from May's *South African Cases and Statutes on Evidence*. 3rd Ed. 1953 para 445 at 260.

312 Zeffertt *et al* 2003:289.

to observed facts, but should desist from drawing any inferences from those facts, a duty resting solely with the court.[313]

This theory, however, allows for a closed set of exceptions, the most importance of which is the allowance of expert opinions.[314] As with English and American evidence law, the admission of expert evidence, with specific reference to expert opinion, was not without controversy.[315] A failure to properly delineate the requirements for accurate expert testimony and confusion in the precise distinction between fact and inference allowed for contrasting judgments on the issue. In 1948, the Cape Provincial Division in the case of *Rex v Theunissen*[316] held that:

> ...an opinion, unaccompanied by the foundation upon which it is based, is again of no value to the judicial officer who has to make a finding on it.[317]

This decision rendered mandatory the duty on expert witnesses to inform the court of the factual basis from which their conclusions were taken. At first glance it would seem implausible that a court would allow admission of expert opinion without factual basis when the 'traditional formulation' of evidence admissibility places such high value on factual testimony.

In 1974, Hoexter J confirmed the necessity of factual foundations for expert opinions in the case of *S v Nangutuuala*:[318]

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313 Zeffertt *et al* 2003:289-290.

314 Interestingly, Du Toit *et al* do not regard the admission of expert testimony as an exception to the 'general rule', but rather a mere application of the principles of relevance.

315 Zeffertt *et al* 2003:290.

316 *Rex v Theunissen* 1948 (4) SA 43 (C).

317 *Rex v Theunissen* 1948 (4) SA 43 (C) at 46.

> Maar dit neem nie weg nie die welbekende stelling dat tensy die grondslag van 'n getuie se kundigheid gelê word – en gewoonweg word dit gedoen deur gepaste vrae aan die getuie self – hy nie as deskundige mag getuig nie.[319]

Despite this, the mid-twentieth century saw cases advocating the admissibility of expertise without delineating a factual foundation were being delivered across the country.[320] Then, in 1985, Cape Provincial Division in *S v Williams en Andere*[321] considered the decision in *Rex v Theunissen*[322] too inflexible and held that submissions regarding the facts from which expert inferences were drawn, are not essential to establishing admissibility, but rather influences the weight to be attached to such admitted inferential evidence.[323] In deciding admissibility of expert evidence the court held that if the expertise of the witness has been established, the evidence may be admitted:

> Al wat benodig is, is dat die hof tevrede moet wees dat hy die nodige kwalifikasies en bevoegdheid besit om die toets uit te voer en die resultate daarvan te interpreteer.[324]

Zeffertt *et al*[325] warned that, although this may be generally true, inability to provide a factual basis for an expert inference may remove

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318 1974 (2) SA 165 (SWA).

319 *S v Nangutuuala* 1974 (2) SA 165 (SWA):165. The principle verbalised here was supported and confirmed in *Coopers (South Africa) (Pty) Ltd v Deutsche Gesellschaft fűr Schädlingsbekämpfung Mbh* 1976 (3) SA 352 (A).

320 For example, *R v Cele* 1943 AD 123; *R v Mbongwe* 1954 (3) SA 1016 (T).

321 1985 (1) SA 750 (C).

322 1948 (4) SA 43 (C).

323 *S v Williams en Andere* 1985 (1) SA 750 (C) at 753.

324 *S v Williams en Andere* 1985 (1) SA 750 (C) at 753.

325 2003:304.

all probative value attached to such evidence and therefore render the evidence altogether irrelevant and consequently inadmissible. This theory is supported by Du Toit *et al.*[326]

Presently, expert witnesses are generally expected to furnish reasons for their decisions and foundational justifications for their opinions.[327]

Zeffertt *et al*[328] further argues that it is wholly unattainable to expect the law to prevent the admission of all opinion evidence. The best that the law can hope to achieve is to distinguish between proper and improper opinion evidence. To do this, one must ultimately investigate the reasons for admitting or rejecting expert opinions.[329]

The second school of thought that came into existence in the twentieth century South African law of evidence, is known as the *Vilbro*-approach, and attempts to address this issue of admitting or rejection of opinion evidence.[330] This theory dictates that opinion evidence is admissible if relevant.[331] In other words, evidence is admissible if it can provide the court material assistance in deciding on a matter beyond the court's

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326 Du Toit *et al* 2008:24-28A.

327 See discussion in Du Toit *et al* 2008:24-28A-30. See also: *S v Kotze* 1994 (2) SACR 214 (O) at 225; *Holtzhauzen v Roodt* 1997 (4) SA 766 SA (W); *S v Shackell* 2001 (4) SA 1 (SCA) at 12:para 27; *S v Engelbrecht* 2005 (2) SACR 41 (W) at 55:para 26.

328 2003:290.

329 Zeffertt *et al* 2003:290.

330 Zeffertt *et al* 2003:290-293. The name originated from the judgment in *R v Vilbro and Another* 1957 (3) SA 223 (AD), in which the presiding officer discussed the rules governing opinion rule at some length.

331 This principle is aligned with section 210 of the Criminal Procedure Act 51 of 1977, which stipulates that no evidence as to any fact, matter or thing shall be admissible which is irrelevant or immaterial and which cannot conduce to prove or disprove any point or fact at issue in criminal proceedings.

expertise. Should it not be in a position to assist the court on the facts in issue, it would be irrelevant and therefore inadmissible.[332] A witness is in a position to help the court substantially if that witness is better qualified than the court to render an opinion or draw an inference.[333] In the event that the court is as competent as the particular witness to form an opinion, the witness's opinion becomes irrelevant and consequently inadmissible.[334]

It therefore follows that expert testimony will be admissible, not simply by virtue of the exception on opinion evidence, but because the witness providing such testimony is expressly qualified or trained to render such evidence, or the witness can effortlessly describe the data upon which any inferences were based, and consequently allow the court to draw the inferences itself.[335]

This rule was embodied in the decision in *R v Herholdt and Others*[336] where the court held the following:

> Though the Crown is permitted to show the state of pecuniary accounts by a schedule or summary of an expert witness, such as a highly qualified and experienced accountant, the witness may not go further and proceed to air his opinion on issues which the Court has to decide.[337]

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332 Zeffertt *et al* 2003:290-291; Zeffert 1976:276.

333 Zeffertt *et al* 2003:291.

334 Zeffertt *et al* 2003:291.

335 Zeffertt *et al* 2003:291.

336 1956 (2) SA 714 (W).

337 Contained in the headnote of *R v Herholdt and Others* (1) 1956 (2) SA 714 (W), and discussed in *Ruto Flour Mills Ltd v Adelson* 1958 (4) SA 235 (T).

In 1958, however, in the case of *Ruto Flour Mills Ltd v Adelson*,[338] council for the defendant objected to the admission of the expert testimony on grounds that it amounts to an opinion that the court must decide, and that the expert therefore went beyond merely assisting the court in reaching its decision. Boshoff J overruled the objection,[339] stating that superfluous evidence is not excluded because it is unreliable, but merely because it is not needed. He further explained that the inferences of specialists are admitted whenever the specialist possesses greater skill than the court and can significantly assist the court in fact finding. The trial court can, in fact, request the expert to provide an answer to the very issue the court must decide.[340]

In 1976, the case *Menday v Protea Assurance Co Ltd*[341] brought some clarity to the approach of South African courts in assessing the admissibility of expert testimony.

> In essence the function of an expert is to assist the Court to reach a conclusion on matters on which the Court itself does not have the necessary knowledge to decide. It is not the mere opinion of the witness which is decisive but his ability to satisfy the Court that, because of his special skill, training and experience, the reasons for the opinion which he expresses are acceptable.[342]

The court in this case also warns against the dangers intrinsic in expert evidence.[343] By this time, it had become apparent that admissible expert

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338 1958 (4) All SA 198 (T).

339 *Ruto Flour Mills Ltd v Adelson (1)* 1958 (4) SA 235 (T) at 202.

340 Schwikkard and Van der Merwe 2009:93.

341 1976 (1) SA 565 (E).

342 Addleson J in *Menday v Protea Assurance Co Ltd* 1976 (1) SA 565 (E) at 569.

343 *Menday v Protea Assurance Co Ltd* 1976 (1) SA 565 (E) at 569.

testimony must be regarded with caution, as courts are generally unable to verify the reliability of an expert's conclusions once relevance and expertise have been established.[344] The problems regarding the reliability of expert evidence in England and the United States of America also reared its uncertain head in South African courts:

> Die Hof moet dikwels homself maar verlaat op die opinie van die deskundige. In die onderhawige geval sou, as die verdediging se deskundige nie die fout uitgewys het nie, dit na alle waarskynlikheid gevolg het dat die skuld van beskuldigde 2 oorweeg sou word op die basis dat sy vuurwapen, wat ook baie kort na die voorval in sy besit gevind is, op een of ander wyse op die toneel van misdaad moes gewees het. Dit kon 'n dramatiese verskil aan die uitslag van hierdie saak gemaak het. Ek kan nie anders as om my ergste ontsteltenis oor hierdie gebeure uit te spreek nie. Deskundige getuies behoort hul ondersoeke met die grootste mate van noukeurigheid en sorgsaamheid te verrig.[345]

In 2005, Satchwell J delineated the requirements for expert evidence admissibility in the case of *S v Engelbrecht*:[346]

> Firstly, the matter in respect of which the witness is called to give evidence should call for specialised skill and knowledge. Secondly, the witness must be a person with experience or skill to render him or her an expert in a particular subject. Thirdly, the guidance offered by the expert should be sufficiently relevant to the matter in issue to be determined by the Court. Fourth, the expertise of any witness should not be elevated to such heights that the Court's own capabilities and responsibilities are abrogated. Fifth, the opinion offered to the Court must be proved by admissible evidence, either facts within the personal knowledge of the expert or on the basis of facts proven by others. Sixth, the opinion of such a witness must not usurp the function of the Court.[347]

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344 *Menday v Protea Assurance Co Ltd* 1976 (1) SA 565 (E) at 569; and later reaffirmed in *William Grant & Sons Ltd and Another v Cape Wine & Distillers Ltd and Others* 1990 (3) SA 897 (C) at 912.

345 Cillié J in *S v Nthati en 'n Ander* 1997 (1) SACR 90 (O) at 94E-F. See also *S v Van der Vyver* [2008] JOL 21332 (C), where the state's seemingly overwhelming forensic evidence was rejected after expert testimony for the defence rendered it wholly implausible.

346 2005 (2) SACR 41 (W) at 54: paras 23-31.

347 *S v Engelbrecht* 2005 (2) SACR 41 (W) at 54-55: para 26.

By the early twenty-first century, South African legal scholars were set firmly on route to addressing the universal problem of preventing unreliable expert evidence from criminal courts.[348]

2.4 CONCLUSION

The symbiotic relationship that is revealed in studying the historical development of both law and science would suggest that employment of the one to find truth in the other is by no stretch of the imagination a novel or implausible concept. However, the immense proliferation of the complexities of science and scientific evidence brought with it some very relevant problems.

Initially, the problem with the use of science as a method of proof of facts in legal disputes, only involved the employment of experts as advisors to the court. As time progressed, concern grew over the quality and reliability of evidence obtained by way of scientific or technical means.[349] As issues pertaining to admissibility and reliability of scientific evidence grew in volume and complexity, the relationship between law and science seem to regress into agitation.[350]

The courts of the jurisdictions under discussion all made significant efforts to ensure relevant and reliable expert evidence is permitted into criminal trials. Some countries attempted to generate legislative

348 See *inter alia*: Zeffert *et al* 2003:305-306; Meintjes-Van der Walt 2000:326-336; Meintjes-Van der Walt 2003:88.

349 Taruffo 2011:VIII.

350 Meyer 1999:2.

provisions to simplify expert testimony admission and ensure reliability of expertise.[351]

The *Daubert*-decision of 1993, represents a definitive attempt by American courts to delineate criteria to allow the presiding officer, as 'gate-keeper' to the admission of scientific evidence in trials, to assume a definitive exclusionary stance and filter only those pieces of evidence that are valid and reliable. The *Daubert* doctrine did not, however, solve the problem entirely. Today, serious concerns have been noted on the reliability of some sciences and scientific methods admitted in court.[352] These concerns are not unique to the United States of America, and re-evaluation of rules for the admission of scientific evidence is vital as legal certainty is to be achieved in criminal justice systems across the world.

> Actually in the modern administration of justice, that is fundamentally based upon the correct application of the law, we do nod [sic] need arbitrary and unreliable decisions about the facts in issue: what we need are rational and truthful decisions, which means that when decisions are based upon science, it has to be valid and good science.[353]

Despite its fallibility, it has been intimated that the *Daubert*-decision currently stands as example to other jurisdictions as model in considerations on expert evidence.[354] It may be suggested that the

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351 For example, the Federal Rules of Evidence in the United States of America, and the Criminal Procedure Act 51 of 1977 in South Africa.

352 In 2009, a report by the American National Academy of Sciences, *Strengthening Forensic Science in the United States. A path forward*. This report discusses at length the problems with various forensic sciences and techniques, and will be discussed in detail in following chapters.

353 Taruffo 2011:XIV.

354 House of Commons 2005:76.

reason for this lies in its acknowledgment of the importance of the *reliability* of expert evidence, rather than emphasis merely on relevance.

It is submitted that South African courts, in an attempt to equal this recognition of reliable expert evidence, must endeavour to establish exclusionary rules to ensure that ‘junk science’ is not admitted in criminal trials. This may ultimately force the investigative forces to turn its focus towards the maintenance of the integrity of the investigative process, including the harvesting of forensic evidence.

CHAPTER 3

DEFINITION, SCOPE AND NATURE OF FORENSIC EVIDENCE WITHIN THE CRIMINAL JUSTICE SYSTEM

3.1 INTRODUCTION

Forensic evidence is employed within a country's criminal justice system, which forms part of a government's exercise of safety and security.[355] The justice system aspires to provide for processes in which those who commit offences are punished,[356] and most often consists of several components or agencies of government. In the United States of America, for example, the criminal justice system, on both state and federal levels, comprises the following parts: law enforcement, prosecution, defence attorneys, courts and corrections.[357] In South Africa, the major participants of the local system are the South African Police Service (SAPS), the justice department,[358] and correctional services.[359]

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355 Cartwright and Shearing 2009:3.

356 Joubert 2012:214; National Center for Victims of Crime 2008. http://www.ncvc.org/ncvc/AGP.Net/Components/documentViewer/Download.aspxnz?DocumentID=45713. Accessed on 15/06/2012.

357 National Center for Victims of Crime 2008. http://www.ncvc.org/ncvc/AGP.Net/Components/documentViewer/Download.aspxnz?DocumentID=45713. Accessed on 15/06/2012.

358 In South Africa, the Department of Justice and Constitutional Development is responsible for the maintenance and protection of the Constitution, the rule of law and the administration of justice. It manages the following duties: the provision of integrated court services and facilities, case-flow management, the appointment of presiding officers, the facilitation of the resolution of criminal disputes, and, in addition, guarantees the independence and integrity of its entities: the National Prosecuting Authority and the Legal Aid Board of South Africa – Justice and Correctional Services 2011. http://www.justice.gov.za/about/sa-yearbook/2010_adminjustice.pdf. Accessed on 15/06/2012.

359 Joubert 2010:214. The Department of Correctional Services in South Africa contributes to the criminal justice system as final enforcer of the sentences imposed by the courts after

The Criminal Procedure Act 51 of 1977 is the fundamental piece of legislation regulating the processes within the South African criminal justice system. This Act specifies four stages rotating within the justice system, namely the pre-trial and trial stages, sentencing, and post-sentencing remedies.[360] It is the pre-trial and trial stages that are of particular value to the present study.

The pre-trial stage in the criminal justice system is dominated by police activity[361] and is launched when a crime has been committed.[362] Following the discovery of the criminal incident, usually by way of reporting to the police, a case docket will be opened and the *raison d'être* of the pre-trial stage, the criminal investigation, will begin.[363]

> The pre-trial investigative procedures can be crucial to the ultimate admissibility, reliability and the weight which are attached to expert evidence.[364]

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conviction – Department of Correctional Services 2012. http://www.dcs.gov.za/. Accessed on 15/06/2012.

360 Joubert 2010:214.

361 Section 205 of the Constitution of the Republic of South Africa of 1996 governs the operation of the South African Police Service (hereafter referred to as the Police). The provisions in this section read as follows:

> (1) The national police service must be structured to function in the national, provincial and, where appropriate, local spheres of government.
>
> (2) National legislation must establish the powers and functions of the police service and must enable the police service to discharge its responsibilities effectively, taking into account the requirements of the provinces.
>
> (3) The objects of the police service are to prevent, combat and investigate crime, to maintain public order, to protect and secure the inhabitants of the Republic and their property, and to uphold and enforce the law.

362 Joubert 2010:214-215.

363 Joubert 2010:215. See also Meintjes-Van der Walt 2005:55-57.

364 Meintjes-Van der Walt 2005:57.

It is during this vital stage that information is recognised, collected and interpreted in an effort to find answers to the six questions that ultimately comprise the first step of a criminal investigation, namely: when, where, who, what, how and why?[365] All information obtained during this time is filed in the case docket, and includes witness statements, reports, other evidence and the investigating officer's case notes.[366] It is also during this stage that scientific evidence is harvested by experts in relevant fields.[367] It is essential that police officers and scientific experts practice their craft during this stage with due regard to the rules and provisions in the Criminal Procedure Act,[368] as well as rules relating to the law of evidence, as a disregard for these provisions might render evidence inadmissible in court.[369]

The investigating detective will continue gathering information until he is satisfied that the case docket contains sufficient information to prove the offender's identity and the elements of whatever crime has been committed.[370] Once the investigation is considered finalised, the investigating officer submits the data-containing case docket to the prosecution service.[371]

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365 Alifano 2006. http://www.worldwidelawenforcement.com/docs/FUNDAMENTALS%20OF%20CRIMINAL%20INVESTIGATIONS.pdf. Accessed on 18/02/2012; Miller 2008:143; Joubert 2010:215. These questions, and their meaning, will be discussed in greater detail later in this chapter.

366 Joubert 2010:215-216.

367 Alifano 2006. http://www.worldwidelawenforcement.com/docs/FUNDAMENTALS%20OF%20CRIMINAL%20INVESTIGATIONS.pdf. Accessed on 18/02/2012.

368 51/1977. With specific reference to those sections authorising and directing the search and seizure of suspects and premises, the interrogation and arrest of suspects, the taking of fingerprints, *etcetera.*

369 Joubert 2010:216.

370 Joubert 2010:215.

371 Joubert 2010:216.

The prosecutor will evaluate the contents of the docket, including any forensic evidence included in the file, and decide whether it contains adequate evidence to secure a conviction.[372] Once the prosecutor is satisfied that the identity and the elements of the crime can be sufficiently proven beyond a reasonable doubt in a criminal court, the case will be enrolled and, eventually, the matter will enter the trial stage of the criminal justice system.[373]

During the trial stage the prosecutor will attempt to submit the forensic evidence into court proceedings in an effort to prove that the version of events suggested by the state is, in fact, the true account of what transpired.[374] Whether the prosecutor succeeds in having the forensic evidence submitted depends on strict compliance with the rules of evidence contained in relevant legislation, the rules of admissibility as contained in South African case law and, naturally, the provisions of the Constitution.[375]

The main focus of this Chapter will be on the true meaning and scope of forensic evidence as it functions in the pre-trial and trial areas of the criminal justice system.[376]

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372 Joubert 2010:216.

373 Joubert 2010:216-217.

374 Joubert 2010:215.

375 The Constitution of the Republic of South Africa of 1996, hereinafter referred to as the Constitution, is the supreme law of the Republic of South Africa. Any legislative stipulation or conduct inconsistent with the provisions of the Constitution is invalid – Section 2 of the Constitution.

376 Discussions on forensic evidence throughout this study, unless otherwise indicated, will be in context of criminal, not civil litigation. Although forensic evidence and testimony in criminal and civil litigation do share certain similarities, great differences necessitate a separation of discussions on the two concepts to properly serve the interests of meticulousness.

3.2 THE PRE-TRIAL STAGE

3.2.1 The investigation of crime: A decision-making perspective

Dr. Hans Gross,[377] the architect of modern criminal enquiry, describes crime investigation as a process of vigilant observation, followed by a series of drawing inferences from what has been observed, to ultimately describing the criminal event.[378] He refers to "adducing proof" as inferring from known facts, data about following or preceding facts.[379]

It is suggested by Carson[380] that it is impossible to embark upon a criminal investigation or prove allegations in court without using inferential reasoning. Theories, hypotheses and inferences are drawn from evidence, and detectives, in pursuit of the truth regarding a criminal event, must infer information from data already available.[381]

Gunter and Hertig[382] agree that an investigation requires the use of logic and reasoning, and that investigators must be skilled in logical reasoning processes to examine the facts of a case, and establish its

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377 Dr. Gross published his watershed treatise, *Handbuch Fűr Untersuchungsrichter Als System Der Kriminalistik*, in 1893. This book was translated and adapted by Richard Leofric Jackson in 1962 in *Criminal Investigation: A practical textbook for magistrates, police officers and lawyers.*

378 Jackson 1962:1-2.

379 Jackson 1962:2.

380 2009:194.

381 2009:193-194.

382 2005. http://ifpo.org/articlebank/intro.pdf. Accessed on 29/06/2012.

meaning. Criminal investigators must detect the clues on the scene of the crime, interpret their implication and assess their validity.[383]

Jackson *et al*[384] describe the role of forensic science as being "the provision of information to help answer questions of importance to investigators and to courts of law. Although the forensic evidence may, on occasion, be factual and incontrovertible, it most often requires the application of a process of inferential reasoning to convert the factual data into an expert opinion that may assist the trial court.[385]

According to Kaye,[386] both science and law are conditional to evidence. In addition to this, scientists and legal practitioners alike, while seeking facts, comprehend those facts in terms of hypotheses, which must then be tested by a process of inferential reasoning.

Over the centuries literature on inferential reasoning and logic in criminal investigation and trials, has seen mostly two main types of logical reasoning: deductive and inductive reasoning.[387]

Deductive reasoning, also known as necessary inferences[388] and used in criminal trials in medieval times,[389] is an appealing type of logic as it

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383 Nordby 2000:3. See also Kim *et al* 2011:349.

384 2006:34.

385 Jackson *et al* 2006:34.

386 1991-1992:315.

387 Stanford Encyclopedia of Philosophy 2010. http://plato.stanford.edu/entries/peirce/. Accessed on 01/07/2012. Inferential reasoning based on logic is by no comparison a novel discovery. In the year 3 B.C., Aristotle founded the concept of formal logic. Since then, this concept has undergone some significant reformulations and improvements – Loevinger 1991-1992:324.

implies that the conclusion drawn is the only true, necessary finding that could be reached in the circumstances.[390] Logical rules are applied to specific sets of observations and require complete knowledge of the circumstances.[391] If the given premises are correct and acceptable, and logical reasoning pursued, the conclusion will be 'necessarily correct.'[392] It does not lead the arguer to new knowledge, but rather, if it is properly applied, tells the arguer no more than what is already included in the premises.[393] For example, when confronted with the following two premises, there is but one necessary conclusion to be drawn (if it is accepted that logical reasoning paths are followed):

All men are wise. (*Premise 1*)
John is a man. (*Premise 2*)

From these premises it can only be inferred that John, being a man, is wise.

From an investigative perspective, deductive arguments represent the unattainable ideal and, in reality, are of very little value to detectives.[394] It is extraordinary for investigators to possess unique knowledge that may serve as true and correct premises for deductive inferences. As

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388 Stanford Encyclopedia of Philosophy 2010. http://plato.stanford.edu/entries/peirce/. Accessed on 01/07/2012.

389 Carson 2009:194.

390 Carson 2009:195-196.

391 Jackson *et al* 2006:34.

392 Carson 2009:195.

393 Carson 2009:194-195.

394 Carson 2009:195.

Carson[395] reminds us, even cast-iron evidence such as fingerprints may not necessarily be unique. The temptation to employ deductive reasoning often leads to the over-statement of generalisations which do not represent rules or true premises.[396]

Perhaps one of the most noteworthy examples of such over-statement of generalisations can be found in the murder trial decided by Van Zyl J, in *S v Van der Vyver*.[397] A conviction must have appeared a virtual certainty when a forensic expert in the case testified that only three blood marks on the victim's bathroom floor could be matched by way of class characteristics with the accused's right shoe.[398] After some controversial revelations during the trial, several recognised specialists in shoe impressions testified for the defence that no such definitive conclusions could have been made with the data available.[399] Ultimately, the state was defeated at the hands of inadequate forensic evidence.

Carson[400] warns against the misuse of deductive reasoning by criminal investigators and that, to successfully circumvent the dangers inherent

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395 2009:195.

396 Carson 2009:195. These temptations are reinforced by the glory afforded to fictional and popular characters like Sherlock Holmes, who famously boasts about his own deductive prowess. Of course, the type of inferential reasoning employed by Mr. Holmes was not deduction, but abduction – Carson 2009:193-195.

397 [2008] JOL 21332 (C).

398 *S v Van der Vyver* [2008] JOL 21332 (C). A discussion of the blood mark evidence can be found at [59] to [85]. In his statement in terms of section 212(4)(*a*) of Act 51 of 1977 on the blood mark evidence, the expert held the following:

> Betreffende die soort, grootte, plek, posisie en verhouding van die unieke kenmerke tot mekaar, stem die skoenafdrukke se klas ooreen met die regterskoen wat aan ene Frederick Barend van der Vyver behoort.

399 *S v Van der Vyver* [2008] JOL 21332 (C): at [76], [79] and [82].

400 2009:195.

in such reasoning, investigators might benefit from learning about the misuse of deduction, rather than its use.

As science progressively infiltrated society and forensic scientists' role in criminal investigation became more pronounced, forensic experts were asked to provide "...information to help answer questions of importance to investigators and to courts of law."[401] Since the information that expert witnesses provide come in the guise of opinions, some process of inferential reasoning has to be pursued to arrive at those opinions.[402] Inductive reasoning is more suitable for use in the formation of these expert opinions, as it "...is the process of reasoning from a set of observations within a framework of incomplete knowledge," and forensic scientists' examination of evidence is limited by the incomplete data the expert possesses of all the facts in a particular case.[403]

Induction argues on the basis of probabilities and not necessary, definite conclusions, and attempts to prove an argument by suggesting assumptions that are probably true.[404] It forms generalisations from existing bodies of fact, creating new knowledge as it does so, yet remains unable to guarantee the correctness of conclusions.[405]

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401 Jackson *et al* 2006:34.

402 Jackson *et al* 2006:34.

403 Jackson *et al* 2006:34-35.

404 Palmer and Crocker 2007:11.

405 Carson 2009:195.

Inductive argument is intimately related to scientific method in that the reliability and accuracy of the inferences, observations and generalisations depend greatly on the quality of the methodology followed.[406] In addition, scientific method is responsible for testing these observations and inferences made by the investigator, to ultimately ensure its reliability.[407]

Again, Carson[408] cautions against familiar use of inductive reasoning by investigators. While induction may be relatively simple, it too is not invulnerable to sources of error. Personal bias, prejudice, an exaggerated reliance on the forensic science involved may all result in erroneous inferences.[409] For instance, although DNA evidence is highly reliable and carries great probative value, mistakes have been encountered in the process of drawing conclusions from the data it provides.[410]

Around 1865, Charles Sanders Peirce, founder of pragmatism in the United States of America and dynamic mathematical logician,

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406 Loevinger 1991-1992:325; Carson 2009:195-196.

407 Not, in fact, the certainty thereof, since we are dealing with inductive probability, rather than deductive certainty - Carson 2009:195-196.

408 2009:196. Carson's concerns are mirrored, perhaps even amplified, by scholars in scientific philosophy, such as Norton – Norton 2010:765-777.

409 Carson 2009:196. Sir Karl Popper published his treatise on the logic of science, *The logic of scientific discovery*, in 1959, in which he asserts that the concept of inductive reasoning is incapable of being concluded from experience or from or logical principles, and that science rather employs deduction to generate hypotheses and to then test these theories by either observation or experiment – Loevinger 1991-1992:327.

410 Carson 2009:196.

suggested that there are, in fact, two kinds of inductive reasoning: inductive reasoning and abductive reasoning.[411]

Perhaps the most valuable to criminal investigation, especially murder enquiries,[412] is abductive reasoning, which starts at the crime scene when signs or clues are observed and interpreted to ultimately generate a hypothesis or explanation of what occurred.[413]

> It is a creative form of sense-making interpretative inference, wherein the presence of a fact is used to generate an explanation for its causes... In a sense, then, crime investigation practice is founded upon the abductive interpretation of various signifiers and can thus be constructed as a situated and stylized form of applied semiotic analysis.[414]

Abduction involves not only the observation of clues or signs, but interpretation thereof and the subsequent invention of explanatory theories.[415] When observing, and therefore interpreting, data on a crime scene, several possible hypotheses may be formulated. As more data are obtained, whether through further scrutiny of the scene or the yielding of forensic evidence, a specific hypothesis may be confirmed or rendered more probable. Further knowledge, in other words, makes an interpretation or abduction more credible.[416]

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411 Burks 1946:303; 2009:194; Stanford Encyclopedia of Philosophy 2010. http://plato.stanford.edu/entries/peirce/. Accessed on 01/07/2012. These systems of inference will be critically discussed and compared in later chapters.

412 Carson 2009:198.

413 Carson 2009:196.

414 Carson 2009:198 as taken from Innes's treatise *Investigating murder: Detective work and the police response to criminal homicide*, published in 2003.

415 Carson 2009:196.

416 Carson 2009:196.

Although descriptions of deductive, inductive and abductive inferential reasoning predominantly focus on the individual definitions and explanations of each one, Peirce[417] opined that these categories of reasoning essentially comprises three stages in a single investigative inquiry, as all three systems are founded upon a *hypothesis*. Abduction invents or suggests hypotheses that may serve as explanations for the observed facts, thereby introducing new data to the investigative equation.[418] Deduction elucidates the hypotheses generated during abduction, inferring essential and definitive consequences that must still be tested for validity.[419] Induction represents the stage in which the hypotheses are tested, usually by way of forensic analyses.[420] Then once again, deduction provides the machinery for calculating the precise consequences of the inferences, if the premises are accurate.[421]

The hypothesis so detected and tested, must account for all the facts observed, otherwise it disqualifies the hypothesis.[422] In terms of criminal investigations, no clue or piece of evidence taken from the primary or secondary crime scenes must remain unexplained by the investigator's theory (or hypothesis) of what occurred.

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417 Burks 1946:303. Also discussed in Carson 2009:196-197.

418 Burks 1946:303. The new data, or conclusions, reached during abductive reasoning should ultimately result in the inference of "definite consequences" that can also be evaluated – Burks 1946:306.

419 Burks 1946:303.

420 Carson 2009:196.

421 Carson 2009:196.

422 Burks 1946:306.

Carson[423] describes the schools of thought on the fundamentality of abductive reasoning in both the forensic science profession as well as in detective work, as well as difficulties intrinsic to abduction in both these arenas.

Particular cause for concern regarding abduction in detective work seems to be:

> ...the slight tendency for consequent factors to be interpreted in such a way that their inferred antecedents are assimilated by the current dominant hypothesis held by the police about the crime.[424]

In other words, attempts would be made to fit newly acquired data into the mould of what the detective's favoured hypothesis on the event is, rather than allowing for the re-interpretation of all known facts and the subsequent re-generation of a new hypothesis.[425]

The employment of abductive analysis in forensic science is obfuscated by the fact that scientists receive objects, items and traces from a milieu outside the laboratory, frequently collected by non-scientists. This creates the risk of interference or alteration, even if by the most unintentional means, and the scientist is left with possibly altered data.[426] In addition to this, the interaction between the police and scientists often lead to an exchange of background information regarding the crime and crime scene. This, in turn, directly impinges

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423 2009:198.

424 Carson 2009:198, as acquired from Innes's treatise *Investigating murder: Detective work and the police response to criminal homicide*, published in 2003.

425 Carson 2009:198.

426 Carson 2009:198.

upon the scientist's interpretation of the data, guiding him to engage in inductive argument on hypotheses that have been suggested to him, rather than engineering novel theories.[427]

Decision-making,[428] it would appear, is central to not only the investigation of crime, but also the process of proving hypotheses.[429] Despite flawed decision-making being the most prevalent type of mistake in the pre-trial process, investigators (and it is submitted, forensic scientists) receive no formal training in decision-making skills.[430] In South Africa, detectives undergo a fourteen week basic training course in which no decision-making skills are taught.[431] In fact, it has been reported in 1997 and 2010, that a substantial amount of practicing South African detectives have not received even basic police detective training.[432] Perturbing statistics indeed, considering the magnitude of the duty of an investigating officer.

While inferential reasoning is vital to the success of an investigation, no such reasoning can be conducted without the aid of signs (or clues), initial knowledge, or data. These signs, knowledge and data ultimately

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427 Carson 2009:198.

428 As descriptive of *inter alia* the reasoning processes followed during an investigation. Decision-making will be discussed at length in chapters to follow.

429 National Centre for Policing Excellence 2005:58.

430 National Centre for Policing Excellence 2005:58.

431 The training programme for detectives is available at http://www.saps.gov.za/training/detectives/intro_crime_invest.htm. No decision-making skills are included in this programme.

432 In 1997, research by the South African Police Service concluded that 45% of South African detectives had yet to receive training at that point – South African Data Archive 1997. http://sada.nrf.ac.za/CodebookPDF/S0054.pdf. Accessed on 20/07/2012. In 2010, it was reported that approximately 24% of investigating officers have received no detective training – SAPA 2010. http://www.news24.com/SouthAfrica/News/5-000-detectives-lack-training-20101014. Accessed on 20/07/2012.

comprise the material, or evidence, that the investigating officer will employ in the process of inferential reasoning to eventually accomplish proof of fact.[433] Evidence may come in the shape of eye witness statements, documentary evidence, real evidence, forensic expert opinion reports, and much more.[434] Since these are the materials that must guide the detective through his decision-making process, it stands to reason that he must have a firm grasp of the nature, scope and true meaning of forensic evidence.

3.2.2 The investigation of crime: The process of investigation

Alifano[435] describes criminal investigation as being a complicated process, both an art and a science, and formally defines it as follows:

> An investigation is an examination, a study, a survey and a research of facts and/or circumstances, situations, incidents and scenarios, either related or not, for the purpose of rendering a conclusion of proof. When one investigates, he/she makes a systematic inquiry, closely analyzes and inspects while dissecting and scrutinizing information. An investigation, therefore, is based upon a complete and whole evaluation and not conjecture, speculation or supposition.

The process of crime detection involves the collective task of accumulating and assessing information.[436] Alifano[437] suggests that this

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433 National Centre of Policing Excellence 2005:67.

434 National Centre of Policing Excellence 2005:67.

435 2006. http://www.worldwidelawenforcement.com/docs/FUNDAMENTALS%20OF%20CRIMINAL%20INVESTIGATIONS.pdf. Accessed on 18/02/2012.

436 Alifano 2006. http://www.worldwidelawenforcement.com/docs/FUNDAMENTALS%20OF%20CRIMINAL%20INVESTIGATIONS.pdf. Accessed on 18/02/2012.

437 Alifano 2006. http://www.worldwidelawenforcement.com/docs/FUNDAMENTALS%20OF%20CRIMINAL%20INVESTIGATIONS.pdf. Accessed on 18/02/2012.

is the fundamental purpose of criminal investigation, as opposed to the popular view, which is that obtaining *evidence* is the primary objective.

> The process should be conducted with the mindset that *from information comes evidence*.[438]

Criminal investigation, as opposed to crime scene investigation,[439] focuses on the entire process of investigation, from the crime scene, expanding to evidence collection, the identification and individualisation of suspects, to, finally, the presentation of evidence in court.[440]

When a case proceeds to trial, only a relatively small portion of the immense amount of information initially gathered during the investigation phase will serve as foundation for evidence presented in court.[441] Although all information is valuable to a certain extent, evaluation and severe scrutiny of information at the different levels of the criminal justice system, will filter the data through the decision-making processes at these different levels to ultimately provide evidence that will serve as proof of fact and be admissible in court.[442]

Alifano[443] contends that the two primary sources from which detectives derive information, are people and things, two entirely contradictory

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438 Alifano 2006. http://www.worldwidelawenforcement.com/docs/FUNDAMENTALS%20OF%20CRIMINAL%20INVESTIGATIONS.pdf. Accessed on 18/02/2012.

439 Crime scene investigation is discussed later in this chapter.

440 Benson *et al* 2010:18.

441 Alifano 2006. http://www.worldwidelawenforcement.com/docs/FUNDAMENTALS%20OF%20CRIMINAL%20INVESTIGATIONS.pdf. Accessed on 18/02/2012.

442 Alifano 2006. http://www.worldwidelawenforcement.com/docs/FUNDAMENTALS%20OF%20CRIMINAL%20INVESTIGATIONS.pdf. Accessed on 18/02/2012.

443 Alifano 2006. http://www.worldwidelawenforcement.com/docs/FUNDAMENTALS%20OF%20CRIMINAL%20INVESTIGATIONS.pdf. Accessed on 18/02/2012. The report by the National

spheres, each requiring an entirely distinctive set of skills and expertise. The scope and significance of information obtained from things, or physical objects, depend to a large extent on the detective's ability to recognise 'things' of evidential value on the crime scene.[444] Since courts have traditionally ascribed higher evidential value to information from physical objects in contrast to witness testimony,[445] it is vital that investigating officers are accomplished in the recognition, handling and interpretation of physical things on crime scenes and its analyses.

In the initial stages of the investigative phase, all information obtained must be processed and organised to answer broad questions about the incident. Alifano[446] describes these broad questions simply as the when, where, who, what, how and why (NEOTWY) of a crime. The National Centre for Policing Excellence[447] in the United Kingdom refers to these questions as 'the 5WH formula' and argues that if this formula is applied to the amassed information and evidence, detectives will be able to

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Centre for Policing Excellence offers the following as potential sources of data in investigations: the victim, witnesses, suspects, locations (including the crime scenes), intelligence databases, passive evidence generates and tangible things, which all boils down to 'people and things' – National Centre for Policing Excellence 2005:44. See also Fisher 2000:1.

444 Alifano 2006. http://www.worldwidelawenforcement.com/docs/FUNDAMENTALS%20OF%20CRIMINAL%20INVESTIGATIONS.pdf. Accessed on 18/02/2012.

445 Alifano 2006. http://www.worldwidelawenforcement.com/docs/FUNDAMENTALS%20OF%20CRIMINAL%20INVESTIGATIONS.pdf. Accessed on 18/02/2012.

446 Alifano 2006. http://www.worldwidelawenforcement.com/docs/FUNDAMENTALS%20OF%20CRIMINAL%20INVESTIGATIONS.pdf. Accessed on 18/02/2012. Also described by Shelton 2011:1, 39, 81, 107. The acronym, NEOTWY, is derived from the last letter of each of the question words in the series. Cohen even describes these questions in relation to the expert witness – Cohen 2008:7-9.

447 National Centre for Policing Excellence 2005:68. The National Centre for Policing Excellence was established in response to the promulgation of the Police Reform Act 2002 in the United Kingdom, and endeavours to develop police doctrine and advice. It shall from here on be referred to as NCPE.

speedily identify lines of enquiry that will ultimately lead to the formation of evidence of facts.

The '*who?'* enquiry will lead the investigator to the people involved in the incident. Who is the victim? Who is the perpetrator? Were there any eye witnesses and who are they? It requires descriptions of those valuable to the investigation.[448] Examples of data relevant to this enquiry includes: fingerprint and DNA evidence; trace evidence in the form of hair analysis; handwriting analysis; bite-mark analysis; *etcetera*.[449]

'*Where?'* would signify an investigation into the locality of the incident and any information that this geographical location might provide to the detective, for instance, whether the crime was committed spontaneously and randomly, or whether it was premeditated and focused on a specific individual.[450] Relevant to locality one might expect data of a geographical nature, for example, plant material, microbial samples, trace evidence in the form of soil samples, and even entomological specimens.

One of the most important examinations to perform in the early stage of detection, is *'what?'* happened during the incident. This certainly does not refer to what may likely be immediately apparent, for instance, that

448 National Centre for Policing Excellence 2005:68.

449 Shelton 2011:1.

450 National Centre for Policing Excellence 2005:68.

the victim was shot with a firearm and died. It includes the entire body of dynamic events that occurred during a specific incident.[451]

Accurate determination of the *'when?'* enquiry is vital to criminal detection since so much is retrospectively reconstructed.[452] Without this data, alibis would have no value. Since the main premise of an alibi defence is the contention of innocence based on the accused person's absence from the crime scene at the time that the offence was committed, it serves a strong denial of the prosecution's case.[453] If no data is available concerning precisely when the crime occurred, it would be virtually impossible for such evidence to be excluded as being a conceivable possibility.

The National Centre for Policing Excellence[454] succinctly explicates the *'why?'* probe: "Why was this offence committed in this location against this victim at this time?"

'How' the offence was committed is subject to the assessment of the perpetrator's competence and knowledge.[455] Tool mark evidence and bloodstain pattern analysis are often valuable in this assessment in that it can assist in determining the events and sequence of events relating to a crime.[456]

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451 National Centre for Policing Excellence 2005:68.

452 Cohen 2008:8.

453 Zeffertt *et al* 2003:151.

454 2005:68.

455 National Centre for Policing Excellence 2005:68.

456 Shelton 2011:81, 98.

The amount and quality of possible scientific evidence produced during a criminal event depends on the nature of the crime, the skill and methods of the perpetrator and the level of contact between the offender and the victim or the offender and the surroundings of the crime scene.[457] Ideally, all information produced during the crime will become evidence presented in court. Unfortunately, this is not the case.[458] Some material on the crime scene, and even on the victim, will be lost or destroyed. Witnesses will be untraceable. Physical evidence will simply not be detected, and some evidence might not be admissible in court.[459]

In South Africa, the management of all scenes of crimes is contained in SAPS Policy 2 of 2005, which provides for protocol regarding the adequate control, management, recording and maintenance of the integrity of all material that might carry evidential weight in court.[460] After a crime has been reported and emergency services, should they have been present on the scene, have departed, first responders to the incident have the responsibility of clearing the area and taking control of the perimeter, which includes securing the crime scene with physical barriers, preferably *via* an inner and outer cordon.[461]

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457 National Centre for Policing Excellence 2005:46.

458 National Centre for Policing Excellence 2005:45-46.

459 National Centre for Policing Excellence 2005:46.

460 Omar 2009:60.

461 Omar 2009:63.

First responders must comply with several additional requirements regarding the crime scene, as well as administrative duties in establishment of a command centre, and must continue with these functions until control of the scene can be safely handed over to the crime scene manager.[462] SAPS Policy 2 defines a crime scene manager as a member of the relevant police investigation unit who manages the crime scene team on the crime scene.[463] The scene manager is then under duty to assign a specific investigating officer (the detective) from the relevant police station and unit to the investigation of the crime, including engaging in the human element of questioning witnesses and obtaining witness statements.[464]

Alifano[465] ascribes the study of human behaviour during a crime investigation to the case detective, including the task of evaluating all emotional, psychological, environmental and sociological aspects.

Apart from controlling the crime scene and securing an investigating officer to the case, the scene manager must also summon a crime scene technician to the location.[466] Technicians are appointed, trained and provided by the Local Criminal Record Centre (the LCRC) in each province.[467] The technician is ultimately responsible for harvesting forensic evidence from the scene, as he must:

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462 Omar 2009:64.

463 As discussed in Omar 2009:64.

464 Omar 2009:65.

465 Alifano 2006. http://www.worldwidelawenforcement.com/docs/FUNDAMENTALS%20OF%20CRIMINAL%20INVESTIGATIONS.pdf. Accessed on 18/02/2012.

466 Omar 2009:65.

467 The officials from the Criminal Record Centre are responsible for recording scenes of crime and objects from crime scenes by way of photography, videography, *etcetera.* They are also

> ...evaluate the situation; decide on and appoint a crime scene processing team; identify, note and protect all possible physical evidence; determine what resources are required for the processing of the crime scene...and must keep a record that will form the basis of a report about how the scene was managed.[468]

Once more, Alifano[469] describes the crime scene technician, or crime scene investigator, as the person responsible for dealing with inanimate objects "...that are unable to mislead, lie or fight." The case detective and crime scene technician are dependent on one another and should have a fundamental respect and insight into the competencies and limitations for each other's work.[470]

In investigating the crime and amassing information and material from a scene, the case investigator and the scene technician are subject to the provisions of the South African Constitution.[471] The investigator and technician are also legislatively disqualified from collecting certain types of evidence.

While section 37(1)(*a*) of the Criminal Procedure Act 51 of 1977, empowers police officials to collect finger-, palm- or footprints (or cause

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in charge of formulating techniques of crime scene investigation, as well as collecting, preserving and processing exhibits and other clues for forensic analyses – South African Police Service 2011. http://www.saps.gov.za/careers/career_quest/purple/lcrc_official.htm>. Accessed on 06/07/2012.

468 Omar 2009:65.

469 Alifano 2006. http://www.worldwidelawenforcement.com/docs/FUNDAMENTALS%20OF%20CRIMINAL%20INVESTIGATIONS.pdf. Accessed on 18/02/2012.

470 Alifano 2006. http://www.worldwidelawenforcement.com/docs/FUNDAMENTALS%20OF%20CRIMINAL%20INVESTIGATIONS.pdf. Accessed on 18/02/2012.

471 The Constitution of the Republic of South Africa of 1996. Section 35(5) of the Constitution places a duty on criminal courts to exclude any evidence that was acquired in defiance of any right in the Bill of Rights if its admission would render the trial unfair or otherwise be detrimental to the administration of justice.

such prints to be taken), section 37(2)(*a*) and (*b*) of the same Act stipulates that only a registered medical practitioner or registered nurse are authorised to take blood samples from persons relating to a crime, whether on request by a police officer, or if the physician or nurse are of reasonable opinion that the contents of the person's blood may later be relevant to criminal proceedings, thereby giving a medical practitioner the discretion in this regard.

By June 2012, The Portfolio Committee for Police (PCP) had accepted a long-awaited policy document on the so-called 'DNA Bill',[472] which will act as the precursor for the final DNA Bill, and which stipulates that the legislator must produce the final Bill by the end of 2012.[473] Among the many propositions contained in the DNA policy document is the suggestion that authorised and duly appointed police officials be trained by medical practitioners to collect DNA-containing material from arrestees and convicted criminals.[474] It remains to be seen whether this collection of DNA-containing material by a police officer will take the form of a mere buccal swab or the taking of blood, for example using a pinprick. It is expected, however, that whatever method is elected will be less invasive than detention and transport to a hospital for drawing blood by way of syringe.[475]

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472 Criminal Law (Forensic Procedures) Amendment Bill B2-2009.

473 Somerset West Community Police Forum 2012. http://www.somersetwestcpf.org.za/node/589. Accessed on 27/07/2012.

474 Somerset West Community Police Forum 2012. http://www.somersetwestcpf.org.za/node/589. Accessed on 27/07/2012.

475 DNA Project 2012. http://dnaproject.co.za/faq. Accessed on 27/07/2012.

3.3 THE FORENSIC SCIENCE

3.3.1 On the crime scene

A crime scene is perhaps the most valuable and blatantly observable source of data and material available in crime resolution,[476] and the process in which forensic evidence is harvested, analysed and interpreted, starts with the crime scene.[477]

Alifano[478] depicts a crime scene as follows:

> The crime scene is the central location of a crime and usually the starting point of an investigation. This, however, is not to say that there are not additional or secondary scenes which, dependent upon the type and to what extent a criminal has perpetrated a crime, could be quite varied and numerous, spanning a great distance over a protracted period of time. These scenes contain physical traces of the criminal, the victim(s), weapons, tools, latent prints, DNA, and serological matter, etc.

Benson *et al*[479] warn against an exaggeratedly restricted approach to defining the crime scene. In circumscribing the scene of an offence, consideration must be given to the fact that the offender entered and exited the scene at places other than where the offence may have been committed, that the crime might have started in one place, and finished in another, and, very importantly, that the body of the victim, as well as

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476 Alifano 2006. http://www.worldwidelawenforcement.com/docs/FUNDAMENTALS%20OF%20CRIMINAL%20INVESTIGATIONS.pdf. Accessed on 18/02/2012.

477 Fisher *et al* 2009:5.

478 Alifano 2006. http://www.worldwidelawenforcement.com/docs/FUNDAMENTALS%20OF%20CRIMINAL%20INVESTIGATIONS.pdf. Accessed on 18/02/2012.

479 2010:19.

the perpetrator, are as much part of the crime scene as any exhibit collected from it.[480]

Fisher[481] confirms that the crime scene is the area where most forensic evidence relating to a criminal incident may be found; that it is the very starting point of a criminal investigation. Additionally, he lists the following as the fundamental objectives of a crime scene investigation: the eventual reconstruction of the crime to determining the events and sequence of events, as well as the mode of operation of the offender; to ascertain the offender's motive; to establish precisely what crime was committed; and ultimately, to retrieve physical evidence of the offence from the primary and secondary scenes.[482]

The immense significance of a crime scene is matched by its sensitivity and vulnerability to its environment, resulting in the unfortunate deterioration of evidence.[483] Global standard operating procedures regarding crime scene processing demand the protection of the scene against contamination and destruction before and during crime scene investigation.[484]

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480 Fisher *et al* 2009:5-7; Benson *et al* 2010:19-20.

481 2000:26.

482 Fisher 2000:46. The primary crime scene, also refered to as the main crime scene, is where the first or initial crime was committed, with the secondary crime scene being the site where physical evidence relating to the offence are to be found. For example, the house where a child was murdered is the primary crime scene, while the motor vehicle in which the child's corpse was transported, would be investigated as the secondary crime scene. See also the discussion on collection of crime scene samples in Meintjes-Van der Walt 2000b:350.

483 Alifano 2006. http://www.worldwidelawenforcement.com/docs/FUNDAMENTALS%20OF%20CRIMINAL%20INVESTIGATIONS.pdf. Accessed on 18/02/2012.

484 Alifano 2006. http://www.worldwidelawenforcement.com/docs/FUNDAMENTALS%20OF%20CRIMINAL%20INVESTIGATIONS.pdf. Accessed on 18/02/2012. See also Fisher 2000:25-27; Fisher *et al* 2009:7.

Fundamental regulations pertaining to scene preservation by investigators and technicians alike, include the use of protective clothing on any crime scene where biological material or trace evidence is likely to be accumulated; the strict management of entry and exit points to and from the scene; and the correct packaging and preservation of gathered exhibits.[485] Biological material should be air-dried before packaging and ideally placed in paper bags.[486] Weapons, such as firearms and knives, must be placed in specially designed containers to avoid damage to the package and loss of potential evidence.[487] All exhibits must be stored in completely sealable, contamination proof containers with unique identification numbers that are recorded in the crime scene log, and verified on transport to the laboratory, at the forensic laboratory during analysis, and during evidence presentation in court.[488] This identity number exists to prove the integrity of the evidence and, therefore, maintains the chain of evidence.[489]

Perhaps the most important justification for the vehement protection of the crime scene, and therefore the integrity of evidence to be collected from it, is contained in the Locard Exchange Principle, named after

485 Fisher *et al* 2009:7-8.

486 Fisher *et al* 2009:7. Plastic bags are conducive to the formation of mould on the samples which ultimately leads to decomposition or destruction.

487 Fisher *et al* 2009:7.

488 Fisher *et al* 2009:8.

489 The chain of evidence, also referred to as the chain of custody, is the manner in which the court can confirm the integrity, reliability and authenticity of the physical evidence presented. In other words, that it has not been manipulated in any manner. The chain allows the court to validate the path the exhibit followed and persons who had access to the evidence throughout the investigative process. To ensure evidence submitted has any evidential value, prosecutors must prove the chain of custody of all exhibits submitted – Meintjes-Van der Walt 2005:57.

French criminalist, Dr. Edmund Locard.[490] Dr. Locard established the precursor of the modern French forensic laboratory in Lyon in 1910, and co-founded the International Academy of Criminalistics after obtaining both his doctorate in medicine and passing his bar examination.[491] His significant contribution to forensic science lies in his dedicated development of trace evidence from crime scenes, *inter alia* systematising dust analysis, bloodstain pattern analysis and microscopic fingerprint analysis.[492] He stated the following:

> Any action of an individual, and obviously, the violent action constituting a crime, cannot occur without leaving a trace.[493]

This principle implies that it is impossible for an offender to enter a scene without altering it in some way, either by adding something to it or removing something from it.[494] Kiely[495] explicates the Locard Principle as meaning that all close physical interaction leads to an exchange of trace evidence like hairs, fibres, soils, and many other trace exhibits. For Locard, it was important that a connection be established between the piece of physical evidence or biological stain, and its source, to ultimately identify the source as the origin thereof, or alternatively, wholly exclude that source as the origin.[496] It stands to

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490 Fisher *et al* 2009:4. Dr. Locard published several books in the early twentieth century on the information that can be obtained about the wearer of clothing by examining that clothing microscopically – Fisher *et al* 2009:5.

491 Stauffer 2004:2-3.

492 Stauffer 2004:9.

493 Translated from his treatise, *La police et les méthodes scientifiques*, published in 1934 – Stauffer 2004:10.

494 Fisher 2000:26; Fisher *et al* 2009:4.

495 2001:46.

496 Stauffer 2004:14.

reason that failure to adequately protect the crime scene would allow existing trace material to be corrupted by those deposited on the scene by visiting police and forensic personnel.

Documentation and recording of the crime scene are essential to the processing thereof, and, prior to collection, the location of evidential material must be carefully recorded, whether by photography, videography, sketching, or computerised surveying devices.[497] The scene of crime must be searched systematically, by means of the spiral method, or by way of dividing the area into lanes and perusing them separately.[498] The area is scrupulously recorded as the search progresses and the locations of evidence marked as they are detected. Practice dictates that fragile evidence is collected first. Fingerprints will be collected as soon as possible to prevent its accidental destruction, while trace evidence and small to microscopic evidence will be gathered thereafter.[499]

The law enforcement community in South Africa was reminded of the magnitude of meticulous crime scene investigation in 2006, when the suspect in a child rape case was traced by members of the community using a cell phone that was left on the scene of the crime, after the South African Police Service (SAPS) failed to scrutinise the scene.[500] In apparent dismay, a police captain was noted as admitting that the SAPS neglects proper crime scene investigation, most notably that of

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497 Fisher *et al* 2009:5-6.

498 Fisher *et al* 2009:6. Practice dictates that fragile evidence, for instance fingerprints, be collected first to prevent its destruction or contamination.

499 Fisher *et al* 2009:6-7.

500 Benson *et al* 2010:16.

incidences of rape.[501] This blatant disregard for rape scene investigation has been held as one of the primary reasons why rape convictions in South Africa have been hugely disappointing.[502] Since rape is viewed as perhaps one of the most heinous crimes committed against the person (as may be inferred from its inclusion in Schedules 5 and 6 of the Criminal Procedure Act 51 of 1977), it is reasonable to suffer some anxiety regarding the diligence with which lesser crimes are studied. In point of fact, some media reports over the last decade have not been kind to societal expectations concerning crime scene investigation in South Africa.[503]

3.3.2 The structure and function of the forensic crime laboratory

When the arduous yet important task of collecting all physical clues from a crime scene has been satisfied, those exhibits are dispatched to the nearest crime laboratory, or forensic laboratory, for analyses. The National Academy of Sciences[504] in the United States of America adopted the following definition of a crime laboratory:

> ...a single laboratory or system comprised of scientists analyzing evidence in one or more of the following disciplines: controlled substances, trace, biology (including DNA), toxicology, latent prints, questioned documents, firearms/toolmarks, or crime scene.

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501 Benson *et al* 2010:16.

502 Benson *et al* 2010:16.

503 Ismail 2001:19; Carstens 2007:14; Sibanyoni 2007:1; Benjamin 2008. http://www.businessday.co.za/Articles/TarkArticle.aspx?ID=3238687. Accessed on 27/06/2008; SAPA 2011. http://www.iol.co.za/news/crime-courts/poor-police-work-blamed-for-murder-acquittal-1.1146629. Accessed on 06/08/2012.

504 2009. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

In the United States of America, the services provided by crime laboratories are unique and maintained on either a federal delivery system, or a state-local system.[505] When a crime has been committed within the jurisdiction and borders of a specific state, the state police and laboratories will conduct the ensuing investigation.[506] Federal violations, that is, those offences specifically defined as federal offences,[507] as well as any offences committed beyond state borderlines, are investigated by federal agencies and the forensic analyses performed by federal laboratories.[508]

Across the world, crime laboratories deliver their services in diverse manners, but for the most part, render those vital services as an affiliate to the local police or sheriff's departments, the prosecutorial service, or as part of the medical examiner or coroner's offices.[509] Until end of 2011, police investigators in England and Wales enjoyed the services of the Forensic Science Services (FSS), a government-owned company (consisting of several crime laboratories) that provided police and the prosecutorial services with crime scene and forensic expertise.[510] Great

505 Fisher *et al* 2009:8. Although these two systems function within their own, distinct jurisdictions, they are found to occasionally overlap. Apart from state laboratories functioning at state level, some local law enforcement agencies are served by regional, county or municipal laboratories – National Academy of Sciences 2009. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

506 Fisher *et al* 2009:8.

507 For example, counterfeiting and smuggling.

508 Fisher *et al* 2009:8. Examples of federal agencies charged with conducting investigation of federal violations include the Federal Bureau of Investigation (the so-called FBI), and the Drug Enforcement Agency (DEA).

509 Fisher *et al* 2009:9.

510 Sample and Laville 2011. http://www.guardian.co.uk/science/2011/sep/08/forensic-science-service-closure-damage. Accessed on 04/08/2012. It is estimated that the FSS conducted forensic analyses in up to 60% of all forensic services ordered by the police in England and Wales. That amounts to 120 000 cases per annum - Sample and Laville 2011.

monetary losses by the FSS moved the British government to hastily close down this service altogether.[511] All forensic analyses are now performed by private forensic institutions and the police themselves.[512] While the decision to cease operations of the FSS was fervidly defended by the government, it suffers tremendous criticism from members of a variety of spheres, and it remains to be seen whether the prediction about monstrous miscarriages of justice due to forensic failures, will materialise.[513]

In South Africa, forensic services are provided by the Forensic Science Laboratory of the South African Police Service (FSL) and a local Criminal Record Centre.[514] The Criminal Record and Forensic Science Service (CRFSS) was founded in May 2005 and combines the resources and skills of the FSL and the Criminal Record Centre.[515] The CRFSS is a subdivision of the deputy national commissioner of crime

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http://www.guardian.co.uk/science/2011/sep/08/forensic-science-service-closure-damage. Accessed on 04/08/2012.

511 Sample and Laville 2011. http://www.guardian.co.uk/science/2011/sep/08/forensic-science-service-closure-damage. Accessed on 04/08/2012.

512 Sample and Laville 2011. http://www.guardian.co.uk/science/2011/sep/08/forensic-science-service-closure-damage. Accessed on 04/08/2012.

513 Sample and Laville 2011. http://www.guardian.co.uk/science/2011/sep/08/forensic-science-service-closure-damage. Accessed on 04/08/2012; Rincon 2011. http://www.bbc.co.uk/news/science-environment-15523182. Accessed on 04/08/2012; Collins 2012. http://www.telegraph.co.uk/science/science-news/9068971/Forensic-Science-Service-closure-will-lead-to-miscarriages-of-justice.html. Accessed on 04/08/2012.

514 Omar 2008:29; Omar 2009:68. Depending on the jurisdiction in which the samples were collected, they may be sent to the forensic laboratory in Pretoria, Durban, Port Elizabeth or Cape Town. Although the opening of the new forensic laboratory in Cape Town was celebrated in July 2012, it has already been in operation since November 2011. This laboratory, which took an estimated R600 million and six years to erect, houses almost 7000 staff members conducting ballistic, biological, chemical and other analyses on exhibits received from police – SAPA 2012. http:// www.iol.co.za/news/crime-courts/new-lab-part-of-forensic-turnaround-1.1343400. Accessed on 27/07/2012.

515 Omar 2008:29.

intelligence and crime detection, providing forensic services exclusively to the South African Police Service (SAPS).[516]

While the four branches of the FSL offer the application of forensic science as it relates to the prevention and combating of crime, the 92 local criminal record centres (LCRC's) across the country are responsible for the documentation and collection of evidence from crime scenes, and submitting the exhibits to the FSL for analyses.[517]

The FSL renders services within the spheres of biology, chemistry, ballistics, questioned document analysis, explosives, and trace evidence.[518] Once members of the LCRC have collected items of potential evidential value from the scene, those exhibits will be sent to the FSL, where laboratory administrative assistants receive the samples, register the cases on the Exhibit Management System (EMS), and issue lab numbers for each sample.[519]

The forensic analyst at the FSL will commence the process of exhibit evaluation when the sample is received, or when the analysis is ordered by the relevant public prosecutor.[520] Subsequent to analysis, reports will be prepared and ultimately included in the case docket that resides with the investigating officer.

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516 Omar 2008:29.

517 Omar 2008:29-30.

518 Omar 2008:30.

519 Omar 2008:31. The EMS system manages and simplifies the control and tracking of case files and samples in storage.

520 Omar 2008:31. In South Africa, DNA analysis, for example, is not performed automatically upon receipt of a biological sample, but only upon direction of the relevant prosecutor in charge of a specific case.

3.3.3 The nature, scope and classification of forensic evidence

Proof of fact in modern criminal litigation depends progressively more on conclusions "...flowing from the application of the findings of one or more of the natural sciences."[521] The use of science and scientific method in the criminal justice system inevitably lead to discussions of forensic science and forensic evidence.[522]

The term 'forensic' has seen a multitude of mutations and applications, suffered grim allegations, and bore some arduous expectations.[523] The value of forensic science in the criminal justice system has been demonstrated persistently and courts across the world are becoming increasingly reliant on its abilities in criminal litigation.[524]

'Forensic', from the Latin word *forensis*, meaning 'of the forum', refers to the place of debate, the courtroom in ancient Roman times.[525] Using 'forensic' in adjectival form denotes a connection with, or employment within, legal debate or a court of law.[526] Forensic evidence would thus suggest facts or opinions generated by application of one or more spheres of natural sciences, which is subsequently submitted during criminal proceedings in court.[527]

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521 Kiely 2001:26.

522 Kiely 2001:26.

523 Inman and Rudin 2001:4-5.

524 Lee 2011:33.

525 Inman and Rudin 2001:4; Meintjes-Van der Walt 2006:152.

526 Inman and Rudin 2001:4.

527 Kiely 2001:26.

But is forensic science 'scientific'? Science is the methodological, inferential process of clarifying and describing the physical universe, using hypothesis testing as the vehicle to do so.[528] The ability to formulate a hypothesis and, even more importantly, to discover a way to test such hypothesis using scientific methods, are ultimately what characterises a discipline as a science.[529] Employing inferential reasoning techniques along with the scientific method, a hypothesis will either be disproved and another formulated, or it will suffer inability to be disproved, which will motivate the criminalist to accept the hypothesis as the only possible truth.[530]

The *Daubert*-decision[531] in the United States of America induced procedural and evidential development of the admission of expert evidence from a juristic perspective, but also generated substantial debate about the apparent and disquieting lack of scientific foundation of some forensic science disciplines.[532] This debate ultimately moved the National Academy of Sciences to perform extensive research on the practice of forensic science in the American justice system, including the status of forensics as a 'science,' and published the findings of this investigation in 2009.[533]

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528 Inman and Rudin 2001:5.

529 Inman and Rudin 2001:5.

530 Inman and Rudin 2001:5-6.

531 *Daubert v Merrel Dow Pharmaceuticals, Inc.* (1993) 509 U.S. 579.

532 Crispino *et al* 2011:157.

533 The report is entitled: Strengthening Forensic Science in the United States. A path forward. A report by: The National Research Council of the National Academy of Sciences – National Academy of Sciences 2009. http://www.nap.edu/catalog.php?record_id=12589. Accessed on

Jackson *et al*[534] provides a simplistic delineation of the role of forensic science as being the provision of data to assist the criminal investigator and court to answer questions of great importance.

Dr. Henry C. Lee,[535] arguably one of the most influential forensic practitioners and academics in the United States of America in the late twentieth and early twenty-first centuries, describes forensic science as "...the application of the natural sciences to matters of the law..." in the broad sense.

Forensic science comprises a wide range of disciplines, each with its own set of distinct practices, techniques, methodologies, reliability, levels of error, general acceptability, and so forth.[536] Some disciplines are laboratory based, like DNA analysis, while others are subject to expert observation and interpretation of patterns, much like bloodstain pattern interpretation.[537]

In 2010, Ribaux *et al*[538] offered a novel and coherent characterisation of forensic science:

19/04/2012; Pardo 2010:367. The contents of this report will be discussed at some length in coming chapters.

534 2006:34.

535 Lee 2011:31.

536 National Academy of Sciences 2009. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

537 National Academy of Sciences 2009. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

538 2010:10. The authors define traces in this context as the most basic 'material or physical' data regarding a crime that may ultimately serve to answer the questions relevant to a criminal investigator, namely what, where, when, who, why and how.

> Forensic science is seen by most practicing forensic scientists as a narrow application of science to law oriented questions... We prefer to define forensic science as the study of traces, which themselves are present as remnants of an activity, most often a criminal activity.

In their apparently innovative view of forensic science and the potential it could offer, Ribaux *et al*[539] tries to move away from the traditional, yet restrictive definition of forensics, to potentially expose it to the tremendous contributions it is capable of making within the sphere of intelligence-led policing and decision-making within the criminal justice system. This idea, however, is not as novel as it may appear.

Eckert[540] recounts the application of science in the investigation of crimes in the latter part of the nineteenth century to enhance the validity and reliability of inferences drawn during the course of the investigation.

Stauffer[541] suggests that by the early twentieth century, Dr. Edmund Locard's work had already implied both "court-oriented" and "investigation-oriented" forensic science, the former being the conventional rationale of providing evidence as proof of fact in courts.[542] Stauffer[543] supports the cultivation of "investigation-oriented" forensic science as a constructive means to assist detectives in conducting

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539 2006:10.

540 1997:1

541 2004. http://www.swissforensic.org/presentations/assets/aafslocard.pdf. Accessed on 29/07/2012.

542 An example of this can be found in the long-standing method of prosecutorial request in DNA analyses in South African criminal trials where DNA-containing material was collected from the crime scene. That biological material would offer no real assistance to the detective during the course of an investigation, but, on demand from the public prosecutor, would operate as admissible evidence in the subsequent trial.

543 2004. http://www.swissforensic.org/presentations/assets/aafslocard.pdf. Accessed on 29/07/2012.

focused criminal investigations, although not necessarily being admissible in court.

While Stauffer and Ribaux *et al* encourage the return of the expansive and unlimited application of forensic science all the way through the criminal justice system, Kirk[544] maintains, simply, that the authentic purpose of forensic science is to establish individuality, in whatever fashion it does so, or to come as close as science would allow to achieving it. What individuality is within the forensic context is vital to the cause of proving facts in court.[545]

3.3.3.1. Criminalistics

Attempts at an authentic description of criminalistics seem shrouded in a cloud of mystery and contradiction.[546] Inman and Rudin[547] believe that the concept of 'criminalistics' was likely conceived by Austrian jurist, Hans Gross,[548] in the late 1800's, in response to a need to adequately describe the emerging field of 'police science', and to bring order and a scientific basis to the anarchic state of criminal detection at the time.[549]

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544 1963a:236.

545 Individuality, and aspects relating thereto, are discussed at greater length under 3.3.3.2.

546 Kirk 1963a:237; Inman and Rudin 2001:10; Fisher *et al* 2009:3.

547 2001:10.

548 The term is a derivative of the German *Kriminalistic*, although the English rendition did nothing to alleviate the difficulty in the pronunciation of the word. In fact, due to its apparent relation to 'criminology', many a criminalist has been incensed by references to being 'criminologists', since the latter term seems to be easier to articulate – Inman and Rudin 2001:10. In a paper published in 1996, bloodstain pattern expert and practicing criminalist, Herbert Leon MacDonell, emphasised the difference between criminology as a behavioural science concerned with the causation of crime, and criminalistics, suggesting that it is important to distinguish the two terms, as most people assume that criminalists practice criminology – MacDonell 1996:33.

549 Van der Westhuizen 1996:8.

Gross's theories on scientific and technical police investigations led to the implementation of criminalistics in many police agencies, the first of which, remarkably, by Alphonse Bertillon in Paris, France.[550] Some years later of course, Edmund Locard established the first crime laboratory in 1910, but unlike Bertillon, founded his laboratory in the Court of Justice in Lyon, France.[551] This produced a consequence most beneficial for criminal justice. While Bertillon's police-based facility produced investigative leads and modes of suspect identification for detectives, Locard's laboratory would cultivate expertise and scientific groundwork for later submission in court.[552] To the great misfortune of the profession, this practice was not replicated in other countries, and modern crime resolution depends on the three distinct practices: legal methodology, investigation by police agencies and analysis and expert opinions within forensic laboratories.[553]

Dr. Paul Leland Kirk,[554] opines that the "science" of criminalistics has evolved from the natural sciences in answer to the great need created by increased criminality in society. Dr. Kirk[555] describes criminalistics as being concerned with the examination of physical objects and facts pertaining to a crime, which could ultimately result in a reconstruction of the incident and an understanding of the crime. He warns, however,

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550 Crispino *et al* 2011:158.

551 Crispino *et al* 2011:158.

552 Crispino *et al* 2011:158-159.

553 Crispino *et al* 2011:159.

554 Kirk 1963b:368.

555 1963b:368.

that criminalistics is not an exact science, and great care should be taken in attempting to make definitive conclusions from data.[556]

Although the *Oxford Concise Dictionary*[557] erroneously describes criminalistics as being a synonym for 'forensics', the *Merriam-Webster Dictionary*[558] defines it as the "application of scientific techniques in collecting and analysing physical evidence in criminal cases."

While Dr. Henry Lee[559] describes the general term 'forensic science' as the application of natural sciences to legal affairs, he considers 'criminalistics' to be a subdivision of forensic science, portraying it as the umbrella term covering fingerprint comparison analysis, firearms and tool mark evidence, pattern evidence, *etcetera*, as opposed to, for example, forensic toxicology, anthropology, and other independently existing disciplines of science.[560]

Inman and Rudin[561] remind us that criminalistics relates neither to expertise in criminal law, nor to criminology, and suggest that the following is an apt, if slightly incomplete, representation of criminalistics:

> The scientific study and evaluation of physical evidence in the commission of crimes.

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556 Kirk 1963b:368.

557 Pearsall (ed.) 1999:338.

558 Merriam-Webster 2012. http://www.merriam-webster.com/dictionary/criminalistics. Accessed on 02/07/2012. This definition is supported by Hurley in Hurley 1995:34.

559 2011:32.

560 Lee 2011:32.

561 2001:11.

In 1954, the California Association of Criminalists (CAC) was founded in the United States of America to ultimately formalise the profession of criminalistics.[562] CAC describes criminalistics as a sub-division of forensic science, being the application of scientific techniques to investigate and resolve crime.[563]

Dr. Paul Kirk,[564] widely considered to be the father of modern criminalistics, lamented the apparent confusion surrounding this term in 1963, and fervidly expressed the need for clarification, yet fell short of providing a clear explanation himself.[565]

Criminalistics, and forensic science at large, has enjoyed its victories as a consequence of two fundamental principles: Locard's exchange principle[566] and Kirk's concept of individuality.[567] Locard's principle, namely, that every contact leaves a trace, was skilfully rephrased by Dr. Kirk in his 1953 publication, *Crime investigation: Physical evidence and the police laboratory*:

> Wherever he [the perpetrator] steps, whatever he touches, whatever he leaves, even unconsciously, will serve as a silent witness against him. Not only his fingerprints or his footprints, but his hair, the fibers from his clothes, the glass he breaks, the tool mark he leaves, the paint he scratches, the blood or semen he deposits or collects. All of these and more, bear mute witness against him. This is evidence that does not forget. It is not confused

562 California Association of Criminalists 2012. http://www.cacnews.org/membership/criminalistics.shtml. Accessed on 02/07/2012. This association, initially American based, has since expanded to include European countries.

563 California Association of Criminalists 2012. http://www.cacnews.org/membership/criminalistics.shtml. Accessed on 02/07/2012.

564 1963a:237.

565 Kirk 1963a:237.

566 As already discussed above under 3.3.1.

567 Crispino *et al* 2011:157.

> by the excitement of the moment. It is not absent because human witnesses are. It is factual evidence. Physical evidence cannot be wrong, it cannot perjure itself, it cannot be wholly absent. Only human failure to find it, study and understand it, can diminish its value.[568]

Dr. Kirk's concept of individuality directs that all objects of our universe are unique.[569] He opines that the true objective of a criminalist, in fact, of all of forensic science, is the pursuit of individualisation:

> The real aim of all forensic science is to establish individuality, or to approach it as closely as the present state of the science allows. *Criminalistics is the science of individualization.*[570]

The value of criminalistics as applied science within a criminal investigation is contained in the reliability and objectivity of the scientific testing.[571] This objectivity is what distinguishes forensic evidence from eye witness testimony, and what amplifies the evidential value added to forensic evidence compared to witness accounts.[572]

3.3.3.2 Identification versus individualisation

Five concepts establish the foundation of forensic science practitioners' work, namely transfer, identification, individualisation, association, and reconstruction.[573] Transfer, the interchange of matter between two

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568 As discussed in Crispino *et al* 2011:160-161. Locard's philosophies, including his exchange principle, have been influenced greatly by Gross - Crispino *et al* 2011:160.

569 Kirk 1963a:235-238, as discussed in Cole 2009:236 and Crispino *et al* 2011:161.

570 Kirk 1963a:236; Osterburg 1971:568. See also Osterburg 1969:97 and Saks 1998:1081.

571 Fisher *et al* 2009:3.

572 Fisher *et al* 2009:3.

573 Inman and Rudin 2001:76. The National Academy of Sciences also includes here evidence produced for purposes of suspect exclusion – National Academy of Sciences 2009. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

objects, represents the legacy created by the Locard exchange principle.[574] Associative evidence links people with a crime scene, while reconstruction requires insight into the sequence of an incident that occurred in the past.[575]

Identification is the reduction of a class of evidence to one, defining the physicochemical nature of a sample from the crime scene without possessing a reference sample.[576] Although philosophically speaking one would associate 'identity' with the quality of uniqueness, Kirk[577] explains that the term 'identification', within the context of a forensic investigation, should be interpreted to mean that the object in question can be categorised into a specific, restricted class.[578]

> For the criminalist to use the word "identification" in its accepted context is to admit that there is no reason for his special existence.[579]

In terms of this definition, a hair shaft may be described in terms of its morphological features as belonging to a white female, but it cannot, in the absence of genetic analysis of any DNA-containing material in the bulb of the hair shaft, be described as belonging to any one specific female to the exclusion of all others.

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574 Inman and Rudin 2001:76.

575 Inman and Rudin 2001:76.

576 Inman and Rudin 2001:78, 115.

577 1963a:236.

578 This is the case since science possesses its own sphere of identification, ranging from species in botany and zoology, to compounds in chemistry, and minerals in geology – Kirk 1963a:236.

579 Kirk 1963a:236.

By the 1960's, Kirk[580] suggested that the time had arrived to render proof of greater specificity; greater precision. Forensic scientists were urged to achieve *individualisation* in their analyses of specimens, should that specific science allow such individualisation.[581]

For individualisation, Inman and Rudin[582] use the following as definition:

> Concluding a singular common source for two items.

In this sense, in contrast to Kirk's view that individualisation is a principle, Inman and Rudin[583] rather consider it to be a process employing fundamental aspects of chemistry and physics to achieve its goal.

Osterburg[584] distinguishes between identification and individualisation by describing identification as the practice of positioning a sample in a predefined, known category, while individualisation expands on this by evaluating a combination of several conditions that exclusively embody that sample.

Perhaps no other example of forensic evidence enjoys more triumph in the business of achieving individualisation than DNA evidence. Here,

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580 1963a:236; Inman and Rudin 2001:114.

581 Kirk 1963a:236. In his 1963 publication, Dr. Kirk laments the failure of science to individualise blood evidence. He criticises blood's ability to merely *identify* the blood group of the source of the blood, rather than individualise the specific individual from whom the blood came. Of course, his concerns would have been eradicated when, in 1985, genetic profiling enabled scientist, Dr. Alec Jeffreys, to individualise blood evidence in the form of DNA typing – Eckert 1997:244.

582 Inman and Rudin 2001:115.

583 Inman and Rudin 2001:115.

584 1969:97.

the singular common source for the reference and evidence sources[585] of DNA-containing biological material will be the person relevant to the investigation, whether as suspect, perpetrator, victim, or possibly even witness.

Individualising characteristics are those examined features that are generated by an arbitrary, unrestrained process, and are used to isolate exhibits to a common origin.[586] Traditionally, certain kinds of evidence were considered to be of an identification nature only, without potential for individualisation. Blood analysis, for example, could initially only produce information on group classification, but knowing that the source possesses a certain blood type does not pinpoint a single person, but all persons with that blood group. Advances in the rigor of blood analysis have resulted in the individualising power of blood evidence in the form of DNA profiling.[587] Similarly, increased organisational formality and extent of propagation have endowed some categories of evidence with the potential for individualisation.[588]

The scientist's capacity to render identifying or individualising evidence relies on the legitimacy of several premises. These include the requirement that some physical objects and biological material exist in

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585 Reference samples represent samples from known origins, while evidence samples are the unknown sample collected from the crime scene. It stands to reason that the testing analyst would need to have a reference sample to generate an individualising match, since its absence would render it impossible for the analyst to provide it with any "identity". A fingerprint can only be matched to a specific person once it has been compared to fingerprints of known subjects.

586 Inman and Rudin 2001:129.

587 Inman and Rudin 2001:130.

588 Inman and Rudin 2001:130. An example of this is physical match evidence, handwriting evidence, and fingerprints - Inman and Rudin 2001:130.

distinctive form and that these objects or material have left some traces of themselves behind. Lastly, that the methods of detection, analysis and inference employed by the criminalist are adequately able to connect the trace to its origin.[589]

By the beginning of the twenty-first century, however, revolutions within the arena of law and forensic science prompted scholars in the respective fields to re-evaluate much of what was known about expert opinions and forensic science.[590] This included, along with great criticism of forensic identification techniques, a revised consideration of the individualisation powers of forensic evidence. Koehler and Saks[591] suggest:

> Given (a) the current lack of scientific support for claims related to individualization in the traditional forensic sciences, and (b) the likelihood that jurors will not meaningfully differentiate an examiner's individualization, we suggest that forensic examiners should be barred from offering individualization opinions.

Still, individualisation seems to be universally aspired to by the criminalistics professional and inability to isolate a single source for two items is often considered tantamount to forensic failure.[592] However, this view is distorted as identification evidence frequently satisfies the burden of proof in criminal proceedings, for example, identification of a firearm as a .22 calibre rifle, or of a certain make of shoe, and can therefore be of great value to both detectives and court.[593]

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589 Saks 1998:1081; Meintjes-Van der Walt 2006:153. See also the discussion in Saks 1998:1081-1094.

590 Pardo 2010:267.

591 Koehler and Saks 2010:1207.

592 Inman and Rudin 2001:122.

593 Inman and Rudin 2001:122.

3.3.3.3 Traditional forensic sciences

Traditional forensic sciences, also referred to as first generation forensic science,[594] have conventionally enjoyed a subordinate role in the hierarchy of evidence compared to eyewitness testimony and accused confessions, due in large part to its limited application.[595] It relies to an unnerving extent on the interpretation skills of the expert and includes handwriting analysis, firearms, tool mark and bite mark evidence, fingerprint comparison, trace evidence analysis, and much more.[596]

Murphy[597] describes first generation forensic methodologies as:

> ...experiential and observational, rather than technical or experimental. They are neither conceptually complicated nor scientifically rigorous.

Since first generation forensics are significantly intuitive and mechanically relatively simple, it does not necessitate the use of complex interpretive equipment or instrumentation, and can, for the most part, generate results that are perfectly comprehensible to laypeople.[598]

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[594] In the present study, the terms 'traditional forensic science' and 'first generation forensic science' will be used interchangeably as denoting the same concept.

[595] Murphy 2007:726.

[596] Murphy 2007:722-723, 726.

[597] 2007:726.

[598] Murphy 2007:727.

For the investigative community, first generation forensic sciences are reactive and independent in its investigative range, compelling the detective to first identify a suspect or object for comparison purposes, because first generation forensics are incapable of identifying a suspect on its own might.[599]

Meintjes-Van der Walt[600] confirms that traditional forensic evidence is submitted into evidence in trials on a regular basis and laments the virtually unimpeded fashion with which this type of evidence has been admitted into criminal trials.

So-called second generation forensic sciences are represented by a relatively novel type of evidence capable of identifying and individualising offenders at an astounding rate and level of reliability, for instance, DNA profiling, data mining,[601] location tracking,[602] and biometric technologies.[603]

While traditional forensics are relatively offence-bound, second generation forensics are applicable to a wide variety of offences.[604] These types of evidence are exceptional in their scientific vigour and

599 Murphy 2007:727.

600 2006:153.

601 This type of evidence is produced when large amounts of information are analysed for pattern recognition, for example, the analysis of telephone records – Murphy 2007:723 at footnote 6.

602 Satellite-based global positioning systems and cell phone triangulation are examples of this type of generated evidence – Murphy 2007:723 at footnotes 7.

603 Murphy 2007:723. Biometric technologies in this context suggest methodologies that depend on computer-generated comparisons and subsequent matches between observed biological features and a stored, known image in a database – Murphy 2007:723 at footnote 8.

604 Murphy 2007:728. For instance, while DNA evidence may be relevant to violent crimes, it may be equally relevant in offences like housebreaking and white collar crimes.

because of their methodological complexity, render it mostly inaccessible to the general public outside of science.[605] The instrumentation and equipment employed in analysing these exhibits are also of a much more intricate and costly nature, and include the use of computerised databases to accumulate massive amounts of data.[606] This aids in rendering second generation evidence, like DNA profiles, proactive in its investigative capability, in that it can provide detectives with a suspect on its own, and provide evidence of guilt.[607]

Second generation evidence has managed to expose both the fallibility and unreliability of first generation evidence, as well as the inability of criminal courts to exclude submission of such fallible evidence, and this has endowed second generation evidence with a sense of awe and trustworthiness.[608] Research has also cast doubt on the legitimacy of traditional forensic evidence, like handwriting analysis, trace evidence analysis and even fingerprint comparison.[609] Simultaneously, Murphy[610] warns against the blind acceptance of second generation evidence:

> It stands to reason that a system that failed to stem the abuse of untested or faulty forms of forensic evidence might also be ill-equipped to safeguard the use of more robust, complicated forms of such evidence... the very traits that make this new generation of forensic evidence so promising serve to raise concerns about the use of such evidence in the future.

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605 Murphy 2007:729.

606 Murphy 2007:729-730. The employment of databases in DNA profiling, for example, raises important concerns regarding issues of privacy. This will not be discussed here.

607 Murphy 2007:730.

608 Murphy 2007:723-724.

609 Murphy 2007:724, 745. Later chapters will reveal the dilemmas and concerns regarding first generation evidence at great length.

610 2007:724-725.

The dawn of the twenty-first century brought with it a kind of modern forensic revolution, which sounded a warning against the blind application of this kind of evidence.[611]

3.4 THE TRIAL

3.4.1 Expert evidence and scientific scrutiny[612]

Forensic science implements its capabilities within the criminal justice system by way of expert opinion.[613] Recent years have seen a tremendous dependence by criminal courts on the evidential assistance provided by scientific experts, but science itself has benefited from immense progression over the last few decades and this has proven to create some difficulty for lawyers, law-makers and presiding officers alike.[614] The advent of decisions in cases like *Daubert*,[615] and investigative reports like that produced by the National Academy of Sciences in the United States of America,[616] created a sense of urgency

611 Murphy 2007:749. The pathology of second generation sciences will enjoy more attention in coming chapters.

612 References to expert evidence, witnesses and scientific scrutiny here are merely of a superficial nature to place forensic evidence in context. Comprehensive discussions will follow in coming chapters.

613 National Academy of Sciences 2009. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

614 Meintjes-Van der Walt 2000a:771.

615 *Daubert v Merrel Dow Pharmaceuticals, Inc.* (1993) 509 U.S. 579.

616 National Academy of Sciences 2009. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

in the need to reassess forensic evidence for purposes of admissibility.[617]

In adversarial proceedings, the prosecution constructs a case with all evidence available, to assert the guilt of the accused in a court of law. The construction of the case would include the assimilation of forensic evidence produced by the investigating officials and the prosecution is under duty to engage in decision-making processes to determine the use of the expert evidence and issues relating to its admissibility.[618]

When the prosecution has submitted forensic evidence as proof of fact, it becomes the responsibility of the presiding officer to contemplate the relevance, reliability and probative value of the proffered testimony.[619] These considerations are multifaceted, complicated and, at times, greatly problematic. The expertise of the witness and daunting issues regarding the foundational principles of the science employed in the analysis of the evidence, are all concerns to be addressed by the presiding officer in deciding on expert evidence.[620] Zeffertt *et al*[621] explain that presiding officers' decision-making process regarding all evidence submitted during trial, must necessarily include inferential reasoning.

3.4.2 Decision-making and inferential reasoning by judicial officers

617 Meintjes-Van der Walt 2006:154.

618 Roberts 1994:471.

619 Meintjes-Van der Walt 2000:319.

620 Meintjes-Van der Walt 2000:320.

621 2003:93.

Fundamentally, presiding officers have to engage in inferential reasoning on two levels. Firstly, the trier of fact has to make conclusions regarding the truthfulness and reliability of the testimony submitted, for example, whether the witness is trustworthy, whether he was misguided in his initial observations although *bona fide* in intent, and so forth.[622] The kind of evidence inviting this particular set of inferential reasoning, is known as direct evidence, and includes statements of fact that the witness observed with his own senses.[623]

Secondly, even where truthfulness has been established, the presiding officer must infer whether the evidence provided indeed supports a finding of guilt against the accused.[624] This evidence is referred to as circumstantial evidence and ultimately relies on facts proven by direct evidence, though it also involves a potential rate of error absent in direct evidence.[625] This potential for error emanates from the accuracy of the presiding officer's evaluation of the evidence, and the subsequent determination of the degree to which the evidence renders the tendered fact more probable.[626]

In 1939, pertinent rules of logic upon which presiding officers must rely when engaged in inferential reasoning was formulated by the Appellate

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622 Zeffertt *et al* 2003:93.

623 Zeffertt *et al* 2003:93.

624 Zeffertt *et al* 2003:93.

625 Zeffertt *et al* 2003:93.

626 Zeffertt *et al* 2003:93-94. The court may, for instance, err in its reasoning or overestimate the probability of the truthfulness of the fact it alleges to prove – Zeffertt *et al* 2003:94.

Division in *R v Blom*.[627] Firstly, so the court held, whatever inference is drawn must be consistent with all the proved facts. Should even one fact fall outside the ambit covered by the inference, the inference cannot be drawn.[628]

Secondly, the inference should be the only possible conclusion supported by the proved facts. If more than one inference is supported by the facts, reasonably doubt must exist regarding the exclusivity of that conclusion.[629]

Several theories on probability and inferential theories have been suggested[630] in an effort to codify the process of inferential reasoning and decision-making by the presiding officer in cases involving forensic scientific evidence.

Contradicting forensic opinions have clouded the credibility of criminal proceedings and complicated the process of inferential reasoning by presiding officers globally. South Africa is not exempt from this predicament.[631] Augmenting this already thorny issue, is the remarkable speed with which advances in science and technology facilitate the

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627 1939 AD 188. See also Zeffertt *et al* 2003:94; Schwikkard and Van der Merwe 2009:538. In this case, the accused person was charged with the murder of a woman whose corpse was positioned on railway tracks postmortem. In the absence of direct evidence of the accused's guilt, the court followed a path of inferential reasoning based on circumstantial evidence, which ultimately resulted in the conviction of the accused. On appeal, the erstwhile Appellate Division of the High Court endorsed the logical reasoning by the trial court and dismissed the appeal.

628 *R v Blom* 1939 AD 188:202-203.

629 *R v Blom* 1939 AD 188:202-203.

630 See Zeffertt *et al* 2003:106. An example of such a theory is Bayes' Theorem, and will be thoroughly discussed in coming chapters.

631 Meintjes-Van der Walt 2000:320.

ability of forensic scientists to answer questions put to it by law, and how slow the legal fraternity is to catch up to the answers.

3.5 CONCLUSION

A noticeable obscurity exists in the nomenclature regarding forensic science and aspects relating thereto. The fact that so much of the profession is enveloped in a fog of mystery, as well as the fact that the modern forensic revolution has cast so much doubt over the scientific foundations of what was already considered 'known', has enhanced the sense of that forensic science is "under siege".[632]

Understanding the true meaning and nature of forensic science, criminalistics, and terms related to the practice of these professions are the very first steps to building a sound foundation for also comprehending the operation, possibilities and potential rates of error of the varying disciplines within forensic science. Once this insight has been achieved, the stakeholders in crime scene investigation might engage in more efficacious application of experts in different fields, detectives might enjoy a more shrewd interpretation of clues generated by forensics, and expert witnesses and legal decision-makers might guard more carefully against over-statement of scientific opinion in court.

All these aspects are vital in returning to forensic science the estimable reputation it once benefitted from.

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[632] Cole 2009:234. The notion that Pyrek clearly conveys in her treatise: *Forensic science under siege: The challenges of forensic laboratories and the medico-legal death investigation system*, published in 2007.

CHAPTER 4

THE PILLARS OF PROOF: EYEWITNESS TESTIMONY AND DNA EVIDENCE

4.1 INTRODUCTION

Enabling the investigating officer to provide answers to 'the 5WH formula,'[633] to exculpate suspects, and to ultimately provide the state prosecutor with an arsenal of evidence to prove the elements of the crime with which a suspect is charged, requires the harvesting of as much data regarding the offence as possible. In point of fact, Joubert[634] describes the burden on detectives:

> ...to present the most reliable and admissible evidence to the court in order to enable the court to reach an accurate decision based upon all the facts placed before it.

In South Africa, as in foreign jurisdictions, many offences are committed by people unknown to the victim, and in such cases, the detective is burdened with the responsibility of harvesting evidence of high probative value, not only of what, why, when, or how the crime was committed, but also by whom.[635] The primary sources of evidence the investigator will employ are statements by victims and eyewitnesses,

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633 The questions pertaining to the criminal event, namely when, where, who, what, why and how, as described by the National Centre for Policing Excellence 2005:68 and Alifano 2006. http://www.worldwidelawenforcement.com/docs/FUNDAMENTALS%20OF%20CRIMINAL%20INVESTIGATIONS.pdf. Accessed on 18/02/2012.

634 2010:336.

635 Institute for Security Studies 1998. http://www.iss.co.za/pubs/monographs/No31/Work.html. Accessed on 18/03/2011.

physical evidence, such as DNA profiles and fingerprints, as well as confessions.[636]

An overwhelming amount of cases, however, are opened annually in which a clear indication of the identity of the alleged offender is available. Should the investigator regard the initial evidence in the docket sufficiently clear and reliable, he is likely to make an arrest within days of the complaint being instituted.[637] Regardless, it is the duty of the investigating officer to ensure that adequate evidence exists to support the allegations, since a perturbing amount of charges are laid against individuals who have not committed an offence.[638] In order to give effect to this responsibility, the detective will once again rely on the reliability of statements by victims and eyewitnesses, as well as on physical evidence.[639]

In this Chapter, the heavy reliance by decision-makers in the criminal justice system on eyewitness statements and testimony, as well as on forensic DNA evidence, the golden standard of scientific evidence, will be examined in light of *inter alia* its nature, reliability and evidential weight. Preceding this discussion will be an examination of the extent and prerequisites of proof of fact in the context of criminal trials.

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636 Institute for Security Studies 1998. http://www.iss.co.za/pubs/monographs/No31/Work.html. Accessed on 18/03/2011.

637 Institute for Security Studies 1998. http://www.iss.co.za/pubs/monographs/No31/Work.html. Accessed on 18/03/2011. In South Africa, the initial investigation of dockets is conducted by so-called 'standby investigators' during the first week of the complaint being made. After the docket has been registered on the computerised crime administration system (CAS) at the relevant station, the standby detective will conduct basic information gathering, after which the docket will be submitted to the detective who is to manage the rest of the investigation on the docket.

638 Institute for Security Studies 1998. http://www.iss.co.za/pubs/monographs/No31/Work.html. Accessed on 18/03/2011.

639 Institute for Security Studies 1998. http://www.iss.co.za/pubs/monographs/No31/Work.html. Accessed on 18/03/2011.

4.2 PROOF OF FACT AND RATIONAL ADJUDICATION

The similarities between law and science involve more than just historical proximity. Proof[640] in both these vocations amounts to evidence or information of sufficient quantity and quality to authenticate an inference, while the process of finding facts in both science and law engages the same logic.[641]

Rules contained in the South African law of evidence, although subject to the supreme Constitution of the Republic of South Africa of 1996, guide and regulate the procedure and techniques in proving facts in criminal (and civil) courts.[642]

South Africa, due to its observance of the English law of evidence, benefits tremendously from the rich tradition and steady development of the Anglo-American evidence scholarship,[643] specifically at the hands of authors like American, John Henry Wigmore,[644] and, perhaps more contemporary, English legal scholar, William Twining.[645]

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640 Proof in law is defined by Schwikkard and Van der Merwe as the receipt of probative material by a court of law in support of a tendered fact, and the subsequent recognition by that court of the truth of the specific fact as it relates to the case – Schwikkard and Van der Merwe 2009:19.

641 Loevinger 1991-1992:323; Meintjes-Van der Walt 2000:319.

642 Joubert 2010:336.

643 Better known as the strict or common law tradition of evidence scholarship, it is a derivative of the English procedural system of adversarial jury trials. It stands in contrast to the Continental or civil law system with its inquisitorial trials, guided by professional judges in the absence of juries – Schwikkard and Van der Merwe 2009:6. See also Twining 2006:36-75 for a comprehensive exposition on history of the Anglo-American evidence scholarship.

644 Zeffertt *et al* 2003:34-35. John Henry Wigmore (1863-1943) was an American legal scholar and lecturer who published one of the greatest treatises on the law of evidence, *Treatise on*

According to Wigmore,[646] rules of the law of evidence fork into two divergent branches, namely the principles of proof, and admissibility.[647] The latter concept, described as procedural regulations applied to prevent mistaken persuasion, has enjoyed intense attention from scholars and researchers, while the former, concerned with probabilistic persuasion, was abandoned to chance.[648] Indeed, the twentieth century saw great emphasis on rules of evidence in both legal scholarship and education, whereas Wigmore's "science" of proof failed to maintain the curiosity of legal scholars and practitioners.[649]

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the Anglo-American System of Evidence in Trials at Common Law, better known as *Wigmore on Evidence,* in 1904-1905. While the initial publication of this work occupied four volumes, its importance was duly recognised and the text maintained and expanded upon, resulting in the twelve large volumes it occupies today. Lesser known was Wigmore's fervent enthusiasm for the teaching of the science of fact-finding, publishing one of the most intellectually sophisticated manuscripts on the analytical and psychological nature of proof, *The Science of Judicial Proof* in 1913, a revised edition in 1931, and another in 1937 – Eggleston 1989:370; Twining 2006:18. It is interesting to note that despite remarkable developments in both the fields of law and forensic science, Wigmore's ideas on logic and logical reasoning have remained relevant throughout the time since the publication of his work.

645 Zeffert *et al* 2003:35. Professor William Twining from University College in London, published two great manuscripts on one of his main pursuits, the logic of proof. *Analysis of Evidence* (which he co-authored with Terence Anderson) was first published in 1991, and the second edition in 2005, while *Rethinking Evidence* was published in 1990, and then again in 2006 – University of Oxford *s.a*. http://www.csls.ox.ac.uk/associates/william_twining.php. Accessed on 20/08/2012. While Wigmore taught methods for determining judicial proof by way of transcripts of American court cases, Twining used both American and English cases in his teachings – Eggleston 1989:371.

646 Anderson and Twining 1991:49, discussing Wigmore's work in *The Science of Judicial Proof*.

647 The terms 'admissibility' and 'weight of evidence' must be clearly differentiated. If the evidence can properly be accepted by the court (for instance, it complies with the condition that the evidence must be relevant to the facts in issue and the expert providing the opinion must be better qualified to draw inferences than the court), it is admissible and no degrees of admissibility exist. Evidence is either admissible or it is inadmissible. Once admitted, however, the persuasiveness of that evidence must be commented upon by court at the conclusion of the case to determine whether or not the standard of proof has been satisfied by the prosecution – Schwikkard and Van der Merwe 2009:20.

648 Anderson and Twining 1991:49; Twining 2006:64.

649 Twining 2006:64.

Wigmore[650] laments this situation, arguing that a "probative science", the science of proof, is imperative as it epitomises the very purpose of judicial enquiry, while rules of admissibility are simply precursors to the primary pursuit, which is:

> ...the persuasion of the tribunal's mind to a correct conclusion by safe materials. This main process is that for which the jury are *[sic]* there, and on which the counsel's duty is focused.

Wigmore's lamentations were echoed in the latter part of the twentieth century, when, in 1978, Professor William Twining too deplored the existing state of evidence scholarship in England, and listed his critique regarding the "corpus of literature" of evidence.[651] Among these points of criticism is the imbalance in the development of admissibility rules, especially exclusionary rules, *versus* other considerations, such as logic and proof, and the potential for error and misconception regarding the subject as a whole that this might bring about.[652]

Twining[653] elucidates the objective of Wigmore's theory on logic-based, inductive persuasion, not as being a renewal of the art of rhetoric, but rather to cultivate skills in thinking about evidence and, perhaps even more importantly, to study cognitive processes (most significantly,

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650 Anderson and Twining 1991:49, discussing Wigmore's work in *The Science of Judicial Proof*; Twining 2006:64.

651 Twining 2006:2. Although Prof Twining has since applauded the progress that has been achieved regarding some of the issues he identified in 1978, it is submitted that it is imprudent to accept that all questions and criticisms regarding the subject have been answered and resolved, especially since, by 2006, Twining still endeavours to investigate the reasons for the "neglect" of evidence scholarship in legal education in his treatise, *Rethinking Evidence*.

652 Twining 2006:2.

653 2006:19-20.

inductive logic) related to the systematic analysis of evidence in order to ultimately determine its probative value.

Wigmore describes the principles of proof as embodying the mind's natural practices that follow in response to tendered evidence and contends that the legal profession must urgently cultivate a science in which jurists may study these natural, rational cognitive processes.[654] Once the rules of admissibility have fulfilled their purpose of allowing trustworthy evidence into proceedings, the legal practitioner embarks upon the most important aspect of criminal proceedings, that is, using rational, logical reasoning to persuade the court of the facts in issue.[655]

Wigmore[656] eloquently describes the private process a legal practitioner may follow in assessing the evidence prior to addressing a court:

> In a given case, then, [the lawyer's] task is to analyze and classify each single piece of evidence in the entire mass, so as to give each piece its value and to lay them all out in their relation to each other. He can then proceed, step by step, to determine their total effect on his mind. Since he can now explain to himself (and to others) his reasoning on each piece, he can also explain his reasoning on the net result.[657]

This approach has been entrenched in South African law by way of case precedent as the correct method in which presiding officers must assess whether the State has successfully persuaded the court of its

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654 Anderson and Twining 1991:50. This concept can also be referred to as the 'rationalist tradition of evidence scholarship.'

655 Anderson and Twining 1991:50.

656 Anderson and Twining 1991:50, discussing Wigmore's rationale in *The Science of Judicial Proof.*

657 Eggleston criticises Wigmore's apparent inability to guide the jurist in the task of combining the effect of individual pieces of evidence to draw a final, definitive inference – Eggleston 1989:371.

case. Nugent JA confirmed in *S v Mbuli*[658] the view held by the Lesotho Court of Appeal in 1980 in the case of *Moshephi and Others v R*:[659]

> The question for determination is whether, in the light of all the evidence adduced at the trial, the guilt of the appellants was established beyond reasonable doubt. The breaking down of a body of evidence into its component parts is obviously a useful aid to a proper understanding and evaluation of it, but, in doing so, one must guard against a tendency to focus too intently upon the separate and individual parts of what is, after all, a mosaic of proof. Doubts about one aspect of the evidence led in a trial may arise when that aspect is viewed in isolation. Those doubts may be set at rest when it is evaluated again, together with all the other available evidence. That is not to say that a broad and indulgent approach is appropriate when evaluating evidence. Far from it. There is no substitute for a detailed and critical examination of each and every component in a body of evidence. But, once that has been done, it is necessary to step back a pace and consider the mosaic as a whole.

Schwikkard and Van der Merwe[660] explain that proving facts in court within the Anglo-American model is founded upon adversarial principles and a strict system of evidence, seeking to "...discover and protect the truth." Nevertheless, Meintjes-Van der Walt[661] highlights the point that definitive factual determinations within the adjudicative process cannot be made with certainty, but that probabilistic determinations are the most attainable objective that may be achieved by a court. Of imperative concern is the determination whether the State has accomplished such a degree of probability in presenting its evidence,

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658 2003 (1) SACR 97 (SCA) at 110.

659 *Moshephi and Others v R* C. of A. (CRI) 8-11 of 1980 at 3.

660 2009:6. Damaška describes the bewildering effect the rules of evidence in the Anglo-American system may have on legal practitioners from the Continental system when, on occasion, they are compelled to collaborate with their common law peers – Damaška 1997:1.

661 2005:417-418.

that it can be said that the State has proved its case beyond reasonable doubt.[662]

Meintjes-Van der Walt[663] further points out that "...evidence is not proof," and explains that where the State has presented all available and admissible evidence in support of its case, the court still has to be persuaded, by way of a process of logical and inferential reasoning and evaluation that the evidence represents sufficient probability to succeed as proof beyond reasonable doubt of the allegations put forward by the State.

This does not mean, however, that the explanation offered by an accused person should be rejected simply because the State's version of events proves 'more probable'.[664] The State still bears the burden of having to prove its case beyond reasonable doubt, which, according to the court in *S v Van Tellingen,*[665] does not imply that weighing of probabilities in criminal proceedings is inappropriate. In *S v Chabalala,*[666] Hefer AJA asserted the following regarding the correct approach in evaluating evidence:

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662 Meintjes-Van der Walt 2005:418. The burden of proof refers to the duty on the State to persuade the court of the truth of certain propositions by the conclusion of the trial. This must not be confused with the term 'evidentiary burden', which supposes the obligation on one party to submit sufficient evidence before court to oblige the opposing party to answer the allegations, or alternatively, to adduce adequate evidence to contest a *prima facie* case put forward by the opposition – Schwikkard and Van der Merwe 2009:559.

663 2005:416. When a fact is said to have been proven, probative material regarding such fact was received by court, followed by the court's acceptance of such fact. 'Evidence' is not yet proof and still subject to court's evaluation according to set standards to determine if the standard of proof in criminal trials, that is, beyond reasonable doubt, has been satisfied – Schwikkard and Van der Merwe 2009:19.

664 *S v Van Tellingen* 1992 (2) SACR 104 at 106.

665 1992 (2) SACR 104 (C) at 106.

666 2003 (1) SACR 134 (SCA) at para 15 on 139-140. In *S v Munyai* 1986 (4) SA 712 (V) at para E, the court confirmed that it is wholly acceptable to view probabilities in the evaluation of a

> The correct approach is to weigh up all the elements which point towards the guilt of the accused against all those which are indicative of his innocence, taking proper account of inherent strengths and weaknesses, probabilities, and improbabilities on both sides and, having done so, to decide whether the balance weighs so heavily in favour of the State as to exclude any reasonable doubt about the accused's guilt. ...a trial court (and counsel) should avoid the temptation to latch on to one (apparently) obvious aspect without assessing it in the context of the full picture presented in evidence.

Wigmore[667] defines 'proof' in criminal proceedings as follows:

> ...the persuasive operation of the total mass of evidentiary fact as to a probandum.[668]

Loevinger[669] describes the concept of proof as the rational, intellectual support for a given inference, adequate enough to verify the accuracy of the inference.

The evolution from evidence to *probandum*, according to Wigmore,[670] occurs in two phases. Firstly, an inference, based on the data before court, is made by way of inductive reasoning to arrive at transitional factual generalisations.[671] Then, founded on these transitional generalisations, more inferences are drawn as new evidence is

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case, and that, along with probabilities, improbabilities on either side of the accusatorial match should also not be ignored.

667 From J.H. Wigmore's *The Science of Judicial Proof*, as discussed in Menashe 2008:34.

668 'Probandum' in this context refers to the concept of *facta probanda,* which denotes the facts in issue in a given case that must be proven for the case to succeed, while the *facta probantia* are those facts relevant to the facts in issue and may likely prove or disprove the *facta probanda.* (Facts in issue may be distinguished further by dividing it into primary *facta probanda*, those facts placed in issue during the pleading stage, and secondary *facta probanda*, which refers to the *facta probantia* that are placed in issue during pleading stage) – Schwikkard van Van der Merwe 2009:17-18.

669 1991-1992:323.

670 From J.H. Wigmore's *The Science of Judicial Proof*, as discussed in Menashe 2008:34.

671 Menashe 2008:34.

tendered. This course of action proceeds until ultimately the court arrives at definitive conclusions regarding the probability of submitted facts.[672]

Meintjes-Van der Walt[673] refers to this process as one depending on generalisations, which operate as the connection between evidence, specifically expert evidence that is fundamentally circumstantial in nature, and the fact in issue.

Judicial officers, legal practitioners and forensic scientists dealing with issues of fact are all constantly required to make judgments regarding probabilities throughout a criminal trial.[674] An accurate description of what 'probability' comprises is only available to the extent that one of several theories regarding this concept may be applicable to a given set of circumstances.[675]

Meintjes-Van der Walt[676] considers the different conceptual delineations of the term 'probability'. Initially, 'probability' simply denoted a scenario being 'provable' or 'capable of being tested.' Later, it morphed into a secondary, slightly simpler definition, namely 'likely to happen'. Finally, arguments have been submitted that it may also refer to the 'degree of

672 Menashe 2008:34. These steps of inferential (inductive) reasoning must at all times comply with the rules of logic as formulated in *R v Blom* 1939 (AD) 188, and discussed in Chapter 3.

673 2005:420.

674 Meintjes-Van der Walt 2000:324.

675 Meintjes-Van der Walt 2005:419.

676 2005:419.

likelihood or persuasion', a definition that seems to find general acceptance among members of the legal fraternity.[677]

Forensic specialists testifying in criminal proceedings might express the results of their experiments in either verbal or mathematical terms of probability. Instances of verbal expression might include terms like "being sure beyond reasonable doubt", "highly likely", "likely", "probable", "possible" and other similar expressions of varying degrees of probability.[678] Mathematical or statistical expressions may include stating the chances of a particular result occurring as being "one chance in 1 trillion."[679]

Around the 1970s, forensic scientists offering expert evidence in criminal proceedings required a theoretical base or measure of expressing the strength of the evidence they so submitted.[680]

Several theories on probability determination have been proposed since the idea of solving questions in science through the use of logical and deductive reasoning took root in the mind of the great Aristotle.[681] As mentioned, probability determination is realised by way of rational, logical inferences. One such theory of inference, Bayes' Theorem,[682]

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677 Meintjes-Van der Walt 2005:419.

678 Meintjes-Van der Walt 2000:325.

679 Meintjes-Van der Walt 2000:325. This type of probability expression is employed in DNA profiling reports.

680 Redmayne 1996:749.

681 Loevinger 1991-1992:324. Kaye discusses seven theories of probability – Kaye 1988:2-5.

682 This theory has been named after its designer, Thomas Bayes – Loevinger 1991-1992:324-325.

suggests a method for calculating the probability of a hypothesis being true, based on the addition of new evidence to an already existing set of data. Simply put, Bayes' theory allows for the increased probability of the truth of one hypothesis in the light of new evidence pertaining to that hypothesis.[683] The strength of a conclusion based on a known set of facts depends on whether those facts are anticipated in the specific circumstances of the case and can therefore distinguish the true hypothesis from another.[684]

Mathematical determination of the probabilities of hypotheses based on Bayes' theory renders it possible to ascertain from a set of premises any inference logically contained in those premises.[685] Upon using this theory, one requires a prior probability, which refers to an estimation of how probable a given hypothesis is before revising it in view of new evidence.[686] The formula employed in a Bayesian calculation is:

$$P(h|e) = P(e|h)P(h) / P(e)$$[687]

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683 Redmayne 1996:748.

684 Loevinger 1991-1992:324. This theory was formulated by Thomas Bayes, but his work was only published posthumously in 1763. Although it is not frequently employed in legal proceedings, selected jurists and scientists still use this method in probabilistic calculations. Loevinger recalls an interesting example of the application of this theory in a murder case where traces of copper, lead, zinc, silver and blue fibers were found on the scene of the offence. When someone was detected wearing blue overalls containing all the trace substances found in the scene, it seemed highly probable that this person committed the murder. However, when applying the formulas of the Bayes Theorem to the specifics of the case, it appears that, while the murder was committed in a small town with a high number of miners working in blue overalls containing the same traces of metals, the probability of finding those substances on an innocent person became that much higher, thereby lowering the initial evidential value of the trace substances – Loevinger 1991-1992:324-325.

685 Loevinger 1991-1992:325-326.

686 Redmayne 1996:748.

687 Loevinger 1991-1992:327.The symbol | denote 'given'. Thus, P(h|e) means 'the probability of the hypothesis given the evidence.'

According to this formula, the subsequent probability is proportional to the prior probability multiplied by a factor produced by a revision of the prior probability on the basis of the new evidence, where P(h|e) is the subsequent probability of h given e, P(e|h) is the probability of e given h, P(h) is the prior probability of h (the hypothesis), and e is the new evidence.[688]

Redmayne[689] offers a functional example of the application of Bayes' Theorem in the presentation of expert evidence in a case of homicide, which may serve to illuminate the above-mentioned formula. Blood found on the scene of a homicide and analysed as to its composition, exhibits elements shared by one in a thousand members of a given population. Upon analysis of the suspect's blood, it is found to contain this very composition of elements. What is the relevance of the 1:1000 frequency of the specific blood composition to the adjudicator? In employing the Bayesian approach, a likelihood ratio will be used to determine the probability of that blood being discovered at the crime scene in view of two hypotheses.[690]

On the one hand, if the assumption is made that the crime scene blood is undoubtedly that of the murderer, one would hypothesise that P(e|h) is the probability of discovering the blood if the suspect did in fact commit the murder, expressed as P(B|M).[691] The second hypothesis

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688 Loevinger 1991-1992:327. The expression of the Bayesian model in numeric form was made possible by George Boole when, in 1854, he illustrated for the first time the capability of algebraic formulas and codes to articulate logical relationships – Loevinger 1991-1992:325.

689 1996:750.

690 Redmayne 1996:750.

691 P being equal to the probability; B equal to the blood evidence (therefore e, the evidence); and M being the hypothesis that the suspect committed the homicide (or h in the basic formula).

would amount to P(B|nM), the probability of discovering the blood on the scene if the suspect did not murder the victim.[692] The expert testifying in the case would impart the following representation of the likelihood ratio:

$$\frac{\text{The probability of the evidence (finding blood) if the suspect murdered the victim } P(B|M)}{\text{The probability of the evidence given that the suspect did not commit the murder } P(B|nM)}$$

This likelihood ratio is a numerical representation of a piece of evidence pertaining to its capacity to distinguish between the two hypotheses considered.[693] Incorporating the given frequency of the blood composition (that is: 1:1000), the following formula can be generated:

$$\frac{1}{0{,}001}$$

Calculating this formula would produce a likelihood ratio of 1000, meaning it is 1000 times more likely that the blood will be discovered on the crime scene if the suspect killed the victim, thereby supporting the hypothesis that the suspect is guilty and rendering the evidence relevant.[694]

While data pertaining to the *evidence* was obtained by the calculation, the presiding officer would still want information regarding P(h|e), the

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692 Redmayne 1996:750.

693 Redmayne 1996:750.

694 Redmayne 1996:750. Redmayne explains that a likelihood ratio of greater than one is supportive of the examined hypothesis, while a ratio between zero and one indicates that the evidence undermines the hypothesis – Redmayne 1996:750-751.

probability that the suspect committed the offence given the evidence, expressed as P(M|B).[695] The calculation will be formulated as follows, based on the Bayesian model [P(h|e) = P(e|h)P(h) / P(e)]:[696]

Prior probability x likelihood ratio {1000} = Subsequent probability

$$\frac{P(M)}{P(nM)} \quad x \quad \frac{P(B|M)}{P(B|nM)} \left\{ \frac{1}{0{,}001} \right\} = \frac{P(M|B)}{P(nM|B)}$$

Redmayne[697] opines that the Bayesian model calls attention to the different questions to be addressed by the forensic expert on the one hand, and the presiding officer on the other. The expert must concern himself with issues in terms of P(B|M), that is, the probability of finding the blood given that the suspect committed the homicide. In contrast, the fact-finder must dedicate himself to questions pertaining to the posterior or subsequent probability, P(M|B), which is the probability that the suspect did in fact commit the crime given that the blood was discovered on the scene.[698] Evett[699] explains succinctly that the preoccupation with the issue of the probability that the suspect in a matter was at the scene of the offence, is exclusively the responsibility of the court. Conversely, the scientist should address the probability of

695 Redmayne 1996:751.

696 Redmayne 1996:751. This model provides the fact-finder with a formula to update the probability of the truth of a hypothesis, but does not require the fact-finder to use precise quantitative data, as this is unnecessary for an accurate description of decision-making – Redmayne 1996:751.

697 1996:751.

698 1996:751. The presiding officer must concern himself with this question as it refers to the prior probability of the hypothesis being true.

699 1987:99.

the *evidence* given that the suspect was at the crime scene, and the same probability given that the suspect was not at the scene.[700]

Confusing the two probability determinations is referred to as 'prosecutor's fallacy', and will inevitably lead to prejudice against the accused.[701] The case of *R v Deen*[702] provides an illuminating example of a forensic expert committing 'prosecutor's fallacy.' Here, the appellant's appeal on his conviction of rape succeeded when it became clear that the testimony of the forensic expert for the prosecution caused the fact-finder (in this case, the jury) to confuse a 1:3000000 probability of discovering DNA matching the defendant's at the crime scene if he was not guilty, with a 1:3000000 probability that the accused had not committed the rape at all.[703] The expert testified erroneously that match probability equals the probability that the DNA containing material originated from a source other than the accused, and indicated under cross-examination that the odds of the DNA containing material belonging to any other man other than the accused, is 1:3000000. The effect of such testimony was a significant misrepresentation of the probative value of the evidence against the accused.

The defence attorney's fallacy, like the prosecutor's fallacy, refers to an erroneous probability determination, caused by a substantial disregard for evidence on identification for the simple reason that many people share the specific identification feature.[704] If expert testimony reveals

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700 Evett 1987:99. See also Meintjes-Van der Walt 2000:340.

701 Redmayne 1996:751. See also Meintjes-Van der Walt 2000:340.

702 *R v Deen* [1994] The Times, 10 January 1994.

703 Redmayne 1996:751-752.

704 Meintjes-Van der Walt 2000:342.

that a specific trait might be found in one in every 100 000 people within a population of 60 million people, it would be inappropriate for the defence to argue that because 600 people in the country will possess that trait the court must assign no probative value thereto. No data will be available on these people, their gender, age, and so forth, and what opportunity they could have had to deposit the DNA containing material where it was found.[705] All evidence should be considered with due regard to the prior probability of the suspect's guilt, as well as the likelihood ratio of the evidence.[706]

While it has been suggested that Bayes' theory might be the most accessible and valuable tool in dealing with forensic evidence in court,[707] not all scholars are entirely enthused about the Bayesian model. Norton[708] suggests that Bayesianism is incapable of solving the problems relating to inductive reasoning and that it should therefore not be viewed as the universal logic of induction. Meintjes-Van der Walt[709] reminds fact-finders that the formula determines the probative value of the evidence in light of the formulated hypothesis, not whether the accused actually committed the crime. The employment of Bayesianism within the forensic context is contentious, as notions of probability differ significantly. This has rendered the Bayes' theory, along with other theories of probability, inappropriate in determining legal proof.[710]

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705 Butler 2010:251.

706 Meintjes-Van der Walt 2000:342.

707 Meintjes-Van der Walt 2000:339.

708 2010:769.

709 2000:339.

710 Redmayne 1996:749.

Evaluation of forensic evidence frequently involves the assessment of 'match' evidence, which is information that specific points of similarity exist between two items of evidence.[711] Meintjes-Van der Walt[712] contends that evidence on the 'matching' nature of two items under investigation should be accompanied by contextual information (in the case of fingerprint evidence for instance, an explanation of the meaning and relevance of ten points of similarity) or statistical data regarding the incidence rate of the 'matching' attribute.

It is unreservedly incorrect for legal practitioners and decision-makers to assume that 'matching' evidence necessarily represents definitive proof of a match between the reference sample (the suspect) and the crime sample (evidence obtained from the crime scene).[713] Koehler,[714] in reference to DNA evidence, warns:

> ...a more accurate description of the evidence is "a *report* of a match between the suspect and crime sample." Like all evidence there is a risk of error associated with DNA evidence... The evidence in question, therefore, is not a DNA match but a report of a DNA match. Accordingly, it is important to consider the role of error rates in determining DNA-related likelihood ratios.

Evidence assessment does not of necessity materialise in mathematical expression only. Judicial decision-makers frequently employ narrative in the fact-finding process, as narrative and scrutiny are complementary in proving past events.[715] It is with narrative that the legal practitioner and

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711 Meintjes-Van der Walt 2000:323.

712 Meintjes-Van der Walt 2000:323.

713 Koehler 1996:868. Also referred to in Meintjes-Van der Walt 2000:323. In other words, that the 'match' represents individualizing evidence.

714 1996:868-869.

715 Twining 2006:244; Meintjes-Van der Walt 2000:337.

forensic expert must convince the court in persuasive, rational, inductive tone, of the truth of the proffered evidence.[716] Despite inherent dangers contained in story-based evidence evaluation, both sides to an adversarial dispute will attempt to generate persuasive arguments integrating elements of the forensic evidence to confirm tendered facts, or to dispute the opposition's allegations.[717]

In the context of the role of forensic evidence in the fact-finding mission, presiding officers are confronted with the daunting task of establishing the quality, reliability and validity of sometimes technical and intricate expert evidence.[718] Additionally, they must determine which elements of the evidence are irrelevant to the facts in issue, and must subsequently determine what weight is to be applied to the relevant evidence[719] in order to comprehend its persuasive effect in the over-all picture of probabilistic determinations. In the inauspicious circumstances where judicial decision-makers are confronted with two conflicting expert opinions, they are tasked with the responsibility of deciding which opinion is rendered more probable by the available evidence.[720]

Meintjes-Van der Walt[721] warns that the conventional methods of assessing evidence provided by witnesses, such as considerations of demeanour, credibility, and so forth, are emphatically inadequate in

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716 Meintjes-Van der Walt 2000:337.

717 Meintjes-Van der Walt 2000:338.

718 Meintjes-Van der Walt 2000:326.

719 Meintjes-Van der Walt 2000:319.

720 Meintjes-Van der Walt 2000:324.

721 2000:321.

assigning degrees of reliability and legitimacy to expert forensic evidence. Furthermore, Meintjes-Van der Walt[722] also suggests the following regarding the *Daubert*-case[723] and assessing expert evidence in South African criminal litigation:

> It is argued that the admissibility test for expert scientific evidence as put forward by the Supreme Court of the United States in *Daubert v Merrell Dow Pharmaceuticals Inc*. should not significantly influence South African courts on the issue of the admissibility of expert evidence. However, it is contended that these criteria should be borne in mind when the fact-finder evaluates the specialist evidence and can serve as justification in the judgment.

The four criteria formulated in the above-mentioned case, while most constructive in evaluating scientific evidence, is wholly inadequate in this endeavour by itself.[724] It has been proposed, however, that the application of these criteria in assessing evidence will educate South African decision-makers on the technicalities of science and scientists, which, in turn, will be formative in the determination of probative value of such evidence.[725]

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722 2000:326-327. The criteria, as already mentioned above, include: a) whether the theory employed in the expert evidence is testable, falsifiable, or refutable, b) whether the theory has gained general acceptance within the scientific community, c) whether the theory has been subjected to peer review and publication in such a way that a high probability exists that errors in methodology would have been detected, and d) what the known or potential error rate is and the existence and maintenance of standards controlling the techniques operation – Meintjes-Van der Walt 2000:327.

723 *Daubert v Merrel Dow Pharmaceuticals, Inc.* (1993) 509 U.S. 57. A comprehensive discussion of the criteria formulated in this case, as well as others regarding evidence admissibility, will follow in Chapter 6.

724 Meintjes-Van der Walt 2000:327.

725 Meintjes-Van der Walt 2000:327. Although she suggests the employment of *Daubert's* admissibility rules in assessing forensic evidence, it would appear from literature that Meintjes-Van der Walt offers these rules, not as exclusive tool, but as potentially helpful *in collaboration with other factors* in evaluating such evidence, which would not stand in contrast to Wigmore's vehement persuasion of separating the spheres of admissibility and proof.

In an effort to minimise the inconvenience of requiring oral expert testimony in all cases where expert evidence is to be submitted into court, the South African legislature formulated section 212 of the Criminal Procedure Act 51 of 1977, specifically subsection 4 of the Act. This statutory provision provides for proof of facts determined by examinations or processes requiring certain specialised skills. Section 212(4)(*a*)[726] reads as follows:

> (4)(*a*) Whenever any fact established by any examination or process requiring any skill—
> (i) in biology, chemistry, physics, astronomy, geography or geology;
> (ii) in mathematics, applied mathematics or mathematical statistics or in the analysis of statistics;
> (iii) in computer science or in any discipline of engineering;
> (iv) in anatomy or in human behavioural sciences;
> (v) in biochemistry, in metallurgy, in microscopy, in any branch of pathology or in toxicology; or
> (vi) in ballistics, in the identification of finger prints or palm-prints or in the examination of disputed documents,
>
> is or may become relevant to the issue at criminal proceedings, a document purporting to be an affidavit made by a person who in that affidavit alleges that he or she is in the service of the State or of a provincial administration or is in the service of or is attached to the South African Institute for Medical Research or any university in the Republic or any other body designated by the Minister for the purposes of this subsection by notice in the *Gazette*, and that he or she has established such fact by means of such an examination or process, shall, upon its mere production at such proceedings be *prima facie* proof of such fact: Provided that the person who may make such affidavit may, in any case in which skill is required in chemistry, anatomy or pathology, issue a certificate in lieu of such affidavit, in which event the provisions of this paragraph shall *mutatis mutandis* apply with reference to such certificate.

When attempting to submit evidence as proof of fact in terms of section 212(4)(a) of the Act,[727] the requirements created by these provisions

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726 Criminal Procedure Act 51/1977.

727 Criminal Procedure Act 51/1977. This section may be employed by both the prosecution and the defence.

must be strictly adhered to.[728] Firstly, the facts that are purported to be proved by the affidavit must be relevant to the issues in the particular case. Secondly, the examination generating the facts submitted must be one that requires skill and expertise in the fields mentioned in section 212(4)(*a*)(i)-(vi) of Act 51 of 1977. Thirdly, a document to be proffered as affidavit containing the facts must be available for submission, and not a copy thereof. Fourthly, the person who formulated the affidavit must either be in the service of the State, a provincial administration, the South African Institute for Medical Research, any university in the Republic or anybody appointed by the Minister of Justice, and it is clarified as such in the affidavit.[729] Fifthly, the deponent must categorically assert which skill or field of expertise was required in the examination of generating the tendered facts. Lastly, if the expertise required falls within the ambit of chemistry, anatomy or pathology, the deponent may issue a certificate instead of an affidavit, while still complying with the requirements of section 212(4).[730]

If all these prerequisites are complied with, the affidavit containing the tendered facts may be produced by the submitting party and shall serve as *prima facie* proof of those facts, implying that the court would have

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728 Schwikkard and Van der Merwe 2000:297.

729 In *S v Kwezi* 2007 (2) SACR 612 (E) the court held that the medical evidence tendered was improperly admitted since the affidavit submitted to court failed to mention that the deponent was in the service of the State. The court may remedy such a situation by taking judicial notice of the fact that the deponent works for the State, if circumstances permit, but may also call the deponent to provide *viva voce* testimony in terms of section 212(12) of the Criminal Procedure Act of 1977. See also Schwikkard and Van der Merwe 2009:297.

730 Zeffertt *et al* 2003:302. It must be taken into account that the court, regardless of the submission of an affidavit or certificate in terms of section 212 of the Criminal Procedure Act 51 of 1977, still possesses the discretion to call the compiling expert to court to provide *viva voce* evidence of the contents of the affidavit or certificate if the court so chooses.

no option but to accept the document. Should the opposing party offer no credible evidence to the contrary, the court is then under duty to accept the document and its contents as definitive proof of fact.[731] In the event that the opposing party places the document or its contents in dispute, rebuttal evidence must be offered to disprove the allegations contained in the document. Should they fail to submit such evidence, the *prima facie* proof will become conclusive proof of the facts contained therein.[732]

Schwikkard and Van der Merwe[733] suggest that, in light of the ambiguous nature of the provision, as well as the potential inherent unfairness contained in the strict application of section 212(4) of the Criminal Procedure Act 51 of 1977, this statute might be an ideal candidate for legislative reform. Strong indication of the potential questionable fairness thereof, is the fact that practice in South Africa for approximately the last 20 years, dictates that courts must employ section 220 of the Act[734] during pleading stages, in order to guide the admissibility of post-mortem reports and medical evidence in an attempt to avoid, as far as reasonably possible, the submission of unreliable medical evidence.[735] Section 220 asserts the following:

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731 Zeffertt *et al* 2003:213. See *S v Veldthuizen* 1982 (3) SA 413 (A) and *S v Mkhize* 1998 (2) SACR 478 (W).

732 *S v Britz* 1994 (2) SACR 687 (W) at 690. The court in this instance also held that the *prima facie* value of the contents of a section 212(4) certificate will not be affected if the opposing party merely disputes the accuracy of the certificate. Evidence has to be adduced to counter this *prima facie* value. This, however, does not repudiate the duty on the State to prove the case against the accused beyond reasonable doubt – Unreported case: *S v Adams* (CA 73/2011) [2012] ZAECGHC 55.

733 2009:297-298.

734 Criminal Procedure Act 51/1977. Discussed by Jones J in *S v Kwezi* 2007 (2) SACR 612 (E) at para 6.

735 *S v Kwezi* 2007 (2) SACR 612 (E) at para 6. See the discussion in Schwikkard and Van der Merwe 2009:297-298.

> An accused or his or her legal adviser or the prosecutor may in criminal proceedings admit any fact placed in issue at such proceedings and any such admission shall be sufficient proof of such fact.

In *S v Kwezi*[736] the court asserted that, in light of the interests of a fair trial, it is improper to rely on section 212 of Act 51 of 1977 alone to admit medical evidence. The courts should explain the impact of an admission in terms of section 220 to the accused, and if the accused admits the contents of the medical or post-mortem report, it may be so admitted. If the accused disputes the contents, the medical expert must be called upon to impart his expertise and findings in the court by way of oral testimony.[737]

Where considerations of evidence assessment pertain to ordinary eyewitness testimony the court must act with utmost care. The court, in *R v Mokoena,*[738] warns that eyewitness testimony on suspect identification may falsely incriminate an innocent person, even if the witness appears to be truthful. In assessing witness testimony, the court must draw inferences regarding the observations of the witness and on the strength of those observations, the truth and accuracy of the tendered fact is inferred.[739] In South Africa, case law effected the cultivation of specific strategies for the evaluation of eyewitness testimony regarding the identification of the accused. They include considerations regarding the accuracy of the observations, the accuracy

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736 2007 (2) SACR 612 (E) at para 6.

737 *S v Kwezi* 2007 (2) SACR 612 (E) at para 6.

738 1958 (2) SA 212 (T) at 216-217. False incriminations may result in consequence of prejudice, revenge and many other motives.

739 Meintjes-Van der Walt 2000:323.

of the eyewitness's recollection and accuracy regarding the conveying of the evidence.[740]

Evaluating evidence and discovering facts in the criminal justice process, whether from expert scientific evidence or eyewitness statements, have proven exceedingly difficult.[741] Unfortunately, this process is due to become even more problematic in the future, as progressively more complicated evidence and scientific evidence will unavoidably amplify the problems inherent in assessing such evidence.[742] It would be an arduous task indeed to place in dispute the argument that accurate assessments of evidence, particularly forensic evidence, demand that legal practitioners and juridical fact-finders become acquainted with concepts of scientific evidence.

4.3 EYEWITNESS TESTIMONY

4.3.1 Introduction

In criminal adjudication, eyewitness testimony has traditionally been considered the most valuable evidence that may be offered during a trial.[743] In South Africa, eyewitnesses are the foremost source of

740 See *R v Mputing* 1960 (1) SA 785 (T) at 787-788. This and other court judgments will be discussed under the section on eyewitness testimony.

741 Meintjes-Van der Walt 2000:325.

742 Meintjes-Van der Walt 2000:342.

743 Shelton 2011:107. See also Pyrek 2007:512.

information in criminal investigations and the key to obtaining prosecutions in criminal disputes.[744]

To disentangle the often knotty issue of identification in a criminal enquiry and answer the question of "who" committed the offence, detectives habitually depend on eyewitness testimony to provide data on the identification of offenders.[745] On this point, Dr. Edmund Locard commented as follows:

> One of the most essential guides which must be obtained from the witness is the description of the criminal.[746]

In court proceedings, the foundation for judicial decision-making is frequently formed by both the evidence provided by eyewitnesses, and the court's trust in the fundamental accuracy of human observation and recollection.[747]

Regrettably, eyewitness evidence is shrouded in a veil of suspicion, bias and unreliability.[748]

> ...mistaken identity is the most likely and common cause of miscarriages of justice, and such miscarriages not only shock the public conscience but give rise to doubt and uneasiness as to the administration of justice.[749]

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744 Ntuli and Bruce 2001. http://www.csvr.org.za/wits/papers/papsndb.htm. Accessed on 18/01/2012.

745 Tredoux *et al* 2007:207.

746 The Justice of the Peace (Alias) 1926:287. This observation, referred to by the anonymous Justice of the Peace, was made by Dr. Locard in his manuscript, *L'Enquête criminelle et les méthodes scientifiques*, published in 1920.

747 Venter *et al* 2003:138. Miller also describes the efficacy of eyewitness testimony in looking for who, what, when, where and even how and why a crime was committed – Miller 2008:143.

748 The Justice of the Peace (Alias) 1926:287; Buckhout 1975:171; Tredoux *et al* 2007:207-208.

749 The Justice of the Peace (Alias) 1926:287.

With the advent of DNA profiling and post-conviction testing, the true scope of wrongful convictions has assumed a dreadful magnitude.[750] The Innocence Project[751] in the United States of America, reports that erroneous eyewitness identification has been accountable for 72% of the wrongful convictions successfully challenged by the organisation.[752]

In South Africa too, the fallibility of eyewitness identification is not unfamiliar to judicial fact-finders. In *R v Mokoena,*[753] Ramsbottom AJP[754] cautioned that, when considering the accuracy of eyewitness identification testimony, courts should be sufficiently dissatisfied with substandard evidence and remain sensitive to the possibility that, despite a *prima facie* appearance of honesty, eyewitnesses may still falsely incriminate accused persons for a variety of reasons, including personal bias, revenge, opportunity to observe, and many more.

Holmes JA,[755] too, warned in *S v Mthetwa:*[756]

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750 Tredoux *et al* 2007:207; Meintjes-Van der Walt 2009:305. This is particularly true of the United States of America, as post-conviction exoneration based upon DNA testing is not popular in South Africa – Meintjes-Van der Walt 2009:308.

751 In 1992, American attorneys, Barry C. Scheck and Peter J. Neufeld established the Innocence Project, an organisation assisting convicted prisoners wrongfully convicted of offences, by proving their innocence through post-conviction DNA profiling. So far, 297 convicts in the United States have been exonerated as a result of DNA testing – Innocence Project *s.a.* http://www.innocenceproject.org/about/Mission-Statement.php. Accessed on 07/09/2012.

752 Innocence Project *s.a.* http://www.innocenceproject.org/Content/Facts_on_PostConviction_DNA_Exonerations.php. Accessed on 07/09/2012.

753 1958 (2) SA 212 (T).

754 *R v Mokoena* 1958 (2) SA 212 (T) at 215-216.

755 *S v Mthetwa* 1972 (3) SA 766 (A) at 768.

756 1972 (3) SA 766 (A).

> Because of the fallibility of human observation, evidence of identification is approached by the courts with some caution.

But it is not only within the inner recesses of a courtroom that misidentification can impair justice. During the course of a criminal investigation inaccurate suspect descriptions by witnesses can obscure the investigation from the onset and prohibit detectives from arriving at the true identity of the perpetrator.[757] According to the Innocence Project, the last two decades have seen "tens of thousands" of innocent individuals scrutinised as prime suspects in crimes before DNA profiling finally absolved them of guilt.[758]

If witness testimony represents such a clearly defined risk of mistaken identity in criminal proceedings where the price of freedom is at its highest, it stands to reason that a meticulous understanding of the reasons for erroneous identifications and its infrequent detections, as well as the justice system's intrinsic safeguards against the acceptance of such evidence, are necessitated. Meintjes-Van der Walt[759] adds:

> ...without a proper understanding of social science research, there can be no consistency in the evaluation of eyewitness evidence.

4.3.2 Estimator- and system variable research

Despite the high persuasive potential of strong eyewitness testimony, historical demonstration of mistaken identity evidence, coupled with

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757 Innocence Project *s.a.* http://www.innocenceproject.org/Content/Eyewitness-Identification_Reform.php. Accessed on 07/09/2012.

758 Innocence Project *s.a.* http://www.innocenceproject.org/Content/Facts_on_PostConviction_DNA_Exonerations.php. Accessed on 07/09/2012.

759 Meintjes-Van der Walt 2009:325.

decades of research on the subject of human observation, memory and recall, have brought to attention the inaccuracy and vulnerability of this type of evidence.[760]

In order to better understand the intricacies and perils of applied eyewitness testimony, and perhaps to finally improve its reliability, Wells[761] proposes two types of research in this arena: estimator-variable research, and system-variable research.

Estimator-variable research is directed at studying estimator variables, which are all those factors influencing eyewitness accuracy, yet do not stand under the control of the police or criminal justice system.[762] This would include aspects such as the lighting at the time of observation, the seriousness of the offence, the race of the parties involved,[763] the presence of weapons during the criminal event, and many more factors that might have prevailed at the time of observation.[764]

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760 Innocence Project *s.a.* http://www.innocenceproject.org/understand/Eyewitness-Misidentification.php. Accessed on 07/09/2012.

761 1978:1546, 1548. Interestingly, Gary L. Wells discriminates between those researchers concerned with what he calls the "tripartite system" of eyewitness testimony research, which includes focus on the acquisition of information, the retention thereof, and the retrieval phase, and estimator- and system-variable research as mentioned above. He prefers concentrating on the latter types of research, as the former is not inherently connected to criminal justice applications – Wells 1978:1547.

762 Wells 1978:1548. See also: Wells *et al* 2006:47-48; Meintjes-Van der Walt 2009:311; Innocence Project *s.a.* http://www.innocenceproject.org/ understand /Eyewitness-Misidentification.php. Accessed on 07/09/2012.

763 Research has shown that cross-racial identification is more likely to be inaccurate than intra-racial identification - Innocence Project *s.a.* http://www.innocenceproject.org/understand/Eyewitness-Misidentification.php. Accessed on 07/09/2012. Since the criminal justice system cannot, in any way, influence these factors one way or the other, they are said to fall outside the control of the criminal justice system.

764 Wells 1978:1548. See also: Innocence Project *s.a.* http://www.innocenceproject.org/understand/Eyewitness-Misidentification.php. Accessed on 07/09/2012.

> Such variables will be termed *estimator variables* because, in actual crimes, one can at best only *estimate* the role of such factors. Independent control over estimator variables is...impossible for actual crimes.[765]

System variables, on the other hand, include those factors that are under direct control of the criminal justice system.[766] The ways in which police officers collect and record information from eyewitness memory, for example, statements and identification parades, as well as the length of time that have elapsed between the observation of the crime and the subsequent witness testimony, are capable of severely influencing the quality of witness identification.[767]

Wells[768] suggests that estimator-variable research, while rendered fundamentally inadequate in improving the correctness of eyewitness testimony by its independence from justice system control, will at least serve to diminish excessive reliance on such evidence by judicial officers.

4.3.2.1 An evaluation of estimator variables

Studying and understanding of estimator variables are imperative for two primary reasons. Firstly, they are fundamental to recognising when and for what reasons eyewitnesses make mistakes. Applied judiciously they may serve to enlighten detectives, prosecutors and judicial officers

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765 Wells 1978:1548.

766 Wells 1978:1548; Wells *et al* 2006:47-48; Innocence Project *s.a.* http://www.innocenceproject.org/understand/Eyewitness-Misidentification.php. Accessed on 07/09/2012.

767 Wells 1978:1548; Innocence Project *s.a.* http://www.innocenceproject.org/understand/Eyewitness-Misidentification.php. Accessed on 07/09/2012.

768 1978:1548.

of the conditions affecting the accuracy of eyewitness evidence.[769] Secondly, a meticulous understanding of system variables benefits from a similar understanding of estimate variables.[770]

Several aspects of an offence, unconstrained by justice system control, determine the accuracy of eyewitness testimony and a comprehensive appreciation of these aspects is indispensable in the evaluation of such evidence by a court of law.

Features of the criminal event itself are vital in determining the precision with which the witness will observe and retain information. It has been reported that factors such as the seriousness and complexity of the crime, as well as the observation time and familiarity with the physical environment of the offence, will, to a large extent, be formative in this regard.[771]

According to Wells,[772] relatively minor offences will "...produce a lower base rate of accuracy..." than an offence of greater seriousness. This statement, however, is subject to the condition that the witness is conscious of the seriousness of the crime at the time of observation,[773]

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769 Wells *et al* 2006:51.

770 Wells *et al* 2006:51. For instance, when a witness has been exposed to the offender for a long period of time in good lighting and other beneficial conditions, poorly constructed system variables, like biased identity parades, will be less likely to result in inaccurate identification evidence than in circumstances where the witness had only a glance at the offender – Wells *et al* 2006:51.

771 See Buckhout 1975:172; Wells 1978:1548-1550.

772 1978:1548-1549.

773 Wells 1978:1549. These remarks follow research conducted by Leippe, Wells and Ostrom in 1978, and reported in the *Journal of Applied Psychology* in the same year.

as well as the significance of the event at the time, and to the observer.[774]

Not surprisingly, the seriousness of an offence, most notably in cases where severe and even life-threatening aggression was experienced, can adversely affect the witness's ability to correctly perceive details of the event and the offender. This is attributable to the fact that persons under extreme stress undergo physiological modifications to initiate the body's 'fight and flight' response to fear. These modifications, including increased heart rate, blood pressure, adrenaline excretion and energy availability, are directed at ensuring the eyewitness's safety and survival, rather than the reliability of perceptions.[775]

While the intricacy of a crime may augment the witness's ability to provide recognition evidence at a later stage, research has also suggested that increased event complexity may in fact decrease the ability to recall other aspects of the event.[776]

The accuracy of recognition seems to increase proportionally to the duration of exposure to the criminal event and the witness's opportunity for observation, although this proportional increase does not appear to be linear, but subject to ceiling and threshold effects.[777]

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774 Buckhout 1975:172-173.

775 Buckhout 1975:173.

776 Wells 1978:1549. A clear distinction must be made between 'recognition' and 'recall' in the context of eyewitness testimony data and research.

777 Wells 1978:1549. See also Buckhout 1975:172-173.

The correctness of information recalled from memory will be amplified by a proper familiarity with the physical environment in which the offence transpired.[778] Quite expectantly, witnesses foreign to the physical milieu of the crime are more likely to distort distances, sizes and even acceleration and deceleration of targets when describing the incident.[779]

Since crime regrettably seldom occurs within a well-lit, laboratory-controlled environment, it stands to reason that inadequate observation conditions will impede the accuracy of perception. Proximity to the criminal incident, the presence of other people, and poor visibility often impair a witness' ability to make accurate observations.[780]

In all these instances, the evaluator must remain cognisant of the menacing possibility that factors stimulating for example facial recognition, may actually impede recognition of other features.[781]

Qualities of the accused person or suspect, as well as those of the observer himself, will also be formative of the reliability of eyewitness testimony. Race, level of attractiveness, gender and age, are aspects influencing accuracy of observation, with race being the most widely researched factor in suspect recognition studies.[782]

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778 Wells 1978:1549.

779 Wells 1978:1549.

780 Buckhout 1975:173.

781 Wells 1978:1549. This fact becomes problematic during trial when eyewitness testimony is discounted as being unreliable on the basis that a fallible description of a lesser feature was provided by the witness – Wells 1978:1550.

782 Wells 1978:1550.

For the most part, research on racial influence of identification testimony reflects a relationship between the race of the accused persons and the race of the eyewitness, implying that individuals of a given race are more likely to accurately recognise faces of the same race than another.[783] The classic example of the adverse effect of racial identification was exhibited in research at the Harvard University in the United States of America, where a drawing of a group of people on a subway train was given to the research population, the observers. The drawing included a seated black man and white man, standing next to him with an antique razor blade in his hand.[784] Half of the observers later described the razor blade being in the black man's hand.[785]

> Most people file away some stereotypes on the basis of which they make perceptual judgments; such stereotypes not only lead to prejudice but are also tools for making decisions more efficiently... Such short-cuts to thinking may be erroneously reported and expanded on by an eyewitness without his being aware that he is describing his stereotype rather than actual events. If the witness's biases are shared by the investigator taking a statement, the report may reflect their mutual biases rather than what was actually seen.[786]

Wells[787] discusses at length the problematic nature of estimator-variable research, its inherent biases, as well as its limited application. It may be proposed that the only truly prudent value of this type of research to the criminal justice system is to inform presiding officers of the unreliable character of eyewitness testimony, and as such, one assumes that

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783 Wells 1978:1550.

784 Buckhout 1975:176.

785 Buckhout 1975:176.

786 Buckhout 1975:176.

787 1978:1550-1552.

presiding officers are not already aware of its capriciousness.[788] Decades of research on this issue, as well as systematically developed case law and judicial scrutiny in South Africa would suggest that presiding officers are appropriately alert to the risks inherent in eyewitness testimony.[789]

Given that system variables are manipulatable by the criminal justice system, it stands to reason that a focus on system-variable research is perhaps more likely to yield eyewitness research results of workable value to the justice system.

4.3.2.2 An evaluation of system variables

System variables become relevant when the criminal incident has passed, and the eyewitnesses are expected, under control of the criminal justice system, to recall the incident in as much detail and as accurately as possible, and to correctly identify the perpetrator of the offence.[790] The term 'system variables' thus explicitly refers to factors which may potentially affect the correctness of eyewitness evidence in the period between the first contact with the police and the subsequent provision of *viva voce* testimony in court.[791]

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788 Wells 1978:1551.

789 Wells, too, reports that no evidence exists in support of the notion that presiding officers are gullible to witness's testimony – Wells 1978:1551.

790 Wells *et al* 2006:54-55.

791 Venter and Louw 2005:29.

According to Buckhout,[792] the unreliability of eyewitness testimony is amplified by the ensuing efforts to retrieve the perceived information. Aspects of a criminal investigation, for example, police interviewing and line-up identifications, as well as facets of the ensuing trial, may contribute to the inability of the witness to perform an accurate identification.[793]

'Retention interval' is the term commonly employed to describe the time lapse between the initial observation and memory formation, and the time of first contact with law enforcement personnel when the witness is expected to retrieve the stored information in the form of statements to police or suspect identification.[794] The strength of recall accuracy corrodes with the passing of time.[795] It may thus be accepted that the more time elapses since the observation of the criminal incident, the more likely it becomes that the witness's memory would succumb to influences of contamination and demise. In a criminal justice system where witnesses are often expected to testify in criminal proceedings months to years after the crime,[796] the effects of such a great retention interval is perturbing indeed.

Other factors that may influence the accuracy of witness evidence include the "filling in" of gaps in memory,[797] during which witnesses

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792 1975:178. See also Venter and Louw 2005:29.

793 Venter and Louw 2005:29.

794 Venter and Louw 2005:29.

795 Buckhout 1975:178; Wells 1978:1552.

796 Venter and Louw 2005:29.

797 The term 'confabulation' refers to the "filling in" of gaps in memory – Venter *et al* 2003:141.

might erroneously complete their own recollection of an event as those witnesses move from the initial police statement to the eventual provision of testimony during the ensuing trial proceedings.[798] During this process of "filling in", the witness may provide false information due to the distortion of his recollection, but since this is often unintentional, the witness cannot be said to be deceitful.[799]

Post-event information and its integration and interaction with previously stored data, is considered by scholars to be one of the greatest hazards to eyewitness testimony.[800] Data provided by other witnesses, investigating officers, forensics personnel, and legal practitioners, can have a diminishing or distortive effect on memory,[801] either by becoming intermingled with true, existing data, by overwriting memories about the original event, or even by confabulation.[802]

While the issues of time lapse, confabulation and post-event influences certainly are ones that should bear concern, the intervening material and testing structures appear to be the primary focus of researchers' attention.[803] The manner in which data is retrieved from the memories of eyewitnesses significantly influences its reliability.[804] Research on suggestive interrogation, especially, has demonstrated the distortive

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798 Buckhout 1975:179.

799 Buckhout 1975:179.

800 Venter and Louw 2005:30.

801 Venter and Louw 2005:30.

802 Venter and Louw 2005:30-31.

803 Wells 1978:1552, 1553.

804 Venter and Louw 2005:31.

effect that different types of intervening interrogation techniques and disguised questions can have on witness description accuracy.[805]

Suggestive interviewing has been described as the introduction of mistakes or the contamination of the witness's memory by way of false presuppositions in the questions posed.[806] A witness's suggestibility is the extent of assimilation and influence of a variety of psychological and social aspects on memory formation and retrieval.[807] Venter and Louw[808] confirm that suggestive interrogation techniques and high witness suggestibility will have a detrimental effect on eyewitness accuracy.

Specific testing construction can be highly effective in eliminating the menace of suggestion. One such a construction is to favour open-ended questions in interviewing witnesses, which will not guide the witness to respond in a particular manner.[809] Questions that require a "yes" or "no" response possesses great suggestive quality and should be avoided, especially in conducting interviews with child witnesses.[810]

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805 Wells 1978:1552-1553. Wells, Memon and Penrod credit researchers like Frenchman, Alfred Binet, and William Stern from Germany, as the pioneers in understanding suggestibility and interrogation in Europe around the early 1900's. Modern scholars like Elisabeth Loftus have focused on instilling witnesses with misleading data by way of both overt and subtle forms of questioning – Wells *et al* 2006:55.

806 Venter and Louw 2005:31-32.

807 Venter and Louw 2005:32.

808 2005:32.

809 Venter and Louw 2005:34.

810 Venter and Louw 2005:34. The effects of estimate and system variables, as well as the function and nature of perception and memory in children is a complex and meticulously researched subject and falls outside the ambit of this study.

It is apparent that unfair testing structures can encourage error in witness testimony, while those structures designed and developed in accordance with principles of fairness as agreed upon by psychologists, can enhance its accuracy.[811]

Studies have shown that entirely unstructured testimony, without the intervention of any questions posed, produces a much greater level of accuracy than any other type of questioning.[812] In simpler terms, where the witness is allowed to relate and elaborate on his observations freely, the probability of exactness is at its greatest, while it decreases when open-ended questions are asked, followed by leading questions and multiple choice questions.[813] While this remains true, additional research suggests that question bias would further impair the accuracy of testimony.[814]

A frequently employed example of multiple choice type of questioning is the conduct of identity parades,[815] which, due to the nature of the process, may fall easy prey to manipulation and control by the police,

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811 Buckhout 1975:179.

812 Wells 1978:1553; Venter and Louw 2005:32. It should be borne in mind that witnesses cannot be allowed to freely relate their stories at all instances of the criminal justice process, since this would cause a great deal of detailed information to be excluded from the account. Questions should then be posed to the witness in an effort to elicit this data – Venter and Louw 2005:32.

813 Wells 1978:1553.

814 Wells 1978:1553. Biased questions can be either negatively biased, in which case an incorrect answer is suggested by the interrogator, or positively biased, where a correct response would be suggested.

815 Identity parades are known as 'line-up identifications' in the United States of America and various other foreign jurisdictions.

as even the instructions provided to the witness prior to the identification of a suspect can result in mistaken identity evidence.[816]

Bias in identity parades may occur from two distinct motivational bases. Firstly, the identifying eyewitness may experience pressure from the police, friends and family, and various other sources, including self-induced pressure, to make a positive identification from the line-up.[817] Secondly, the eyewitness may be susceptible to spoken or unspoken hints from the police officers conducting the identity parade, or from other witnesses or law enforcement personnel prior to, or during the course of the identity line-up.[818]

In identification by way of photographic line-ups, unfair testing construction occurs where something in one of the photographs is distinct from the others.[819] For instance, if the person in the photograph is of different gender from the other faces, different race, dress, or build, or even where the photograph itself is of wholly different quality, that picture is likely to be selected.[820]

Wells[821] suggests that system variables should be employed during criminal trials as though they were estimator variables, where experts

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816 Wells 1978:1553. For instance, when a police officer informs the witness that the suspect "is in the lineup", more false identifications will result than when the witness is simply told that the suspect "may or may not be" in the lineup – Wells 1978:1553.

817 Venter and Louw 2005:36.

818 Venter and Louw 2005:36.

819 Buckhout 1975:179.

820 Buckhout 1975:179.

821 1978:1554.

estimate, based on the system variables present, the likelihood of accuracy. However, this in itself would present immense problems and is likely to result in over- or underestimates of accuracy.[822]

Nevertheless, system-variable research can be immensely valuable in improving on current witness reliability by, for instance, inspiring the criminal justice system to introduce shorter witness-testing intervals, to compose fairer identity parade line-ups and to minimise the use of suggestive interrogation.[823]

4.3.3 The fallibility of eyewitness identification and testimony

When a witness is called upon to remember an incident, or to identify objects or people, two essential and intricate processes are called into operation: observation and memory.[824] Observation, or perception, occurs when the five senses *observe* stimuli that are then converted and organised into knowledge that is significant to the observer.[825] Memory, on the other hand, is generated when the converted information is stored in the brain for subsequent recall.[826]

This data processing is fundamentally a decision-making process subjectively influenced by the entirety of the observer's background and personal experiences, his capabilities, beliefs, biases, attitudes and

822 Wells 1978:1554.

823 Wells 1978:1555.

824 Venter *et al* 2003:139.

825 Venter *et al* 2003:139-140.

826 Venter *et al* 2003:140.

eventually the manner in which his memory is tested.[827] Moreover, numerous failures and errors can occur at any point along this process, which will adversely affect the accuracy of information recalled at a later stage.[828] All these factors comprise the estimate and system variables manipulating the quality of eyewitness observation and recollection.

Research[829] has suggested that since human perception and memory form the basis of eyewitness identification and testimony, aspects affecting the quality of the witness's perception and memory formation should be recognised and understood by all the role players in the criminal justice system, from investigating detectives, to decision-making judicial officers. It may be argued that once the perception that the mind is a recording lens has been eradicated, and all estimate and system variables are adequately appreciated, investigators, legal practitioners and judicial officers alike, will unavoidably find themselves in a better position to root out unreliable identification evidence and thus prevent the perturbing phenomenon of individuals being innocently investigated and accused.

Meintjes-Van der Walt[830] credits Hugo Münsterburg[831] for being one of the primary researchers to devastate the old belief that the human

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827 Buckhout 1975:172; Venter *et al* 2003:140.

828 Venter *et al* 2003:140.

829 See Meintjes-Van der Walt 2009:325; also Venter *et al* 2003:138.

830 2009:314.

831 German psychologist and advocate of forensic psychology, Hugo Münsterburg, published one of his most revered treatise, *On the Witness Stand: Essays on Psychology and Crime*, in 1908. This book contains watershed research on witness memory and suggestive interrogations – Cherry 2012. http://psychology.about.com/od/profilesal/p/hugo-munsterberg.htm. Accessed on 17/09/2012. See also Buckhout 1975:186, and Wells *et al* 2006:47.

memory "...is neither a filing cabinet nor a video camera where information is stored and can be retrieved when needed." Since then, scholars in human perception and memory have repeatedly echoed this sentiment. In 1975, Buckhout[832] described human observation as being careless and irregular, and memory rife with inadequacies.

Amongst the abundance of observation and memory-related research within the sphere of psychology, much of what used to be shrouded in a fog of obscurity and error has since become better understood.

4.3.3.1 The problem with perception

Buckhout[833] states unequivocally that human perception is "...sloppy and uneven." Criminal events and external stimuli are not passively recorded by eye witnesses, but rather selectively examined on the basis of the witness's own, subjective disposition, rendering the perception fundamentally subjective, as opposed to being, ideally, objective.[834]

Augmenting the capricious nature of human observation is the likely risk of perceptual distortions, erroneous event reconstruction, the observer's tendency to simplify and organise while perceiving stimuli that are intricate and chaotic, as well as confabulation, which is filling gaps in memory when unable to recall details of a previous observation.[835]

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832 1975:171-172.

833 1975:171.

834 2003:141.

835 Venter *et al* 2003:141, 143. Venter *et al*. at 142 describes this as being an inference based on the facts remembered and then confusing the inference with what really transpired.

The problem with perception, as succinctly described by Venter *et al*,[836] is the co-existence of two exceedingly different kinds of information processing systems within every individual, namely data-driven processing and conceptually driven processing. The former involves the sensory organs' perceptions of the external world, while the latter comprises prior knowledge, information already accumulated in semantic memory.[837] The interconnectedness of these two systems renders it immensely difficult for the observer to differentiate between what was actually seen and what was thought to be seen.[838]

Prejudice and subjectivity unavoidably command the observer to a misinterpretation of the data so observed.[839] Observation bias, too, will impose two different observers to effectively perceive two different sets of data from the same incident.[840]

4.3.3.2 The reliability of memory

Memory is data perceived, analysed and saved in the recesses of the mind to be subsequently recollected.[841] Like perception, memory is not constant and changes with time and the introduction of new data, which, in the context of eyewitness observations, may come from sources outside the actual criminal event, like newspaper reports and

836 Venter *et al* 2003:142-143.

837 Venter *et al* 2003:142.

838 Venter *et al* 2003:142-143.

839 Venter *et al* 2003:143-144.

840 Venter *et al* 2003:144.

841 Venter *et al* 2003:144.

conversations with other witnesses,[842] investigating officers or even prosecutors. Any information that the witness observes after the criminal incident, known as post-event information, may become incorporated into memory, causing alterations in what was initially remembered. As a consequence of this a truthful witness may mistakenly provide distorted evidence despite honest intentions.[843]

While memories can also be amended by means of a process of reconstruction and confabulation, a multitude of estimate variables, like the witness's ability to properly observe the criminal event or retain as memory information regarding the event, will likely have bearing on the accuracy of memory.[844]

But memory, once formed, is by no means free from undue persuasion. Research suggests that memories do not exist in isolation, is not static and is subject to external interference, such as system variables like suggestive questioning and misinformation.[845] In addition, the process of recalling stored data is subject to alteration attributable to reconstructive memory which causes remembrances to be assimilated with familiar events and knowledge, just as is the case with perception.[846]

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842 Meintjes-Van der Walt 2009:315. See also Venter *et al* 2003:146; Venter and Louw 2005:35-36.

843 Venter *et al* 2003:146.

844 Meintjes-Van der Walt 2009:315.

845 Venter *et al* 2003:145; Venter and Louw 2005:29.

846 Venter *et al* 2003:145.

Memory formation has been described as a product of a three stage progression, with each stage's proper operation dictating the accuracy of the recalled memory.[847] Firstly, the "acquisition stage" represents the period of observation, the programming of the observed data into memory, and the interpretation of that data in the framework of the observer's pre-existing experience. The success of the acquisition stage is to a large extent determined by estimate variables, such as the duration of observation, abilities and limitations of the witness, and many more.[848]

Secondly, the "retention stage" embodies the interval between the perception and the eventual recollection.[849] Both estimator and system variables like the length of the interval, as well as additionally observed information after the event, referred to as post-event interference or information, can potentially distort the accuracy of the memory, or even result in forgetting the information altogether.[850]

During the third stage, the "retrieval stage", the retained data is brought to consciousness.[851] Within the context of a criminal investigation, this will be achieved by application of system variables, such as questioning the witness, having the witness participate in identification parades and, eventually, testifying in court.[852]

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847 Venter *et al* 2003:147.

848 Venter *et al* 2003:147-148.

849 Venter *et al* 2003:148.

850 Venter *et al* 2003:148; Venter and Louw 2005:30.

851 Venter *et al* 2003:149.

852 Venter *et al* 2003:149.

While the system variables employed within the "retrieval stage", such as questioning and identification parades are aimed at the most successful and unbiased retrieval of the witness's memories, Buckhout[853] opines that no testing method is without some degree of suggestion. Whether subtle or palpable, inadvertent or deliberate, no form of questioning, photographic identification or identity parade is completely free from suggestion by the officers conducting the test. The consequences of suggestive testing increase when the individual performing the tests is in a position of authority, or dressed in uniform or a white coat.[854]

In South Africa, with its eleven official languages and countless dialects, suggestive questioning can potentially represent an immense dilemma. Questions during witness interviews should always be posed in the language best understood by the witness and in a manner that is clear and unmistakable, so as to avoid fallacious testimony.[855]

While hypotheses formation is a vital part of a criminal investigation, it can be devastating to the acquisition of the truth if the investigating detective does not guard against the aspiration to make fact fit the theory. Ignorance to this possibility may lead to distortion and unreliability in interpreting facts, instead of understanding the true significance of those facts.[856] Even where a multitude of witnesses

853 1975:180.

854 Buckhout 1975:181.

855 Venter and Louw 2005:34.

856 Buckhout 1975:181. See also Venter and Louw 2005:31.

agree on suspect identification, it is no guarantee of the accuracy of the identification.[857]

It may be argued that constructive evaluation of eyewitness evidence, whether employed in the course of the criminal investigation, or submitted to court as proof of fact, depends on the awareness of the key role-players, that is, detectives and officers of the court, of the factors that may adversely affect the accuracy of that evidence. However, research regarding the perceptions of police officers of eyewitness evidence indicates that investigating officers mostly believe that eyewitnesses' testimony and statements are accurate.[858] At the conclusion of the research it was also reported that police officers rarely have sufficient time to conduct adequate and effective interviews with witnesses,[859] an alarming accusation, since proper testing structure is fundamental in eradicating question bias and suggestion.

The lack of police awareness of eyewitness issues and the importance of improved understanding of the capricious nature of eyewitness testimony amongst police investigators was confirmed by Wise, Cushman and Safer.[860] Their research, as published in 2012, contained detailed suggestions to law enforcement officers on the scientific processes to follow to elicit optimum evidence from witnesses during

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857 See Wells *et al* 2006:46, where the authors refer to a murder case in the United States of America where five eyewitnesses erroneously identified an innocent man as the murderer of a 9-year old girl. The accused was convicted, sentenced to death, and only released after eight years on death row following DNA exoneration.

858 Kebbell and Milne 1998:328.

859 Kebbell and Milne 1998:328.

860 2012:183-184.

questioning, including pre-interview, interview and post-interview procedures.[861]

In 2009, Wise *et al*[862] performed research in order to determine what prosecutors and defence attorneys believe and comprehend about eyewitness testimony. Alarmingly, the research reflected that prosecutors had inadequate knowledge of factors influencing the accuracy of eyewitness testimony, and that they constantly tended to overestimate the reliability of such evidence, yet underestimated the role of erroneous eyewitness identification in wrongful convictions.[863]

In surveying the extent of judges' familiarity with the pitfalls of eyewitness testimony, it was discovered that judges, too, suffer a disturbingly restricted level of understanding of eyewitness factors.[864] Moreover, it appears from the results of the study that judges enjoy little exposure to research in the realm of eyewitness testimony and are distressingly unaware of all the factors that affect eyewitness reliability.[865]

In the absence of exposure to eyewitness reliability research, police detectives, legal practitioners and presiding officers are exclusively dependent on their "common sense intuitions" to evaluate eyewitness evidence.[866]

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861 Wise *et al* 2012:178-181.

862 2009:1268-1277.

863 Wise *et al* 2009:1277.

864 Wise and Safer 2004:438.

865 Wise and Safer 2004:438.

866 Schmechel *et al* 2006:180.

4.3.3.3 Conclusion

Despite the apparent unreliable nature of eyewitness testimony, legal practitioners still argue its superiority to circumstantial evidence.[867]

Notwithstanding meticulous research in the sphere of perception and memory, Venter *et al*[868] propose the expanded research of the topic within the South African milieu.

> Increased understanding of the processes of memory and perception will have a positive effect in the field of eyewitness testimony by providing criteria which, when applied by psychologists, legal professionals and the police, will help ensure more reliable assessment of eyewitness identification and testimony.[869]

Two particular arguments may be submitted in support of the establishment of a research culture in South Africa pertaining to eyewitness testimony. Firstly, from the discussion on estimate variables it is apparent that biased inter-racial perception greatly influences the accuracy of such perception. In South Africa, where racial disputes are rampant,[870] it stands to reason that particular attention should be given to understanding this phenomenon.

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867 Buckhout 1975:186.

868 Venter *et al* 2003:162.

869 Venter *et al* 2003:162.

870 Isilow 2011. http://africawitness.wordpress.com/2010/10/21/racism-still-alive-in-s-africa-16-years-after-apartheid/. Accessed on 12/12/2012; Political Analysis South Africa 2012. http://www.politicalanalysis.co.za/2012/05/08/the-pathology-of-white-privilege-and-racism-in-south-africa-a-personal-perspective/. Accessed on 12/12/2012.

Secondly, if research on system variables positively indicates that language ambiguity should be strictly avoided when constructing interview questions, it may be argued that Venter and Louw[871] are correct in suggesting that suggestive questioning should be extensively studied in the context of the South African justice system.

While appreciation for the plethora of factors influencing the correctness of eyewitness testimony is vital to the key role-players in the criminal justice system, it would appear that this is, in fact, lacking.[872] Since eyewitness identification is frequently the only evidence connecting a suspect to a crime, it is imperative that police officers, legal practitioners and judicial decision-makers comprehend the dangers intrinsic in this type of evidence.

Champions of the psychology profession have suggested that a possible solution to the immense problem of preventing eyewitness misidentification, is the use of psychological expert testimony on eyewitness memory where witness recollection is the only evidence against an accused.[873]

4.3.4 The approach of courts in South Africa in evaluating eyewitness evidence

It is incumbent upon the State to prove all the elements of a crime against the accused beyond a reasonable doubt. As stated above, the

871 2005:34.

872 Wise *et al* 2009:1277.

873 Cutler *et al* 1987:233.

court must be convinced of the identity of the offender, an essential element to the prosecution of any crime.[874]

Proof of identity is greatly dependent on direct eyewitness testimony but South African courts are not unfamiliar with the shortcomings of this type of evidence.

> Uitkenningsgetuienis is om verskeie redes nie altyd betroubaar nie en moet baie sorgvuldig oorweeg word voordat dit aanvaar word.[875]

Following the warning by Holmes JA[876] in 1972, courts in South Africa generally approach eyewitness identification testimony with caution, warning that an apparently sincere and credible eyewitness does not guarantee trustworthy evidence, but that the reliability of the observations must also be tested.

Evaluation of evidence in the South African criminal justice system includes the application of the cautionary rule, which specifies the approach to be followed by court when considering the evidence of specific witnesses.[877] This rule stipulates that a court engaged with the evaluation of evidence should continuously remind itself to be vigilant in contemplating evidence which experience has shown to be worthy of suspicion, and that the court should seek precaution against wrongful

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874 *R v Blom* 1939 AD 188 at 210.

875 *R v Mputing* 1960 (1) SA 785 (T) at 786H. See also *S v Nyembe* 1982 (1) SA 835 (A) at 842, where the court held that: "The wise trial judge knows that human memory is only too fallible..."

876 The presiding officer in *S v Mthetwa* 1972 (3) SA 766 (A) who warns at 768 that "...because of the fallibility of human observation, evidence of identification is approached by the Courts with some caution."

877 Schwikkard and Van der Merwe 2009:546.

findings based on such suspicious evidence.[878] Precaution, in this instance, may be available in the form of corroborative evidence, but also, for example, the detection of dishonesty, failure to conduct cross-examination, the absence of contradicting testimony, and so forth.[879]

Where the finding of a court depends on the testimony of a single witness,[880] the court held in *S v Webber*[881] that the cautionary rule should be applied to the testimony provided by a single witness, and that it should not be disallowed merely because of apparent bias on the side of the witness. Schwikkard and Van der Merwe[882] assert that the preferred approach in a case where the fate of the accused depends on single witness evidence, is that the court should assess the strength of the bias and establish its significance against the entirety of all the presented evidence.

In *R v Mputing,*[883] Boshoff J[884] undertakes an assessment of an effective approach to eyewitness testimony evaluation, recognising the difficulty of the task:

> Die vraag ontstaan hoe uitkenningsgetuienis benader moet word. Hierdie vraag lewer moeilike probleme op want die proses van herkenning is 'n

878 Schwikkard and Van der Merwe 2009:546. In 1998, the cautionary rule applying to complainants in cases of a sexual nature, was abolished by the Supreme Court of Appeal in *S v Jackson* 1998 (1) SACR 470 (SCA).

879 Schwikkard and Van der Merwe 2009:546-547.

880 Section 208 of the Criminal Procedure Act 51/1977 stipulates that a court may convict an accused of any offence on the single evidence of any competent witness.

881 1971 (3) SA 754 (A).

882 2009:552.

883 1960 (1) SA 785 (T).

884 *R v Mputing* 1960 (1) SA 785 (T) at 787D-E.

> werking van die onderbewussyn... Hierdie vermoë om akkuraat te herken word beïnvloed deur 'n groot verskeidenheid van omstandighede.

Boshoff J[885] asserts that the value of a witness's identity evidence is dependent upon the correctness of his observations of the criminal event, the accuracy of his memory, and finally, his ability to correctly convey the initial observations in court.

As indicated by the court in this matter, the accuracy of the witness's observations is subject to several factors. Firstly, the witness's dedication and physical ability to make accurate observations, which includes considerations of eyesight, age, illness, the importance ascribed to the incident by the witness, personal bias, fear, disinterest, and so forth.[886]

Secondly, the accuracy of the observations will be influenced by the specific circumstances existing at the time of making the observations, for example, the distance of the witness from elements of the criminal incident, the period and angle of observation, visibility and quality of light and other related factors that could facilitate or impede the view.[887]

Thirdly, the facial and physical characteristics of the persons being observed will also shape the accuracy of the testimony. Some individuals have highly distinctive features that would allow a witness to describe the features in some detail and accuracy, for instance, tattoos,

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885 *R v Mputing* 1960 (1) SA 785 (T) at 787F-G.

886 *R v Mputing* 1960 (1) SA 785 (T) at 787G-H.

887 *R v Mputing* 1960 (1) SA 785 (T) at 787H.

scars, peculiar eyes, noses, and so forth.[888] Exact descriptions of the physical features of the offender, including aspects such as height, weight, build and complexion, will add to the value of the testimony, as the accused is present in court during proceedings, and the court will be able to compare the description with the appearance of the accused.

It is of great consequence that witness recollections correspond with observations. The accuracy of the witness's recollection of the incident depends on his memory and strength of recall, which is affected by a number of issues. Firstly, the physical ability of the witness will have an impact on his ability to remember that which he had observed. Some individuals have a greater capacity to store information in memory, while factors such as age and illness can also impinge on ability to recall.[889]

Secondly, the impression that the criminal event made on the witness will shape the witness's memory.[890] In other words, the accuracy of the specific memory will be enhanced if the witness observed the offender in circumstances that imprinted itself in his mind, or if the offender is known to the witness.

Thirdly, the greater the length of time that has elapsed between making the observations and being requested to recall the incident, will

888 *R v Mputing* 1960 (1) SA 785 (T) at 787H – 788A.

889 *R v Mputing* 1960 (1) SA 785 (T) at 788B.

890 *R v Mputing* 1960 (1) SA 785 (T) at 788C.

negatively affect recollection accuracy, since memory fades with time.[891]

Fourthly, memory will be adversely or favourably influenced by a range of external factors, like suggestions from the police during questioning, as well as internal factors, like the witness's instinctive human yearning for justice.[892]

Lastly, the court must determine whether the witness is capable of distinguishing between the reality of his observations and inferences drawn based on those observations.[893]

Providing identity testimony during criminal proceedings is a voluntary and intentional act, and not reliant on the subconscious mind or subject to a plethora of influences like observation and recollection. For this reason, the accurate conveying of stored information depends solely on the integrity and credibility of the witness.[894]

In reference to these factors, Holmes JA[895] declared the following regarding the court's ultimate evaluation of the reliability of eyewitness testimony:

> These factors, or such of them as are applicable in a particular case, are not individually decisive, but must be weighed one against the other in the light of the totality of the evidence, and the probabilities.

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891 *R v Mputing* 1960 (1) SA 785 (T) at 788D.

892 *R v Mputing* 1960 (1) SA 785 (T) at 788E.

893 *R v Mputing* 1960 (1) SA 785 (T) at 789B-E.

894 *R v Mputing* 1960 (1) SA 785 (T) at 789F.

895 *S v Mthetwa* 1972 (3) SA 766 (A) at 768.

Meintjes-Van der Walt[896] remarks that establishing the tangible effect of any combination of factors thus far discussed on the weight that should be attached to eyewitness testimony from case law is, at this juncture, impossible.

The adversarial nature of criminal proceedings in South Africa, like in all adversarial jurisdictions, offers cross-examination during trial as the mechanism to recognise and expunge fallacious evidence. Indeed, John Henry Wigmore considers cross-examination to be "...the greatest legal engine ever invented for the discovery of truth."[897]

In 2011, Valentine and Maras[898] published results following empirical research on the effect of cross-examination on the accuracy of eyewitness evidence. It was discovered that, in contrast to what many legal professionals believe, cross-examination is highly efficacious in manipulating eyewitness testimony and that it in fact causes a decline in eyewitness evidence accuracy.[899] Although subject to limitations in the research and likely to benefit from further scrutiny, the study suggested that cross-examination is fundamentally incapable of ensuring correctness of eyewitness evidence.[900]

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896 2009:310.

897 Valentine and Maras 2011:554.

898 2011:554-555.

899 Valentine and Maras 2011:559-560.

900 Valentine and Maras 2011:559-560.

4.3.5 The approach of courts in England and Wales in evaluating eyewitness evidence

The England and Wales legal system is not unique in its cautious approach to eyewitness testimony evaluation. In an effort to minimise wrongful convictions based on unreliable eyewitness testimony, the English legal system has cultivated judicial instructions or warnings to members of a jury in criminal proceedings to assist them in evaluating such evidence.[901]

In 1956, an application was submitted to the Court of Appeal in England and Wales[902] to have the trial judge formulate a general instruction that, where identification evidence was provided by a single witness, the members of the jury should be warned that it would be perilous to convict without any form of corroboration.

In 1972, the Eleventh Report of the *Criminal Law Revision Committee* proposed legislative reform to confer a statutory obligation on presiding officers to warn jury members of the cautionary approach they should assume in convicting offenders based on the accuracy of single witness testimony.[903] While the ambitious objectives of this report could surely not be faulted, it ultimately failed to be absorbed into legislation.

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901 Bromby *et al* 2007:305.

902 In the case of *R v Williams* (1956) Crim LR 833.

903 Bromby *et al* 2007:307.

The case of *R v Turnbull*[904] represents the very first serious judicial consideration of the fallacious nature of eyewitness testimony.[905] The court in this instance held that eyewitness evidence, while sometimes unreliable, can ultimately be categorised as either higher or poorer quality evidence, and that "good quality" evidence should not automatically be disallowed.[906] The implication of such a ruling is that reliable single witness identification testimony can effectively result in a conviction without any additional corroborative evidence.[907]

The *Turnbull*[908] judgment necessitated the warning of jurors for caution when convicting accused persons on single witness evidence and ultimately generated a set of guidelines, referred to as the *Turnbull* rules, to assist jury members in evaluating eyewitness identification evidence.[909] Aspects such as the visibility and lighting conditions at the time of the offences, the distance of the witness from the accused, the duration of observation by the witness and other estimator variables, were included in this set of criteria.[910]

These rules have become widely accepted in the England-Wales legal system, as well as in some other common law systems, as a check for

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904 (1977) QB 224; (1976) 3 All ER 549; (1977) 63 Cr App Rep 132.

905 Bromby *et al* 2007:309.

906 Bromby *et al* 2007:309-310.

907 Bromby *et al* 2007:310.

908 (1977) Cr App Rep 132.

909 Bromby *et al* 2007:310.

910 Bromby *et al* 2007:310.

eyewitness testimony.[911] Where juries fail to apply these rules, it becomes probable that the conviction will be set aside on appeal.[912]

In addition to the rules generated in the *Turnbull*-case,[913] it was also stipulated that in cases where good quality identification evidence is provided, the jury can adequately evaluate the evidence without additional corroboration, while in the case of poorer quality evidence, the presiding officer should reclaim the case from the jury at the close of the state's case unless there is supplementary evidence to support the accuracy of the testimony.[914]

The application of the jury direction and *Turnbull*-rules come into effect whenever the case of the prosecution relies wholly or substantially on the accuracy of the eyewitness identification and this evidence is disputed by the defence.[915] Furthermore, where circumstances of the case conceive of potential errors in the identification, the processes according to the *Turnbull*-case must also ensue.[916]

While the *Turnbull*-rules find application in criminal proceedings, the Police and Criminal Evidence Act of 1984 (PACE) attempted to increase eyewitness identification efficacy by instituting several procedural directives which police officers have to comply with when

911 Bromby *et al* 2007:310.

912 Lawcards Series 2010:90.

913 *R v Turnbull* (1977) Cr App Rep 132.

914 Lawcards Series 2010:93.

915 Lawcards Series 2010:91.

916 Lawcards Series 2010:91.

identification evidence is offered.[917] These processes are included in PACE Code of Practice C, and while these regulations are not quite statutory in nature, breaches of the Code will probably result in the exclusion of the identifying evidence.[918]

4.3.6 The approach of courts in the United States of America in evaluating eyewitness evidence

Eyewitness evidence is imperative in criminal investigation and criminal proceedings in the United States of America,[919] and, similarly to South Africa, it is the primary type of evidence employed in criminal trials in America.[920]

With the advent of the twenty-first century, the United States of America expedited executive and legislative reform pertaining to eyewitness identification processes conducted by police officers to diminish inaccurate eyewitness recollection.[921]

In 1999, the United States of America's National Institute of Justice, under the auspices of the Department of Justice, formulated guidelines on eyewitness testimony in the form of *Eyewitness Evidence: A Guide*

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917 Lawcards Series 2010:96. The Code includes stipulations that where an identification witness is available, such evidence must be tested by way of identification procedures, like identification parades, or photographic identifications – Lawcards Series 2010:96.

918 Lawcards Series 2010:96.

919 Miller 2008:143.

920 Wise *et al* 2009:1266.

921 Schmechel *et al* 2006:181.

for Law Enforcement.[922] At the time, the only research conducted on this terrain was performed by psychologists and the citations included in the guidelines were thus of psychological research and publications,[923] although the drafting of the document was by and large a multi-disciplinary effort.[924]

In 2003, the National Institute of Justice published a training manual[925] containing best practice recommendations for the retrieval of eyewitness evidence in a manner that matches the scientific rigour of physical evidence.[926] These best practices were designed in accordance with the line-up section in the *Guide*,[927] and include the following: i) compiling line-ups, ii) witness instruction prior to viewing a line-up, iii) performing the identification parade, and iv) documenting the results of the identification.[928] These recommendations have been

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922 Wells *et al* 2006:46. See also Schmechel *et al* 2006:181; Wise *et al* 2009:1277. *Eyewitness Evidence: A Guide for Law Enforcement* (hereinafter referred to as *The Guide*) was officially published on October 26, 1999, in Washington D.C. and is available at http://www.ojp.usdoj.gov/nij/pubs-sum/178240.htm. *The Guide* is separated into five divisions that are consistent with the stages of a criminal investigation pertaining to eyewitness evidence. These divisions include: a) witness handling at crime scenes, b) retrieving a description of the suspect by way of sketches or mug shots, c) follow-up questioning, d) field investigations, and e) line-up identifications – Turtle *et al* 2003. http://www.psychology.iastate.edu/~glwells/Best_Practice_Recommendations_fo_% 20Eyewitness.pdf. Accessed on 01/10/2012.

923 Wells *et al* 2006:46.

924 Schmechel *et al* 2006:181.

925 Turtle *et al* 2003. http://www.psychology.iastate.edu/~glwells/Best_Practice_ Recommendations_fo_% 20Eyewitness.pdf. Accessed on 01/10/2012.

926 Schmechel *et al* 2006:181.

927 *Eyewitness Evidence: A Guide for Law Enforcement* – Turtle *et al* 2003. http://www.psychology.iastate.edu/~glwells/Best_Practice Recommendations_fo_% 20 Eyewitness.pdf. Accessed on 01/10/2012.

928 Turtle *et al* 2003. http://www.psychology.iastate.edu/~glwells/Best_Practice_ Recommendations_fo_% 20Eyewitness.pdf. Accessed on 01/10/2012.

distributed to police precincts across America, and several of these agencies have adopted and implemented these procedures.[929]

The approach of the criminal justice system in the United States pertaining to the evaluation of eyewitness testimony is succinctly delineated by Justice Ginsburg in the case of *Perry v New Hampshire*.[930] The defendant in this matter appealed his conviction on a charge of theft after being arrested for allegedly trying to break in to motor vehicles in a parking area. The defendant's arrest followed his identification by an eyewitness, who, according to the defendant on appeal, erred in her identification.[931]

The basis for appeal was that the court *a quo* made a mistake in necessitating an initial demonstration that police arranged suggestive identification procedures. The defendant contended that because of the suggestive circumstances surrounding his identification, the presiding officer should have evaluated the eyewitness testimony before exposing such testimony to the jury, thereby complying with the Due Process Clause.[932] In addition to this, he argued that eyewitness testimony by itself is of a severely unreliable nature.[933] The court held that the

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929 Schmechel *et al* 2006:181.

930 *Perry v New Hampshire* 132 S.Ct. 716 U.S.N.H. (2012).

931 *Perry v New Hampshire* 132 S.Ct. 716 U.S.N.H. (2012) at 718.

932 *Perry v New Hampshire* 132 S.Ct. 716 U.S.N.H. (2012) at 718. There are two Due Process Clauses in the American Constitution, one for federal courts, the other for courts on state level. The federal Clause is contained in the Fifth Amendment of the Constitution and stipulates that no person shall be deprived of life, liberty or property without due process of law. The Fourteenth Amendment provides that no State shall deprive any person of life, liberty or property without due process of law - http://www.usconstitution.net/const.html. Accessed on 31/12/2012. Where these clauses are invoked in criminal proceedings, eyewitness identifications can be rescinded if unnecessary suggestion.

933 *Perry v New Hampshire* 132 S.Ct. 716 U.S.N.H. (2012) at 719.

admission of the identification evidence without preliminary judicial evaluation of its reliability did not render the trial fundamentally unfair.[934]

Due process in the American legal system dictates, *inter alia*, that the determination of the reliability of eyewitness testimony normally falls to juries, except when contaminated by improper police conduct,[935] which would then qualify the witness testimony to first be screened by the trial judge. Should the trial judge then consider there to be a substantial probability of severe misidentification, that judge would then disallow the admission of such evidence at trial.[936] Conversely, if judicial testing discovered sufficient indication of reliability, the evidence would be allowed in trial, despite questionable police interference.[937] Suggestive circumstances with the potential to distort witness accuracy *not* created by police, however, does not warrant preliminary judicial consideration.[938]

In *Perry v New Hampshire,*[939] the court reiterated the factors employed in contemplating eyewitness identification reliability as first formulated in

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934 *Perry v New Hampshire* 132 S.Ct. 716 U.S.N.H. (2012) at 730.

935 Including construction of identification procedures polluted with unnecessary suggestion.

936 Precedent set in *Simmons v United States* 390 U.S. 377, 384, 88 S.Ct. 967, 19 L.Ed. 2d 1247 (1968), dictating that identification evidence should only be suppressed where the identification procedure was of such immense suggestive nature that it would cause "…a substantial likelihood of irreparable misidentification."

937 *Perry v New Hampshire* 132 S.Ct. 716 U.S.N.H. (2012) at 720.

938 *Perry v New Hampshire* 132 S.Ct. 716 U.S.N.H. (2012) at 720-721. The Due Process Clause does not represent an exclusionary rule leading to automatic exclusion, but commands a case-by-case assessment of the reliability of evidence. Automatic exclusion would frustrate, rather than achieve, justice - *Perry v New Hampshire* 132 S.Ct. 716 U.S.N.H. (2012) at 724-725.

939 *Perry v New Hampshire* 132 S.Ct. 716 U.S.N.H. (2012) at 725.

Neil v Biggers.[940] These factors comprise a "totality of circumstances" approach, and includes the opportunity the witness had in observing the accused at the time of commission of the offence, the extent of the witness's attention, the apparent accuracy of the initial description of the offender, the level of observed certainty or confidence the witness exhibits, as well as the time interval from the observation to providing testimony during trial.[941]

It is of great interest to note that two of the above-mentioned factors, namely the confidence with which the witness testifies and the accuracy of previous descriptions, have been meticulously researched by scholars in the field of psychology. Both these factors have been shown to have little correlation to the accuracy of eyewitness testimony,[942] yet it remains an instruction to juries in evaluation of such evidence, perhaps confirming previous research on presiding officers' limited understanding of factors influencing eyewitness correctness.

The court in the instance of the case of *Perry v New Hampshire*,[943] in responding to the allegation that eyewitness testimony is of a severely unreliable nature, confirmed the potentially fallacious nature of such evidence, but added that this did not render the introduction of the evidence at the defendant's trial fundamentally unfair, and does not justify the formulation of an exclusionary rule for such evidence.[944] It

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940 *Neil v Biggers*, 409 U.S. 188, 93 S.Ct. 375, 34 L.Ed. 2d 401 (1972).

941 *Perry v New Hampshire* 132 S.Ct. 716 U.S.N.H. (2012) at 725. Also in *Neil v Biggers*, 409 U.S. 188, 93 S.Ct. 375, 34 L.Ed. 2d 401 (1972).

942 Cutler *et al* 1987:234.

943 *Perry v New Hampshire* 132 S.Ct. 716 U.S.N.H. (2012).

944 *Perry v New Hampshire* 132 S.Ct. 716 U.S.N.H. (2012) at 728.

remains the duty of the jury to evaluate the reliability of eyewitness evidence.

4.4 FORENSIC DNA EVIDENCE

4.4.1 Introduction

Of all the potential practical applications that the determination of a person's exact genetic constitution might offer, none is so ensconced in public psyche as forensic DNA typing.[945]

Today, like eyewitness testimony, DNA profiling is inescapably part of solving crime and an indispensable advantage in any criminal docket. DNA evidence can provide the investigating officer and prosecutor with vital information regarding the identity of the offender, thereby solving the riddle as to "who" had committed the crime in question.[946]

Meintjes-Van der Walt[947] argues that it is fundamentally important for legal practitioners to comprehend the science of DNA, both the rudimentary foundations, as well as the recent advances, and to recognise the valid justifications for disputing the weight of DNA evidence in criminal proceedings.[948] According to Epstein,[949] the

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945 DNA is the acronym for deoxyribonucleic acid. All references hereafter to the latter will be indicated with the acronym.

946 Lynch and Hancock 2009:4. See also Goodwin and Meintjes-Van der Walt 1999:151.

947 2010:1.

948 Reference is made here to the weight of DNA evidence as issues pertaining to the admissibility of DNA evidence in criminal trials has, for the most part and subject to justified defence attacks, been resolved. Effectively every state and federal court in the United States of America have held that DNA typing evidence passes both the *Frye*- and *Daubert*-tests for

evidentiary force of DNA typing is so widely recognised and commended in criminal litigation, that both sides to the adversarial dispute should embrace the science, rather than attempting to find ways around it.

However, police officers, too, must take cognition of these factors. It is doubtful whether the science of DNA fingerprinting will have any tangible value within the criminal justice system if law enforcement officers do not appreciate the possibilities and fallibilities of this type of evidence. It is a formidable investigative tool,[950] as it may, in addition to serving as corroborative evidence of specific elements in substantive offences like crimes of a sexual nature,[951] housebreaking, robbery and murder, also benefit the detective by providing answers to investigative questions such as “who”, “what”, “when”, “where” and even “why”. This may be achieved by way of drawing conclusions from aspects such as the type of DNA-containing evidence discovered during an investigation, the source of the DNA, or the specific location where it was found.[952]

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admissibility of expert scientific evidence in criminal trials – Epstein 2004:25. In South Africa, DNA evidence is typically admitted by way of section 212(4) of the Criminal Procedure Act 51/1977, which dictates that if all requirements set down by this section are complied with, an affidavit regarding the evidence so tendered will, upon the mere production of such affidavit, be *prima facie* evidence of the tendered evidence. DNA typing is generally accepted in South African courts as reliable technique and admission challenges tend to steer more towards technicalities and chain of custody issues, as most other issues pertaining to the analysis technique have been rendered obsolete – Meintjes-Van der Walt 2010:56-62.

949 2004:25. See in this regard also Goodwin and Meintjes-Van der Walt 1999:151-152.

950 U.S. Department of Justice *s.a.* http://www.ncjrs/pdffiles1/bc000657.pdf. Accessed on 16/10/2012.

951 Approximately 70% of the cases investigated by the biology unit of the Forensic Science Laboratory of the SAPS comprise sexual assault – Omar 2008:31.

952 See Meintjes-Van der Walt 2010:1-2.

Butler[953] describes DNA typing as "...the most useful investigative tool to law enforcement since the development of fingerprinting more than 100 years ago."

In the mid 1970's, blood was employed in forensic investigation to categorise people into four groups, namely those with A, B, AB, or O types of blood. For the most part, this was inadequate in reliably establishing identity.

On the morning of September 10, 1984, English geneticist, Professor Alec John Jeffreys, happened upon a scientific breakthrough that would spectacularly alter the operation and efficacy of forensic science.[954] In performing DNA experiments in his laboratory at the University of Leicester, he discovered the individualising nature of DNA profiles, and genetic fingerprinting was born.[955]

Later that same day, Professor Jeffreys, astonished by his own discovery, made inventory of all the possible applications of DNA typing. Crime resolution through the establishment of identity, determining family relationships, paternity resolution, immigration

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953 2010:2. American geneticist, Dr. John M. Butler, is one of the most revered forensic DNA authorities in the world. He is currently group leader of Applied Genetics at the National Institute of Standards and Technology for the U.S. Department of Commerce in the United States of America.

954 BBC 2012. http://news.bbc.co.uk/local/leicester/hi/people_and_places/history/newsid_8242000/8242497.stm. Accessed on 06/10/2012. See also Butler 2010:4-5. While Prof. Jeffreys has never won the Nobel Prize for his remarkable achievement, he was awarded the Albert Lasker Award for Clinical Medical Research in 2005. This award has been referred to as "America's Nobels," as it is the most distinguished honour for outstanding contributions to basic and clinical medical research, as well as public service on behalf of medical research – University of Leicester *s.a.* http://www2.le.ac.uk/ebulletin/news/press-releases/2000-2009/2005/09/nparticle-kv8-487-wdd. Accessed on 06/10/2012.

955 BBC 2012. http://news.bbc.co.uk/local/leicester/hi/people_and_places/history/newsid_8242000/8242497.stm. Accessed on 06/10/2012.

disputes,[956] determining the foundations of inherited diseases, improving transplant science, facilitating conservation biology, establishing human origins and migrations,[957] and numerous other valuable enterprises were entered onto the list.[958]

In 1986, Professor Jeffreys was presented with the opportunity to demonstrate the immense forensic significance of genetic fingerprinting, which transpired to also be the first DNA exoneration. When two young girls from Leicestershire, England, were raped and murdered in 1983 and 1986, respectively, it was apparent from the similarity of the events that a single offender committed both crimes.[959] The police, suffering great pressure from the public to resolve the high profile crime, elicited a confession from a suspect and submitted his blood for genetic comparison with semen collected from both crime scenes.[960] Professor Jeffreys found that the crime and reference samples did not match, which excluded the suspect as being the donor of the crime sample, and thus produced the first DNA exoneration of an innocent man.[961]

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956 The very first use of Professor Jeffreys' discovery of genetic fingerprinting was in 1985 in just such a case of disputed immigration. When a British citizen returned home from his ancestral home, Ghana, authorities refused him entrance to Britain and accused him of passport fraud, until Professor Jeffreys proved his genetic connection to his mother and siblings residing in the United Kingdom - University of Leicester *s.a.* http://www2.le.ac.uk/ebulletin /news/press-releases/2000-2009/2005/09/nparticle-kv8-487-wdd. Accessed on 06/10/2012.

957 Interestingly, Professor Jeffreys employed DNA typing to prove that the extent of human genetic variation in Africa was significantly greater than that in other populations, thereby supporting the notion that people originated from Africa.

958 University of Leicester *s.a.* http://www2.le.ac.uk/ebulletin/news/press-releases/2000-2009/2005/09/nparticle-kv8-487-wdd. Accessed on 06/10/2012.

959 Butler 2010:5.

960 Butler 2010:5.

961 Butler 2010:5.

With no other identified suspects, the police conducted a voluntary mass DNA screening of almost 4 000 men within the geographical area of the crimes, without any success. When a witness reported to the police that she had heard a man at a local pub boasting about having given a blood sample to his friend, Colin Pitchfork, for forensic testing, the police interviewed Pitchfork and obtained his blood for DNA typing by Professor Jeffreys. It was revealed that Pitchfork's DNA profile matched the semen found on both the murdered girls' scenes, and he was accordingly convicted of both crimes.[962]

Apart from being the pioneering case in DNA exoneration and conviction, Butler[963] also credits the Pitchfork-case as a sound indicator of the importance of a DNA database in identifying offenders. Given that DNA profiling is essentially a comparative science, geneticists require a database of existing DNA profiles to compare with samples from crime scenes if they are to identify unknown perpetrators. In addition to this, statistical calculations are used to approximate the probability of a random DNA match amongst unrelated individuals.[964]

In 1987, the miracle of forensic DNA profiling was successfully introduced in the United States of America, but it was not until 1995 that this revolutionary technology was employed in criminal investigations in South Africa.[965]

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962 Butler 2010:5. Colin Pitchfork is currently serving a sentence of life imprisonment.

963 2010:5.

964 The matter of statistical analysis, along with other themes pertaining to DNA, will be expansively discussed in the course of this chapter.

965 Goodwin and Meintjes-Van der Walt 1999:152. DNA evidence in South Africa was accepted as admissible and reliable in the same year in *S v Nondala & Another* (Eastern Cape Division CC 20/95 unreported) – Goodwin and Meintjes-Van der Walt 1999:152.

Forensic DNA analysis has been described as the golden standard of forensic evidence.[966] Even the damning report by the National Academy of Sciences[967] on the forensic sciences depicts DNA evidence as "scientifically sound" and unsurpassed in its reliability.[968]

In light of the astonishing feats DNA has achieved, one would be forgiven for placing in it all hope for criminal resolution.

Gradually, however, as DNA profiling technology improved and police and legal practitioners progressively discovered both the enormous persuasive effect of DNA evidence, as well as its manipulability, instances of false convictions based on DNA evidence and problems relating to laboratory analyses began to permeate the collective awareness of scholars and practitioners.[969]

Distressingly, DNA evidence has inculpated innocent persons as suspects in crimes, and instances of false convictions based on DNA evidence has seen the light.[970] Warning bells sounded when, in October 2011, a young woman convicted of double murder in Italy, was

966 Shelton 2011:27.

967 National Academy of Sciences 2009. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

968 National Academy of Sciences 2009:5-5. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

969 In this regard see Epstein 2004:25-32; Murphy 2008-2009:489-512; Naughton and Tan 2011:245-257; Kaye 2012:1-7.

970 Dolan and Felch 2008. http://www.geneticsandsociety.org/article.php?id=4441. Accessed on 05/10/2012. Hanlon 2011. http://www.dailymail.co.uk/debate/article-2044935/Amanda-Knox-freed-Now-DNA-evidence-trial-Kercher-murder-acquittal.html. Accessed on 20/10/2011.

acquitted after the DNA evidence upon which she was initially convicted, was shown to be unreliable.[971]

Due partly to the daunting phenomenon of false convictions based on DNA evidence, the admittance of this type of evidence no longer ensues undisputed at every instance. The proliferation of genetic awareness amongst legal practitioners resulted in case-specific questions and objections regarding *inter alia* laboratory procedures, methods in proclaiming DNA matches, and statistical calculations.[972]

To clearly appreciate both the might and apparent fragility of DNA evidence, a scrupulous study of the basic foundational science of genes and genetic profiling, as well as the dangers and problems relating to DNA evidence, is necessitated.

> In a trial where DNA evidence is used by the prosecution for purposes of conviction, it is in the interest of the adversarial parties and the adjudication to be familiar with the scientific foundation for DNA analysis.[973]

4.4.2 Fundamental DNA biology

4.4.2.1 Basic principles of DNA[974]

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971 Hanlon 2011. http://www.dailymail.co.uk/debate/article-2044935/Amanda-Knox-freed-Now-DNA-evidence-trial-Kercher-murder-acquittal.html. Accessed on 20/10/2011.

972 Meintjes-Van der Walt 2010:2.

973 Meintjes-Van der Walt 2010:ix.

974 While every effort was made to complete this section as meticulously as possible, it is not intended as a scientifically comprehensive exposition of every facet of genetic identification. Such a discussion falls beyond the scope of this study. Rather, it is an attempt to familiarise legal practitioners and law enforcement personnel with the basic science of DNA and DNA profiling.

In the same manner that a brick represents the basic building block of a house, the cell is the fundamental unit of the human body.[975] Unlike a brick, however, the cell contains machinery capable of generating the raw materials, energy and waste removal faculties necessary to maintain life.[976]

Generally situated near the centre of each matured cell in the body is a round or oval structure, the nucleus, which contains the cell's genetic material, deoxyribonucleic acid (DNA).[977] DNA directs protein synthesis and serves as genetic design during the process of cell replication.[978]

The DNA molecules in the nuclei store data regarding humans' physical attributes and countless other features, which are ultimately genetically passed down to progeny.[979] Determinations of eye colour, hair texture, skin pigmentation and the capacity for cellular development all resides in DNA.[980] The relevance of DNA to the justice system, and to

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975 Palmer 2003:105; Butler 2010:19. See also Watson *et al* 1992:2.

976 Butler 2010:19. The human body comprises around 100 trillion cells, all of which originated and developed from the zygote, the single cell that materialised from the amalgamation of a father's sperm and a mother's egg – Butler 2010:19.

977 Sherwood 2001:18; Butler 2010:19. The DNA in nuclei exists as coiled rods known as chromosomes – Watson *et al* 1992:2. Not all cells in the human body enclose DNA-containing nuclei. Erythrocytes, or red blood cells, for example, contain no nuclei at maturity, and therefore no DNA – Sherwood 2001:371. A hair shaft, for instance, contains no nuclear DNA as it possesses no nuclei. There is, however, extra-nuclear DNA, known as mitochondrial DNA, which exists in mitochondrial cells within the hair shaft – Butler 2010:19. Mitochondrial DNA is inherited from maternal lines only and is not as variable as nuclear DNA – Meintjes-Van der Walt 2010:4.

978 Sherwood 2001:18; Butler 2010:19.

979 Palmer 2003:105; Butler 2010:19. See also Goodwin and Meintjes-Van der Walt 1999:153.

980 Palmer 2003:105.

identification specifically, lies in the fact that each individual's DNA code is unique to that individual.[981]

Every DNA molecule consists of small compositional elements called nucleotides. In turn, each nucleotide comprises three parts, namely a nucleotide base, or nucleobase, a sugar, and a phosphate molecule. The sugar and phosphate units[982] adhere to each other to create the spinal structure of the molecule, while the nucleobase attaches to each sugar molecule alongside this 'spine.' It is the nucleobase, or simply 'base', that endows genetic variation in each nucleotide.[983]

An 'alphabet' of four possible nucleobases permits an enormous amount of possible combinations at each position along the DNA molecule.[984] Adenine (A), thymine (T), cytosine (C) and guanine (G) affix to the sugar molecules in greatly diverse patterns, with each person's combination of bases being unique.[985]

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981 Meintjes-Van der Walt 2010:3. The DNA of identical twins remains the exception to this rule. Identical twins are born after a single zygote divided into two genetically identical embryos in the uterus of the mother at an early stage of development – Sherwood 2001:738.

982 These units are called 'deoxyribose' – Palmer 2003:105; Lynch and Hancock 2009:4. The sugar-phosphate 'backbone' is crucial in the maintenance of the structural integrity of the DNA molecule – Goodwin and Meintjes-Van der Walt 1999.

983 Butler 2010:20-21.

984 With there being approximately three billion nucleotide positions in the human genome, with four possible nucleobases, an almost infinite amount of combinations are feasible – Butler 2010:20.

985 Lynch and Hancock 2009:4; Butler 2010:20. There is a single exception to this rule. Identical twins, originating from a mutual zygote, share a DNA profile, as their nucleobase sequences will be an exact match.

Apart from prescribing the genetic individuality, the particularly unique sequence of nucleobases that each person bears also encodes the other informational content generally found in DNA.[986]

If one could imagine dissecting the nucleus in a cell, one would find DNA existing fundamentally as two strands, bonded together by way of hybridisation. The nucleobases on one strand of the sugar-phosphate backbone match up with their complimentary bases on the second strand,[987] due to the formation of hydrogen bonds[988] between the complimenting bases. Two hydrogen bonds form between the A-T base pair, while three bonds arise between the G-C base pair, rendering this pairing slightly more resilient than the former.[989]

This 'base-pairing' between two strands of DNA causes it to twist around in a ladder shape, forming a double helix of genetic material.[990]

The formation of hydrogen bonds between nucleobases is not, however, indissoluble, but can be fractured by elevated temperatures or chemical treatment, referred to as denaturation.[991] Even the destruction

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986 Butler 2010:20.

987 Adenine (A) compliments thymine (T), while guanine (G) compliments cytosine (C). The result of this complimentary base-pairing is that if the sequence of one strand of DNA is known, the sequence of the other strand is easily determinable by merely following the A-T, G-C pairing rule – Butler 2010:21-22.

988 Hydrogen bonds are types of weak, electrostatic attractive forces between a negatively charged atom in one molecule and a hydrogen atom in another molecule – McKee and McKee 1999:40-41. The fragile hydrogen bonds between the complimentary bases allow for the effective replication of the molecule, enabling cell division during growth – Goodwin and Meintjes-Van der Walt 1999:153.

989 Butler 2010:21. See also Meintjes-Van der Walt 2010:7-8.

990 Butler 2010:21.

991 Butler 2010:22. Denaturation may include placing the DNA in a salt solution of low ionic strength, or by exposing it to natural denaturants like urea or formamide. The latter

of these hydrogen bonds can be reversed. Heated and separated DNA strands, when cooled, will naturally rehybridise, or anneal, to its complimentary sequence.[992]

Upon closer examination of the DNA in a cell's nucleus, one would find that the double helix-structured DNA strands are coiled into several closely packed clusters or string-like structures, entrenched in protective proteins called histones.[993] These 'clusters' are chromosomes. Within all the cells contained in the human genome[994] reside 22 pairs of autosomal and one pair of sex-determining chromosomes, giving rise to an aggregate of 23 pairs of chromosomes.[995]

Chromosomes are counted in 'pairs' since it essentially consist of two sets of chromosomal strands, one inherited from each parental donor. For this reason, all human cells containing these two-set chromosomes, are said to exist in a diploid state.[996] Female egg or male sperm cells exist in a haploid state, indicative of the presence of only a single set of chromosomes.[997] Thus, where a diploid cell encloses 46 chromosomes, a haploid cell will be limited to 23 chromosomes. It is only once the egg

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destabilises DNA by generating hydrogen bonds with the nucleotides and thereby preventing bonding with the complimentary nucleobases – Butler 2010:22.

992 Butler 2010:22. This process is referred to as reannealing or renaturation – Butler 2010:22.

993 Watson *et al* 1992:14.

994 'Genome' is a collective term referring to the totality of DNA material within a cell, in other words, the comprehensive set of instructions for generating an organism in every living, nucleus-containing cell.

995 Butler 2010:23. Autosomal DNA is also sometimes referred to as 'autosomes' – Palmer 2003:27.

996 Butler 2010:24.

997 Butler 2010:24.

and sperm cells merge that these haploid cells become diploid in the form of a zygote or embryo.[998]

The sex-determining chromosomes are labelled either XY, containing a combination of single X and Y chromosomes, in the case of male chromosomes, or XX, as is the case with female chromosomes, designating two copies of the X chromosome.[999] While the Y chromosome may also occasionally be employed in identity determination, it is principally the markers on the autosomal chromosomes that provide the molecular machinery for individualisation.[1000]

The structure of a single chromosomal strand consists of three fundamental components. The centromere forms the centre, sphere-like structure of a chromosome and regulates the movement of the chromosome during cell division, or mitosis.[1001] On either side of the centromere are appendages, one shorter than the other, that terminate in telomeres, structures that serve to protect chromosomes from degradation.[1002]

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998 Butler 2010:23-24.

999 Butler 2010:24; Meintjes-Van der Walt 2010:5.

1000 Butler 2010:24. Since portions of the Y chromosomes are transplanted from father to son, Y-chromosome DNA testing is employed in tracking male pedigrees and finds application in instances such as motherless paternity testing cases, studying human migration, genealogical research, and many more – Butler 2010:364-365.

1001 Butler 2010:27.

1002 Palmer 2003:380; Butler 2010:27. Interestingly, telomeres shorten with every cell division. The length of a telomere is thus considered to be a measure of ageing in cells. One of the very first cloned animals, Dolly the sheep, passed away at an early age from lung disease common in older sheep. It was found that she had shorter telomeres than naturally conceived sheep and a great debate raged over the effect of cloning on telomeres and the resultant life expectancy of cloned organisms – Knight 2003. http://www.newscientist.com/mobile/article/dn3393-dolly-the-sheep-dies-young.html. Accessed on 19/10/2012.

The DNA material in chromosomes, the nucleobases, consists of 'coding' and 'non-coding' sections. The coding segments contain sufficient data needed for cellular protein production, and are called genes.[1003] Genes are the material and functional components of genetics passed from parent to child.[1004] These genes exhibit great diversity in size, with some consisting of a few thousand base pairs, and others, tens of thousands.[1005] The genetic programming of each individual is contained in the order of nucleobases in the DNA, as organised in these genes.[1006]

Genes, in turn, comprise segments coding specific proteins, as well as intervening, non-coding portions.[1007] Those segments responsible for protein-coding are referred to as 'exons' and the non-coding portions, or 'introns', are uninvolved in protein-production or manipulating biological functions.[1008]

Butler[1009] skilfully sheds some light on the nature of genetic data stored in DNA molecules by comparing it with printed data. If the human body is analogous to a library, the cells in the body represent the books and the nuclei the chapters in those books. When opening each of the

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1003 Palmer 2003:135; Butler 2010:25.

1004 Palmer 2003:135.

1005 Palmer 2003:135.

1006 Palmer 2003:105.

1007 Palmer 2003:180; Butler 2010:25.

1008 Palmer 2003:180; Butler 2010:25.

1009 2010:20.

chapters one would find pages, in the same manner one would find chromosomes when opening the nuclei. The loci or genes can be equated with the paragraphs on the page. While short DNA sequences can be strung together to ultimately constitute loci or genes, words are threaded together to form paragraphs. DNA nucleotides, or bases, represent the letters that ultimately generate the words.[1010]

The repetitive non-coding sections of DNA represent the vast majority of DNA volume[1011] and have traditionally been thought to have no known function, causing scholars to identify these sections as 'junk' DNA.[1012] By the early twenty-first century, however, innovations in genetic research revealed that this so-called 'junk' DNA in fact contributes substantially to structural and functional development of cells, as well as the development and perhaps even treatment of human disease.[1013]

While most of the coding regions in DNA are functionally similar amongst all humans,[1014] a whole host of sections of non-coding DNA existing throughout the human genome differ greatly from person to

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1010 Butler 2010:20.

1011 It has been averred that genes comprise only about 5% of human genomic DNA – Butler 2010:25.

1012 Palmer 2003:195; Butler 2010:25. See also Lynch and Hancock 2009:6.

1013 Palmer 2003:195; Butler 2010:25. In 2012, research shed some light on the actual significance of this 'junk' DNA. An immense research project showed that up to 80% of this once considered useless DNA is, in fact, active and essential in regulating the behaviour and proper operation of cells, organs and tissues. It has also been revealed that an intricate 'wiring system' is contained in this non-coding DNA, and that alterations in this system may contribute to human diseases such as multiple sclerosis, rheumatoid arthritis, Crohn's disease and cancer – Kolata 2012. http://www.nytimes.com/2012/09/06/science/far-from-junk-dna-dark-matter-proves-crucial-to-health.html. Accessed on 16/10/2012.

1014 These are, for instance, genes that code for the development of a heart, limbs, organs, and other features shared by all people – Palmer 2003:106.

person. These divergent sections are referred to as 'polymorphisms,' or 'variable markers.'[1015]

The DNA variable markers[1016] employed in individualisation are found in either the large portion of non-coding DNA on the chromosome, or the introns within genes that do not code for genetic variation.[1017] Accordingly, scientists only extract these portions of DNA from biological samples when performing DNA typing.[1018] The markers employed in DNA typing must necessarily exhibit the highest possible variation (polymorphism) to discriminate between biological samples.[1019]

A category of DNA polymorphisms repeating multiple times in succession and habitually employed in DNA typing, is known as short tandem repeats (STRs).[1020] These STRs, customarily merely two to four base pairs in length, are short regions of DNA that repeat continually at numerous loci throughout the human genome.[1021] The amount of STR repeats individualises one person from the rest of the population.[1022]

1015 Palmer 2003:105-106.

1016 The phrase 'DNA marker' signifies a known, traceable region on a chromosome used for DNA profiling – Palmer 2003:136; Lynch and Hancock 2009:5.

1017 Butler 2010:25. This raises an interesting question: if the markers employed in DNA profiling are not seated in the genetic coding portions of the chromosome, would essential individual information be rendered by such DNA profile? This question has been raised continually in privacy concerns regarding the creation of DNA databases. Butler affirms that since the non-coding sections of DNA are employed in DNA typing, no data regarding race, features, or predisposition to disease is generated during the analysis, rendering obsolete concerns that such information obtained from DNA typing would be leaked to, for instances, potential employers or insurance companies during insurance risk assessment – Butler 2010:279.

1018 Palmer 2003:106.

1019 Meintjes-Van der Walt 2010:12.

1020 Lynch and Hancock 2009:5.

1021 Meintjes-Van der Walt 2010:12.

1022 Meintjes-Van der Walt 2010:12.

The position on the chromosomal strand of a gene or DNA marker in a non-coding segment is traditionally referred to as a 'locus'.[1023] Homologous chromosomes are of the same size and genetic construction, meaning that a replica of genes, inherited from each parent, exist at the same locus on each chromosome.[1024]

Each DNA locus is capable of retaining more than one alternative gene form. These alternative possibilities are termed 'alleles.'[1025] Alleles are inherited separately from each parent.[1026] If two alleles at a specific genetic locus on a homologous chromosome are dissimilar, they are heterozygous, and homozygous if they are identical at that locus.[1027] Exposing differences in alleles at matching loci is indispensable in DNA profiling.[1028]

A genotype is the classification of the alleles existing at a particular locus.[1029] Goodwin and Meintjes-Van der Walt[1030] succinctly describe the term 'genotype' as being "…the allelic composition of a gene..." If there are two possible alleles at a given locus, for example, A and a, a

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1023 Butler 2010:25.

1024 Butler 2010:25. This does not, however, guarantee an identical DNA sequence, as mutations may ultimately cause alterations.

1025 Palmer 2003:13; Butler 2010:25.

1026 Meintjes-Van der Walt 2010:6.

1027 Butler 2010:25.

1028 Butler 2010:25. See also Goodwin and Meintjes-Van der Walt 1999:153.

1029 Butler 2010:25.

1030 1999:153.

resultant three possible genotypes may be obtained: AA, aa, or Aa.[1031] If genotype represents a person's genetic construction, phenotype signifies the physical appearance or expression of a trait, for instance, blue eyes.[1032]

DNA profiles are the combination of genotypes detected for multiple loci, while profiling refers to the process of establishing the genotypes at particular loci along the DNA strand.[1033] To minimise the possibility of detecting random matches between unrelated persons, numerous loci are normally examined in the course of DNA profiling.[1034] For this reason, it is vital to understand the principle of population variation.

4.4.2.2 Population variation

Butler[1035] maintains that approximately 99,7% of humans' base pair sequence is identical, while only about 0,3% of our genetic composition, equivalent to roughly 10 million nucleotides, are unique to every individual and thus available for DNA fingerprinting.

1031 Butler 2010:25. In this example, the AA and aa genotypes are homozygous, while Aa is heterozygous.

1032 Meintjes-Van der Walt 2010:6.

1033 Butler 2010:25. In a sample that contains two alleles, one with 13 repeat units and the other with 18, will have a genotype of '13,18.' This manner of indicating alleles in a sample facilitates comparisons between multiple samples – Butler 2010:29.

1034 Butler 2010:25.

1035 Butler 2010:28. The National Human Genome Research Institute reported that as much as 99,9% of human base pair sequences are identical – National Human Genome Research Institute 2011. http://www.genome.gov/17516714. Accessed on 17/12/2012. See also Meintjes-Van der Walt 2005:223.

Genetic variation is represented by the different alleles at a particular locus.[1036] Three distinct forms of variation are possible: sequence polymorphisms, length polymorphisms and copy number variants (CNVs).[1037] In DNA profiling, numerous DNA markers or loci are examined, since the greater the amount of markers observed, the greater the chance that two unrelated people will have different genotypes.[1038] Profiling the entire genome of a victim or suspect is not viable in terms of expense and time, so accurate estimation of identity is subject to the examination of numerous discrete locations on the particular individual's DNA.[1039] The variability that is exhibited at these locations will then be employed in the exclusion or inclusion of the individual as donor of the biological material from the scene or victim.[1040]

Butler[1041] affirms that certainty beyond any doubt is not conceivable:

> Because absolute certainty in DNA identification is not possible in practice, the next best thing is to claim virtual certainty due to the extreme small probability of a coincidental (random) match.

4.4.3 General aspects of forensic DNA typing

DNA evidence is yielded from 'real' science and the employment of established scientific methodology, developed from scientific research

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1036 Butler 2010:29.

1037 Butler 2010:29.

1038 Butler 2010:29-30.

1039 Butler 2010:30.

1040 Butler 2010:30.

1041 2010:30.

not specifically sought for application in court. DNA typing is unsurpassed as the most avidly studied and authenticated of all the forensic science techniques.[1042]

DNA profiling can be performed from miniscule amounts of DNA-containing material, such as bloodstains, saliva, bone, hair, semen, and other biological matter.[1043]

The practice of DNA fingerprinting may be categorised into several approaches, including restricted fragment length polymorphism (RFLP) techniques, as well as polymerase chain reaction (PCR)-based methods.[1044] The latter technique has usurped the former, as it can successfully yield sufficient amounts of DNA for profiling from DNA-containing material of low quantity and poor quality.[1045]

STRs are generally the DNA markers of choice in the process of PCR-based genetic typing since they are sufficiently sensitive to enable processing of low-quantity or degraded DNA material. In addition, they are capable of being automated and are sensitive to fluorescent detection, allowing analysts rapid access to data from the markers. Contrary to RFLP-based systems, STR markers easily and accurately distinguish between unrelated as well as closely related individuals, and facilitate the employment of computerised DNA databases.[1046]

1042 Meintjes-Van der Walt 2010:1.

1043 Butler 2010:32.

1044 Butler 2010:32.

1045 Butler 2010:33.

1046 Butler 2010:33.

4.4.3.1 Collecting and storing DNA-containing material

According to Butler,[1047] the proper collection of biological evidence from crime scenes, including the collection of reference DNA samples for comparison purposes, cannot be overstated, and warns against the collection of redundant samples which places unwarranted pressure on the forensic laboratory.

Meintjes-Van der Walt[1048] justifiably warns that pre-trial investigative procedures should be approached with caution, as it ultimately dictates the admissibility and reliability of expert DNA evidence, as well as the weight attached to it. Some of these pre-trial procedures include the collection of samples of biological material from crime scenes, as well as the recording and storing of samples.[1049] These procedures must be conducted in strict accordance with quality assurance standards, as failure to do so is likely to result in contamination of DNA samples, mixing or mislabelling of samples and a plethora of other flawed processes that will nullify any results obtained from DNA analysis.[1050]

Police officers or scientific practitioners serving in police agencies[1051] submit all pieces of evidential material gathered from the scene of an

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1047 2010:80-82.

1048 2010:13.

1049 Meintjes-Van der Walt 2010:13.

1050 Meintjes-Van der Walt 2010:13.

1051 In South Africa, crime scene technicians and forensic analysts are employed under the South African Police Service Act 68 of 1995, and, upon appointment, become police officers in principle.

offence, and if possible, also any reference samples available, to forensic laboratories.[1052]

Omar[1053] describes the volume of cases that the biology unit of the FSL in South Africa may receive in one year for DNA analysis as accruing to almost 42 000. Of these, only 40% will pass preliminary tests for the presence of blood or semen, and a mere 24% of these samples will contain 'good quality' DNA that will ensure further scrutiny. This means that only approximately 10% of submitted forensic samples will ultimately be subjected to DNA analysis.[1054]

As possible clarification for this perturbing phenomenon, Omar[1055] suggests that certain dilemmas might exist at the most important stage of the criminal investigation, evidence collection. Insufficient training of forensic field workers, low quality samples resulting from exposure to environmental factors, partially completed crime sampling kits, and poor storage methods are offered as some of the problems contributing to low quantity DNA analysis in South Africa.[1056]

The forensic laboratories in South Africa require prosecutor requests forms to be submitted to the laboratory with the purpose of prioritising DNA analysis of specific cases. This is to ensure that analysis results

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1052 Butler 2010:32.

1053 2008:33.

1054 Omar 2008:33.

1055 2008:33.

1056 Omar 2008:33.

arrive at court in time for trial. In the absence of these request forms the particular trial may suffer severe delays in waiting for the outcome.[1057]

With DNA evidence, as with all items of real evidence, a critical requirement is that the chain of custody of that particular sample is intact. Chain of evidence refers to the observed, uninterrupted, written chronological history of the persons who handled the evidence from the time of collection, until its presentation in court during trial.[1058] Meintjes-Van der Walt[1059] describes the twofold purpose of the chain of evidence as being the determination of a solid foundational link between the evidence and the accused, object or location, as well as an assurance that the piece of real evidence is authentic, that it is what it claims to be.

Research conducted by Meintjes-Van der Walt[1060] in 2010, addressed both the issue of chain of evidence in the treatment of specifically DNA evidence, as well as the question whether disruption in the chain of evidence in such cases would affect the admissibility or the probative value of the disputed DNA evidence. Emphasising the importance of an intact evidence chain, it was proposed in this study that disrupted chains of evidence where influential evidence, such as DNA, is offered for admission should render the evidence inadmissible, and in cases where it is admitted, the court should attach negligible value thereto.[1061]

1057 Omar 2008:33.

1058 Meintjes-Van der Walt 2010a:373, as reported in Swanson, Chamelin and Territo in 2003 in their treatise, *Criminal investigation* (8th edition) at 33.

1059 2010:14. These purposes and rules of chain of evidence was quoted by Chetty J in the case of *S v Adams* CA 73/2011 (EC) at [5].

1060 2010a:371-372. Since a meticulous study of all aspects of chain of evidence falls beyond the scope of this study, further scrutiny of the subject may necessitate thorough reference to the article of Meintjes-Van der Walt of 2010a.

1061 Meintjes-Van Der Walt 2010a:383.

In the reportable case of *S v Adams* CA 73/2011 (EC), where appeal was lodged against conviction and sentence on multiple counts of rape, Chetty J[1062] was obliged to address the issue of an alleged disruption in the chain of evidence of a DNA profile admitted into evidence by affidavit in accordance with section 212(4) of the Criminal Procedure Act 51 of 1977, as claimed by defence counsel on appeal. The defence requested the court to attach no weight to the admitted DNA evidence, but, in turn, the court held, that while the operation of section 212(4) of Act 51 of 1977 does not relieve the State of its burden to prove the accused person's guilt beyond reasonable doubt, it does provide the court with *prima facie* proof of the DNA evidence thus submitted,[1063] which implies that a speculative attack on the integrity of the chain of evidence without additional credible evidence will not be sufficient to reduce the probative weight attached to the DNA report. Here, *prima facie* proof will become conclusive proof.[1064]

4.4.3.2 Extracting DNA and its quantitation

DNA typing may only commence once the DNA has been extracted from its cellular components and any non-biological matter contaminating the sample.[1065] Cellular proteins that enclose and

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1062 *S v Adams* CA 73/2011 (EC) at [3].

1063 *S v Adams* CA 73/2011 (EC) at [4].

1064 *S v Adams* CA 73/2011 (EC) at [6].

1065 Palmer 2003:118; Meintjes-Van der Walt 2010:37. Comprehensive discussions on the four main methods of DNA extraction falls beyond the scope of this study. In this regards see Palmer 2003:118; Butler 2010:99-108.

preserve DNA in the environment of the cell can impede the ability to perform DNA analysis.[1066]

DNA can be extracted from any DNA-containing biological material, such as blood, vaginal fluid, semen, skin cells, sweat, bone, teeth, tissue, saliva and nasal secretions.[1067] Material such as faeces and dandruff may be analysed but is generally considered poor sources of DNA.[1068] Hair can be a source of DNA if naturally shed or plucked with the bulb of the root still attached to the shaft.[1069] Without the bulb, only mitochondrial DNA from the hair shaft can be extracted and analysed.[1070]

Once the DNA has been extracted from its cellular and non-biological envelope, it is crucial to measure the amount of human DNA before proceedings with analysis, as low quantity DNA and the presence of non-human DNA will result in poor results.[1071]

1066 Butler 2010:99.

1067 Meintjes-Van der Walt 2010:2.

1068 Meintjes-Van der Walt 2010:2.

1069 The DNA in the root of a hair shaft may yield more DNA in nanograms per root than bone or tissue samples per milligram. The average amount of produced DNA per plucked root is 1 to 750ng/root, while the average DNA harvested from bone is 3-10nanograms/milligrams of bone – Butler 2010:101.

1070 Palmer 2003:108; Butler 2010:65. In 1996, the Federal Bureau of Investigation (FBI) in the United States of America pioneered mitochondrial DNA analysis to test samples of low or no content nuclear DNA, such as bone, teeth, or hair. Mitochondrial DNA testing differs from nuclear DNA testing in the following respects: i) Since mitochondrial DNA is inherited solely from the mother, it cannot discriminate between two maternally related persons like nuclear DNA can, and ii) unlike nuclear DNA, it cannot provide a positive individualisation, merely link a forensic sample to a particular family – Palmer 2003:108-109.

1071 Butler 2010:99, 111. Approximately 0,5 to 2,0ng of input human DNA is optimal for commercial DNA profiling kits. If quantification of the DNA reveals content of less than 0,5ng the DNA must undergo amplification processes to increase the amount until it is rendered suitable for typing. More DNA than 2,0ng may also result in inaccurate results – Butler 2010:111.

4.4.3.3 The Polymerase Chain Reaction

Prior to the development of the polymerase chain reaction (PCR) method of amplifying specific sequences of DNA, forensic samples of low quality and quantity DNA was impossible to analyse.[1072] Since its birth in 1985, the PCR technique is now employed by DNA laboratories to augment the insufficient amount of DNA at the particular locus to be analysed, into millions of copies of the specific STRs that would enable successful DNA typing.[1073] The technique therefore encompasses amplification, not DNA fingerprinting itself, and additional scientific analyses are required to provide a DNA profile.[1074]

Just prior to cell division taking place in the human body, the DNA in the relevant cell replicates itself by way of a natural process in which the double helix DNA strand unwinds and produces an identical, complete copy of itself, which is then finally enclosed in the newly formed cell.[1075] PCR is essentially founded on this principle, but instead of replicating entire DNA strands, it focuses on specific STR loci which will be most effective in performing subsequent DNA typing, and replicates it continually until millions of copies have been produced.[1076]

1072 Butler 2010:125.

1073 Meintjes-Van der Walt 2010:37. Currently PCR is employed with every DNA analysis, regardless of the limitation or degradation of the forensic sample, since, apart from its capacity to magnify the DNA content, PCR is also vital in identifying the particular STR regions employed during the process of DNA typing – Meintjes-Van der Walt 2010:37.

1074 Palmer 2003:107.

1075 Palmer 2003:111.

1076 Meintjes-Van der Walt 2010:37-38; Butler 2010:125-126.

The PCR process involves the enzymatic[1077] activation and separation of the DNA strands, the annealing of artificially generated primers[1078] to the separated strand, targeting of specific loci, and, finally, the complete replication of the strand. This process, which includes a course of heating and cooling of the sample in question, is repeated until millions of copies of the targeted DNA strands have been produced.[1079]

4.4.3.4 An overview of DNA profiling – STRs, separation and STR genotyping

DNA individualisation relies on 0,3% of the human genome that differs from person to person. Within the entire human DNA content are found numerous repeated DNA sequences, typically in the non-coding regions of the DNA, which occur in a great variation of sizes amongst individuals without effecting the genetic operation of the individual.[1080] Within these, the STRs are best suited for forensic application by virtue of its immense hypervariability.[1081]

STR DNA typing is profoundly more sensitive than previously employed techniques and even more accurate.[1082] Butler[1083] opines that the use of

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1077 The enzyme regulating the replication and repair of DNA is called 'polymerase' – Palmer 2003:312.

1078 Primers, also referred to as oligonucleotides, are small sections of DNA that adhere to a separated DNA strand and allow polymerase enzyme to build the complimentary strand and replicate the original, separated strand – Palmer 2003:317.

1079 Meintjes-Van der Walt 2010:38; Butler 2010:126. See also Meintjes-Van der Walt 2010:38-41; Butler 2010:126-141 for exhaustive discussions and descriptions of the PCR process.

1080 Butler 2010:147; Meintjes-Van der Walt 2010:41.

1081 Meintjes-Van der Walt 2010:41. See also Butler 2010:151.

1082 Meintjes-Van der Walt 2010:42.

1083 2010:154.

STR markers in profiling is also much faster than the first DNA fingerprinting method developed by Professor Alec Jeffreys in the early 1980's, namely restriction fragment length polymorphism (RFLP).

To facilitate data comparisons and reproducibility, the forensic genetics community has generated a collective nomenclature to describe the alleles at particular STR loci.[1084] The number of repeats at a locus represents the name of the allele, for instance, if the sequence CGAT is repeated x amount of times, that allele will be referred to as allele x.[1085]

However, scientific reports from the FSL of the SAPS contain DNA profiles referring to two allele names, for example, x:x or x:y.[1086] Since two possible alleles may exist at a given locus, one inherited from each parent, an x:x allele may exist where the very same allele was inherited from both parents.[1087] A x:y allele is found where the x allele was inherited from the mother, while the y allele was inherited from the father.[1088]

The realisation of DNA profiling by using STR markers can only be achieved if a common set of standardised markers is employed.[1089] The more STR markers involved in the typing, the lower the probability of

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1084 See the discussion in Meintjes-Van der Walt 2010:41.

1085 Meintjes-Van der Walt 2010:41. If the said STR repeated five times, the allele would thus be called allele 5.

1086 As explained in Meintjes-Van der Walt 2010:41.

1087 As explained in Meintjes-Van der Walt 2010:41.

1088 Meintjes-Van der Walt 2010:41. Where a 15 and a 16 allele was inherited from each of the parents, the allele reading would be 15:16.

1089 Butler 2010:154.

two individuals sharing the same profile and the more formidable the power of individualisation of that profile.[1090]

Butler[1091] describes the thirteen standardised STR markers employed in forensic DNA profiling in the United States of America. After almost a year of research and testing, the chosen thirteen core STR loci were entered into the American national DNA database known as the Combined DNA Index System (CODIS). These markers produce a random match probability rarer than one in a trillion among unrelated persons.[1092]

According to Meintjes-Van der Walt,[1093] the most commonly employed STR system in South Africa in the early twenty-first century is the AmpF*l*STR Profiler Plus™ PCR Amplification kit, which involves the use of ten STR loci during DNA typing. This typing tool was introduced at the Forensic Science Laboratory (FSL) in 1998, when STR-PCR technology replaced all other methods of analysis.[1094]

Geneticists and forensic scientists enjoy the amenity of STR markers in kit form thanks in large part to two major American companies that developed these sets to facilitate and equalise DNA typing across the

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1090 Lynch and Hancock 2009:6; Meintjes-Van der Walt 2010:42.

1091 2010:154-155. The thirteen core STR markers were identified by the FBI in 1996. In addition to these markers, the amelogenin gene is used to perform sex-determining tests – Butler 2010:154. Amelogenin is a gene existing on the X and Y chromosomes that enables the establishment of gender from a biological sample – Palmer 2003:14.

1092 Butler 2010:155.

1093 2010:43-44. Research is currently underway to eventually change this kit to one that employs more loci and increase random match probability in the diverse South African society.

1094 Portfolio Committee on Police 2011:8.

globe.[1095] The AmpF*l*STR Profiler Plus™ kit employed by the FSL was designed by one of these two companies, *Applied Biosystems.*[1096] Comprising this system are the ten STR loci used to perform DNA typing,[1097] including one amelogenin gene which is sex-determining.[1098]

Once the targeted DNA sequences have been amplified to workable quantities, the resultant mixture of different sizes DNA fragments representing different alleles needs to be separated in such a manner that each allele is clearly distinguished from another.[1099] The process of separation traditional encompasses electrophoresis, a technique employing an electric current generated in a gel electrophoresis device to separate DNA fragments in either a slab gel or capillary environment.[1100] The negatively charged DNA molecules, once inserted in the slab gel and subjected to an electric charge, will be repelled by the negative charged electrode and migrate down the length of the medium towards the positively charged electrode.[1101] The rate at which the different DNA fragments migrate through the selected medium will be determined by their respective sizes, with the shorter DNA repeats moving at a greater speed down the gel than the longer fragments.[1102]

1095 Butler 2010:158.

1096 Butler 2010:159.

1097 These loci include: D3S1358, VWA, FGA, amelogenin, D8S1179, D21S11, D18S51, D5S818, D13S317 and D7S820 – Butler 2010:159.

1098 Meintjes-Van der Walt 2010:43. Laboratories in the United Kingdom employ the AmpF*l*STR SGM Plus system, also designed by the Applied Biosystems company. This kit operates with eleven STR loci, including the amelogenin gene – Meintjes-Van der Walt 2010:43.

1099 Butler 2010:175.

1100 Palmer 2003:113; Butler 2010:175-176.

1101 Butler 2010:176.

1102 Meintjes-Van der Walt 2010:45-46.

The mere separation of the DNA fragments will still bear no reportable information. The separation has to be detected. Fluorescence technology is one of the most popular methods of DNA detection due to its capacity for multicolour analysis, as well as the speed and relative simplicity of the technology.[1103]

When primers are added to the separated DNA strands during the PCR process, those primers are labelled with a range of different fluorescent dyes. When those amplified STR alleles then migrate through the slab gel, the light energy emitted by the different colours found at different lengths, is converted to an electronic signal proportional to the amount of light emitted. These signals are measured in relative fluorescence units (RFUs) and are visualised as peaks on an electropherogram.[1104]

The information contained in the electropherogram must be translated into the STR genotype, which is the allele (homozygote) or alleles (heterozygote) for a specific locus and is reported as the number of repeats in the allele. A full STR genotype or profile is generated by the combination of all the locus genotypes into a single series of numbers.[1105]

The height of the observed peaks on the electropherogram represents the amount of DNA fragments of a specific length and reflects the intensity of the fluorescent light detected by the computer system.

1103 Butler 2010:187.

1104 Butler 2010:187; Meintjes-Van der Walt 2010:45.

1105 Butler 2010:205.

Where alleles from one individual are measured, it is expected that the peaks would feature at approximately the same heights measured in RFUs.[1106]

The different colours of the peaks signify the different colour dyes with which the various alleles were labelled. In this manner, different alleles can be distinguished even where they are of similar length.[1107] The green peaks to the left of the horizontal line of the graph indicate gender,[1108] while especially tall red peaks represent the size standard, obtained from the addition of DNA fragments of known length and against which the system must be calibrated throughout the process of analysis so that DNA fragments of unknown length may be measured.[1109] These red peaks are disregarded when decoding a DNA profile.[1110]

Two neighbouring peaks on the electropherogram are indicative of heterozygous genotype at that allele, in other words, that locus contains two different alleles. Individual peaks represent homozygous genotypes where the locus only possesses one allele.[1111]

The numbers along the horizontal line of the electropherogram signify the RFUs, which is indicative of the number of copies of that allele's

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1106 Meintjes-Van der Walt 2010:46.

1107 Meintjes-Van der Walt 2010:48.

1108 A single, tall peak represents a female, while two peaks are indicative of male DNA – Meintjes-Van der Walt 2010:48.

1109 Butler 2010:207-208; Meintjes-Van der Walt 2010:48.

1110 Meintjes-Van der Walt 2010:48.

1111 Meintjes-Van der Walt 2010:48.

STR in the sample.[1112] To be relevant, these RFU figures must be higher than the analytical threshold, approximately 50 RFUs, to be considered a true detection.[1113] When peaks are elevated above the interpretation threshold, or 150 RFUs, then it can be deduced with some confidence that the amplified alleles are being detected.[1114]

The numbers along the vertical axis of the graph denote the lengths of the DNA fragments under observation. The longer the DNA fragment, the further down to the right it would appear on the graph.[1115]

Ultimately the lengths of the STR markers are recorded as a series of numbers. This denotes the 'DNA profile' and is the electronic representation of the physical DNA sample.[1116]

4.4.3.5 Statistical interpretation of DNA profiles

When a DNA profile has finally been obtained it remains, in isolation, relatively inadequate in offering any usable information towards individualisation. The profile found from material collected from the scene of the offence now has to be compared with the generated DNA profiles of all suspects in the particular case, or, in the absence of identifiable suspects, compared with profiles entered into a DNA database.[1117]

1112 Meintjes-Van der Walt 2010:47.

1113 Butler 2010:207.

1114 Butler 2010:207.

1115 Meintjes-Van der Walt 2010:47, 50.

1116 Lynch and Hancock 2009:7.

1117 Lynch and Hancock 2009:9.

In comparing the STR profiles one of three possible conclusions may be reached. Firstly, the case report may read that the samples are a match, or, the profile represents an inclusion.[1118] This occurs when the peaks on the electropherogram have the same genotypes and no inexplicable differences exist between the samples.[1119]

The true meaning of a DNA 'match' should not be misconstrued. No 'match' between two DNA profiles is unique, and it is not inconclusive proof that the unknown forensic sample and the reference sample originated from an identical source.[1120] It simply indicates that the suspect cannot be excluded as possible source.

Secondly, the comparison might yield an exclusion or non-match, portending that a genotype comparison indicated profile differences that can only be justified if the two samples originated from completely different sources.[1121]

Finally, the comparison might render inconclusive results. When the data does not justify a conclusion of a profile match or when insufficient data exists.[1122]

1118 Butler 2010:221.

1119 Butler 2010:221.

1120 Meintjes-Van der Walt 2010:75.

1121 Butler 2010:221.

1122 Butler 2010:221.

Once STR profiles have been compared and found to match, the matching profile must be compared to a population database to determine how probable the match is if the accused person is *not* the source of the crime scene sample.[1123] A statistical interpretation is offered to ascertain the rarity of the relevant DNA profile. In the absence of such a statistical analysis no determination of the probative value that should be attached to such evidence can be offered. It is the level of rarity that ultimately governs the value of the evidence.[1124]

4.4.3.6 DNA Databases

DNA databases are the repository for information obtained from DNA samples and contain several categories of DNA profiles, including a convicted offender profile database, random population profiles, and profiles from unsolved crime scenes.[1125]

DNA databases are essential in law enforcement investigations.[1126] By comparing unknown DNA profiles from crimes scenes or victims with profiles on databases, suspects can be identified in crimes that would otherwise never have been resolved.[1127]

1123 Meintjes-Van der Walt 2010:86. For a succinct discussion on calculating random match probabilities, see Meintjes-Van der Walt 2010:86-97.

1124 Meintjes-Van der Walt 2010:87-88, taken from Michaelis *et al*.'s publication in 2008: *A litigator's guide to DNA: From the laboratory to the courtroom*.

1125 Palmer 2003:110.

1126 Butler 2010:260.

1127 Butler 2010:260.

The United Kingdom was the first to construct a national database, the United Kingdom National DNA Database (NDNAD), in April 1995.[1128] This database enjoys aggressive application and, due to an expansion programme implemented in 2000, has accumulated an immense amount of DNA profiles, mainly apportioned into two segments.[1129] The first, the Criminal Justice Database, contains the DNA profiles from suspects, as well as charged and convicted persons of any recordable offence, while the second, the Crime Scene Database, comprises DNA profiles from biological material collected from crime scenes.[1130]

In 2008, in the case of *S & Marper v United Kingdom*,[1131] however, the European Court of Human Rights (ECHR) unanimously held that the United Kingdom had infringed on the right to a private life under Article 8 of the European Convention for the Protection of Human Rights and Fundamental Freedoms by retaining DNA profiles of individuals suspected of crimes but not yet convicted. In response to this judicial finding, the Protection of Freedoms Act 2012 has been enacted to ensure that only individuals who have been convicted of an offence will have their DNA profiles retained indefinitely.[1132] Sections 1 and 2 of this Act stipulate, *inter alia*, that DNA profiles may be retained until the

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1128 Lynch and Hancock 2009:26; Butler 2010:263-264.

1129 Butler 2010:264. The NDNAD is reported to be the largest DNA database per capita in the world – Lynch and Hancock 2009:38.

1130 Lynch and Hancock 2009:27.

1131 Swergold 2010:179; *S & Marper v United Kingdom* 2008. Court of Human Rights, Grand Chamber. Applications 30562.04 and 30566.04. Judgment of 4 December 2008; Meintjes-Van der Walt 2010b:107.

1132 Home Office 2012. http://www.homeoffice.gov.uk/police/national-dna-database/pofa-2012-dna-fingerprint-prov/. Accessed on 31/12/2012. See also Express.co.uk 2011. http://www.express.co.uk/posts/view/364510/Full-DNA-samples-to-be-destroyed. Accessed on 31/12/2012. Sections 1 to 25 comprise provisions regarding DNA and fingerprint retention.

conclusion of criminal investigations or court proceedings, but must be destroyed upon acquittals. Section 14(4) orders the destruction of DNA samples either after a DNA profile has been obtained, or six months after the sample was taken.[1133]

In the late 1980's in the United States of America, the federal government pursued the establishment of a combined national, state and local DNA database system for the storage and comparison of DNA profiles, and is referred to as the Combined DNA Index System (CODIS).[1134] It, too, consists of two indexes, namely the Convicted Offender Index which comprises DNA profiles of persons convicted of certain offences, and the Forensic Index, containing profiles from DNA-containing material from crimes scenes.[1135]

The American government, similar to its English counterpart, has dedicated some effort into expanding on CODIS. Several pieces of legislation have been enacted to facilitate the accumulation of DNA information on database, including the DNA Identification Act of 1994 (authorising the expansion of a national database); the DNA Analysis Backlog Elimination Act of 2000 that authorised the collection of DNA samples from federal conviction offenders; the Justice for All Act of 2004, regulating the collection of DNA samples from indicted persons for the National DNA Index System (NDIS), the FBI Laboratory's

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1133 Protection of Freedoms Act 2012. See also Home Office 2012. http://www.homeoffice.gov.uk/police/national-dna-database/pofa-2012-dna-fingerprint-prov/. Accessed on 31/12/2012.

1134 Lynch and Hancock 2009:30; Butler 2010:266. The National DNA Index System (NDIS) allows DNA profiling laboratories to conduct weekly DNA match searches in CODIS – Lynch and Hancock 2009:30.

1135 Lynch and Hancock 2009:30-31.

database; and the DNA Fingerprint Act of 2005, authorising the inclusion of DNA profiles of arrested and detained persons.[1136]

Pending the formalisation of the highly anticipated legislation[1137] regarding the creation of an improved DNA database, South Africa currently has no convicted offender database and the existing database is not legislatively controlled.[1138] The National DNA Database of South Africa (NDDSA) now only holds DNA profiles collected from crime scenes and DNA samples of persons suspected of a crime or arrestees.[1139] The expansion and legislative control of the NDDSA is subject to the promulgation of the Criminal Law (Forensic Procedures) Amendment Bill B2-2009,[1140] which is anticipated to establish several types of indexes and elevate the NDDSA as a criminal intelligence tool.[1141]

DNA databases as criminal investigative instruments have enjoyed success around the world. In the United Kingdom, more than 50 000 criminal investigations have been assisted by comparisons within the local national database, NDNAD.[1142] In the United States of America,

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1136 Butler 2010:277.

1137 Criminal Law (Forensic Procedures) Amendment Bill B2-2009.

1138 Lynch and Hancock 2009:33; DNA Project 2012. http://dnaproject.co.za/legislation-homepage/legislation/south-africa-the-current-situation. Accessed on 06/10/2012.

1139 DNA Project 2012. http://dnaproject.co.za/legislation-homepage/legislation/south-africa-the-current-situation. Accessed on 06/10/2012.

1140 Hereafter referred to as the 'DNA Bill'. This proposed legislation seeks to deal with deficiencies in current legislation regarding the collection, storage and employment of DNA evidence, as well as the enlargement and management of a national DNA database – Lynch and Hancock 2009:33.

1141 DNA Project 2012. http://dnaproject.co.za/legislation-homepage/legislation/south-africa-the-current-situation. Accessed on 06/10/2012.

1142 Butler 2010:264.

the national database, CODIS, has aided approximately 129 514 criminal investigations.[1143]

In South Africa, the regrettably weak national DNA database and absence of any regulating legislative provisions have caused a failure of DNA profiling to yield similar assistance to investigative detectives, but it is expected that the finalisation of the DNA Bill will greatly assist investigations in similar manner by causing the NDDSA to be significantly enlarged.[1144]

4.4.4 The supposed infallibility of DNA evidence

4.4.4.1 Introduction

DNA evidence has gained almost mythical importance, and is shrouded in a veil of perceived infallibility.[1145] While its immense efficacy and superiority in the arena of scientific evidence cannot be disputed, it has slowly started to permeate the minds of the scientific and legal communities that even this Achillean forensic tool has its limitations and vulnerabilities.[1146]

By the time that DNA typing crossed the Atlantic Ocean to the United States of America in the late 1980's, few objections to the admission of

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1143 Butler 2011. http://www.youtube.com/watch?v=dhqEEAl-g34. Accessed on 10/10/2012.

1144 Lynch and Hancock 2009:34, 38.

1145 Epstein 2004:26.

1146 Dolan and Felch 2008. http://www.geneticsandsociety.org/article.php?id=4441. Accessed on 05/10/2012. Hanlon 2011. http://www.dailymail.co.uk/debate/article-2044935/Amanda-Knox-freed-Now-DNA-evidence-trial-Kercher-murder-acquittal.html. Accessed on 20/10/2011.

DNA evidence was tendered and courts readily accepted this new, revolutionary type of evidence.[1147] By 1989,[1148] defence attorneys had attained considerable experience in the science of DNA and started challenging DNA evidence admission on technical points of the analyses. Although this did not necessarily affect the admissibility of DNA evidence, it did succeed in exposing the limitations and fallibility of DNA typing.[1149]

Apart from enduring debates on alleged civil and privacy infringements, Dolan and Felch[1150] warn that DNA evidence has occasionally incriminated innocent individuals in offences, both by virtue of contamination or mislabelling in the laboratory, and by overestimation or misinterpretation of its meaning in criminal proceedings. A report issued by the National Academy of Sciences following rigorous research into the practice of forensic science in the United States of America, stated that while DNA evidence has indeed raised the bar for scientific reliability, only approximately 10% of cases comprise DNA and even

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1147 Edmond 2011:129.

1148 In the case of *People v. Castro* 545 NYS 2d 985 (Sup. Ct. 1989), in which the accused was charged with murder, DNA evidence was challenged for the very first time. The court meticulously scrutinised DNA typing methodology and held that it met the standards formulated in the *Frye*-case, and was therefore admissible and reliable. The court did, however, find that the specific profiling laboratory's methodology was erroneous. The particular DNA evidence was consequently deemed unreliable and was excluded. Fortunately, the accused decided to plead guilty to the charge and was convicted thereupon.

1149 Edmond 2011:129-130. The destabilisation of DNA evidence in the late 1980's was imposing enough to warrant the FBI's intervention, when it sponsored the establishment of the Technical Working Group on DNA Analysis Methods (TWGDAM). This entity manages membership and imposed a mandatory passage point for technical and social exchanges, thereby succeeding in standardising DNA analysis to a large extent – Edmond 2011:130. This period saw a proliferation of scientific research on human DNA markers and the ensuing strengthening of validation standards of DNA evidence in courts – Lieberman *et al* 2008:28.

1150 Dolan and Felch 2008. http://www.geneticsandsociety.org/article.php?id=4441. Accessed on 05/10/2012. Hanlon 2011. http://www.dailymail.co.uk/debate/article-2044935/Amanda-Knox-freed-Now-DNA-evidence-trial-Kercher-murder-acquittal.html. Accessed on 20/10/2011.

where it is available, "…it will assist in solving a crime only if it supports an evidential hypothesis that makes guilt or innocence more likely."[1151]

Lieberman *et al*[1152] suggest that admissibility and weight challenges against DNA evidence in court have historically been launched in the basis of laboratory deficiencies, contamination, absence of proper written operating procedures, laboratory accreditation, chain of custody, difficulties with statistical interpretations and much more. The ease with which DNA material can be contaminated has generated inaccurate results and this has given rise to some wrongful convictions.[1153]

Today, the notion of the infallibility of DNA evidence no longer endures. Thompson[1154] states unequivocally that while DNA evidence remains tremendously reliable and indispensable, errors in DNA profiling occur frequently.

Harmon,[1155] as early as 1993, cautioned that DNA evidence is merely corroborative and cannot conjure up convictions where any other incriminating evidence is absent.

An overview of the literature on the fallible nature of DNA evidence would suggest two main lines of concern. Firstly, faulty DNA analysis, insufficient samples or statistical misinterpretation could render

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1151 National Academy of Sciences 2009:1-5. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1152 2008:31.

1153 Lieberman *et al* 2008:31.

1154 2008:3. See in this regards also Goodwin and Meintjes-Van der Walt 1999:158-164.

1155 1993:175-176.

inaccurate findings. Secondly, despite accurate and properly conducted analysis, the meaning and weight attached to DNA evidence may be improperly overestimated or misconstrued.

4.4.4.2 The fallible nature of DNA evidence

Research conducted[1156] on specifically the concerns regarding the reliable nature of DNA evidence and typing was instigated in 2010 and revealed that DNA analysis performed in forensic laboratories are subject to perturbing subjectivity and bias.[1157] It also exposed the substantial inconsistencies in the guidelines on interpreting DNA sample statistics.[1158]

A growing number of cases in the United States of America are experiencing partial profiles, since smaller and smaller amounts of DNA are being analysed by forensic laboratories. In addition to this, biological samples from crime scenes may be contaminated or degraded, rendering partial or incomplete DNA profiles.[1159] What this implies is that profiles are generated in which certain alleles fail to appear, an occurrence known as 'drop-outs', or alternatively, false peaks on electropherograms are created by imperfections in the analysis machine and are mistaken for alleles, known as 'drop-in'.[1160]

1156 See Geddes 2010. http://www.newscientist.com/article/mg20727733.500-fallible-dna-evidence-can-mean-prison-or-freedom.html. Accessed on 02/03/2012.

1157 Geddes 2010. http://www.newscientist.com/article/mg20727733.500-fallible-dna-evidence-can-mean-prison-or-freedom.html. Accessed on 02/03/2012.

1158 Geddes 2010. http://www.newscientist.com/article/mg20727733.500-fallible-dna-evidence-can-mean-prison-or-freedom.html. Accessed on 02/03/2012.

1159 Thompson 2008:4.

1160 Geddes 2010. http://www.newscientist.com/article/mg20727733.500-fallible-dna-evidence-can-mean-prison-or-freedom.html. Accessed on 02/03/2012.

The same problem has been reported in the United Kingdom and by 2011 research showed that low copy number DNA and the employment of databases to identify suspects, can potentially generate false and unreliable results falsely incriminating innocent people and leading to false convictions.[1161]

Mixed DNA samples are also cause for concern, as the subjective estimation of the analysing scientist plays an important role. During an investigation into the accuracy of analyst opinions in mixed samples, a sample of mixed DNA from an actual crime scene in the United States of America, as well as the profile of the individual convicted for the offence, was given to seventeen experienced genetic analysts.[1162] Allegations of unwavering objectivity would suggest that all seventeen analysts would arrive at the same conclusion regarding the guilt of the convicted man. Alarmingly, only one of the seventeen scientists agreed with the initial report that the convicted individual could not be excluded as depositor of the DNA. Four submitted that the evidence was inconclusive, while twelve indicated that the convicted individual could be excluded as origin of the DNA.[1163]

In 2009, Israeli scientists exposed to an increasingly suspicious legal audience the troubling phenomenon of 'fake DNA.'[1164] The presentation of DNA evidence to court during criminal trials operates on the premise

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1161 Naughton and Tan 2011:246. See also Thompson 2008:3-4.

1162 Geddes 2010. http://www.newscientist.com/article/mg20727733.500-fallible-dna-evidence-can-mean-prison-or-freedom.html. Accessed on 02/03/2012.

1163 Geddes 2010. http://www.newscientist.com/article/mg20727733.500-fallible-dna-evidence-can-mean-prison-or-freedom.html. Accessed on 02/03/2012.

1164 Frumkin *et al* 2010:95-103; Bolden 2011:409.

that the DNA so tendered is genuine, originating from true biological sources. Frumkin *et al*[1165] revealed that through the employment of conventional and simple techniques and instruments, DNA of any desired genetic profile can be synthesised *in vitro* and deposited on objects, planted on crime scenes and even incorporated into human tissue with the greatest of ease. Equally distressing is the fact that, at the time the study was conducted, typing techniques used in American laboratories were incapable of recognising such artificial genetic interference.[1166]

In the same study, however, the researchers describe methodology that may be employed to detect such fake DNA and distinguish it from natural genetic material.[1167] A process of methylation, an epigenetic chemical modification of DNA, can be applied to reveal synthetically generated DNA.[1168] It remains to be seen to what extent this solution would defend the credibility of DNA evidence, since it is not traditionally applied to DNA samples but only where concerns regarding the authentication of DNA material exist.

Epstein[1169] suggests several methods of attacking tendered DNA evidence in criminal litigation. Firstly, she proposes that despite the purity of the science, DNA evidence is still subject to the chain of evidence requirement, which may not necessarily be intact and thus

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1165 2010:95-96.

1166 Frumkin *et al* 2010:95-96.

1167 Frumkin *et al* 2010:96.

1168 Frumkin *et al* 2010:96.

1169 2004:26.

vulnerable to challenge. Secondly, DNA typing is dependent on the proper functioning of machines and equipment. Should such equipment fall into disrepair, challenges regarding the accuracy of findings may be offered. Lastly, challenges pertaining to the accuracy of statistical determinations of random match probability may be launched, as few matters are as predisposed to misinterpretation, misapprehension, and erroneous description as evidence regarding statistical occurrence and probabilities.[1170]

Despite the dangers inherit in the intricate science of DNA typing, its value in the criminal justice system remains unsurpassed. From the above it appears essential, however, that the processes of collection, analysis and interpretation of DNA evidence must be conducted in such a manner as to avoid the horror of injustice.

4.4.4.3 Misinterpreting the meaning and significance of DNA results

According to Lieberman *et al*,[1171] there exists a likely chasm between human interpretation of DNA evidence and the actual accuracy of this type of evidence.

> The presumed infallibility of this scientific evidence, however, may not necessarily extend to how it is perceived, interpreted, and applied by human actors within the criminal justice system.[1172]

1170 Epstein 2004:26.

1171 2008:27-28.

1172 Lieberman *et al* 2008:27.

Murphy[1173] avers that even where DNA typing was performed perfectly and precisely according to standard protocol, the analysts are still called to provide discretionary views and choices pertaining to the interpretation of the results, and raises the same difficulties with drop-out and drop-in alleles as was already discussed with mixed DNA samples. Despite the immense power of this type of evidence, it is not a purely objective science and thus imperfect.[1174]

The same author also contends that the technical intricacy of DNA typing, its reliance on databases, as well as its wide application are likely to "…aggravate the conditions that ultimately caused widespread failures in the first generation."[1175] Legal practitioners confronted with DNA reports are even more ill-equipped to evaluate the accuracy and reliability of such evidence.[1176]

In the United States of America, where the jury system is still applied in criminal trials, Lieberman *et al*[1177] investigated studies on the effect of DNA evidence on lay juries, and discovered that the presentation of DNA evidence, especially the intricate mathematical calculations on match probability, leaves jurors uncertain and confused. In this state, lay jurors tend to convict when DNA evidence is inculpating, and acquit when such evidence is exculpating, regardless of the rest of the evidence, errors in DNA testing, and ferocious cross-examination.[1178]

1173 2008-2009:491.

1174 Murphy 2008-2009:512.

1175 Murphy 2007:725, 748.

1176 Murphy 2007:748-749.

1177 2008:32.

1178 Lieberman *et al* 2008:40, 44.

At the 3rd International Conference on Evidence Law and Forensic Science[1179] presented by the China University of Politics and Law in Beijing, China in 2011, Ligertwood[1180] discussed the wisdom of convicting accused persons on DNA evidence alone, even where the DNA typing was accurate and reliable. Considering the high standard of proof of criminal trials in all jurisdictions, Ligertwood[1181] argues that DNA evidence results in statistical frequency and that these statistics alone cannot constitute proof in court, since the concept of proof is not a probabilistic calculation subject to mathematical determination, but rather an inductive consideration. DNA evidence must therefore be presented in a manner that also addresses possible innocent explanations of the results and empowers the court to consider other evidence tendered. The absolute necessity and importance of the totality of reliable evidence presented to court in the accurate inductive determination of guilt is thereby emphasised.[1182]

Concerns have also been heard regarding the new technology in analysing so-called 'touch DNA.'[1183] This technology is highly sensitive as it requires only very small samples of DNA-containing material. As little as seven or eight cells from the outermost layer of human skin are

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1179 This conference was established with the specific purpose of creating greater integration in research and practice between the disciplines of law and science.

1180 2011:3.

1181 2011:3.

1182 Ligertwood 2011:3.

1183 Touch DNA refers to Low Copy Number (LCN) DNA analysis, which provides for the analysis of very low quantities of DNA material – Caddy *et al* 2008. http://www.homeoffice.gov.uk/publications/police/operational-policing/response-caddy-dna-review?view=Binary. Accessed on 05/12/2012.

all that is requisite to conduct successful DNA typing.[1184] Despite the FSL's enthusiasm about its ability to perform such typing, there are concerns that innocent DNA transfer might be misconstrued and blameless individuals may be incriminated in events they were not part of.[1185]

In the United Kingdom in 2008, a report[1186] was published in which it was indicated that whenever touch DNA technology was employed in generating profiles for use in criminal litigation, it must be unambiguously stated that the nature of the origin material of the DNA is unknown, the time at which the DNA was transferred cannot be deduced, and that a much greater risk for secondary transfer of the DNA material exists than for traditional DNA profiling techniques.[1187]

In the case of *R v Reed,*[1188] the English court of appeals dealt with the nature and admissibility of touch DNA and the Low Copy Number analysis procedure, and held that it was, in fact, admissible.

No less disconcerting is offenders' perceived increased understanding of the biochemistry of DNA and their subsequent capacity to 'plant' DNA, as well as to avoid detection based on their discarded genetic material.[1189] Owing to the popularity and high incidence of forensics-

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1184 DNA Project 2012. http://dnaproject.co.za/blog/category/dan-detective. Accessed on 06/10/2012.

1185 Murphy 2008-2009:501-502.

1186 Caddy *et al* 2008. http://www.homeoffice.gov.uk/publications/police/operational-policing/response-caddy-dna-review?view=Binary. Accessed on 05/12/2012.

1187 Robertson and Roux 2010:21, in discussion of the UK report on low template DNA.

1188 [2010] 1 Cr App R 23, 310. This case will be discussion in more detail in Chapter 6.

1189 Thompson 2008:35-36.

related programmes on television, offenders are more and more likely to prevent their own DNA from being detected on crime scenes and to plant the discarded DNA of innocent persons on crime scenes.[1190]

Finally, Epstein[1191] cautions that the probative value of the DNA evidence may be contested based on the relevance of the DNA on the scene or victim, highlighting legal practitioners' tendency to add overestimated value to the presence of DNA results in case dockets. For instance, if a victim in a rape case alleges she was raped in the accused person's house, the presence of his semen on towels in the bathroom of the said house will be irrelevant as probative evidence of guilt.

Issues regarding probative value of DNA evidence in South African litigation has also underscored the corroborative effect of this type of evidence as opposed to its ability to stand alone as proof of fact. Experience has shown how easily and swiftly DNA evidence can be rendered irrelevant when accused persons on rape charges, where DNA is most often employed in South African trials,[1192] submit plea explanations admitting sexual intercourse but offering consent as basis of their defence.[1193]

1190 Thompson 2008:35-36. See also Grieve and Wiggins 2001:836.

1191 2004:26.

1192 Lynch and Hancock 2009:1.

1193 Murphy 2007:734. Even in murder trials DNA evidence can be reduced to irrelevance where a certain defence, for instance private defence, is alleged. The ease with which DNA can be rendered irrelevant in rape and murder cases has prompted some scholars to suggest that DNA evidence "…may hold the greatest promise in solving low-level crimes like property and possession offences" – Murphy 2007:734.

4.5 CONCLUSION

While eyewitness and DNA evidence are entrenched as heroes in the law of evidence, it is clear from research and case law that eyewitness identification testimony is tremendously unreliable and poses one of the most serious problems in the administration of criminal justice.[1194] An abundance of instances of false convictions based on eyewitness testimony muddles the most often employed type of evidence in almost all jurisdictions.

The total elimination of eyewitness testimony, however, is neither a desirable nor a feasible approach to improving criminal justice.[1195] Other evidence therefore needs to be submitted to corroborate this kind of evidence.[1196]

During the course of investigations too, detectives and police officers need to enlighten themselves with the pitfalls of eyewitness evidence.

> If eyewitnesses are a central part of police investigations, an uncritical acceptance of eyewitness evidence by police officers may be misleading and hinder the appropriate investigation of crimes. On the other hand, the police may minimise the disruptive potential of incorrect information if they are critical of eyewitness evidence.[1197]

However, research regarding the perceptions of police officers of eyewitness evidence indicates that investigating officers mostly believe

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1194 Woocher 1977:969.

1195 Wells 1978:1547.

1196 Meintjes-Van der Walt 2009:326.

1197 Kebbell and Milne 1998:324.

that eyewitnesses' testimony and statements are accurate.[1198] At the conclusion of this research it was also reported that police officers rarely have sufficient time to conduct adequate and effective interviews with witnesses,[1199] an alarming accusation, since proper testing structure is fundamental in eradicating question bias and suggestion.

The golden standard of scientific evidence, DNA profiling, has transformed the way in which expertise is seen to prove facts. It is a reliable, reproducible standard of evidence. It is not, however, the answer to crime and by no means immune to subjectivity and errors. It will also not be relevant in all cases or circumstances. The Crown Prosecution Service of England Wales operates in accordance with policy that dictates that no prosecution shall proceed on the basis of DNA evidence alone, but that additional evidence must always be submitted as corroboration.[1200] This is nothing if not sensible, since only approximately 5% of crime scenes perused in England and Wales yield DNA-containing evidence.[1201]

If eyewitness testimony and DNA evidence, the pillars of proof in criminal proceedings, cannot stand alone in satisfying the high standard of proof in criminal litigation, it stands to reason that other avenues of evidence need to be considered and researched.

1198 Kebbell and Milne 1998:328.

1199 Kebbell and Milne 1998:328.

1200 Meintjes-Van der Walt 2010:76.

1201 Grieve and Wiggins 2001:835.

CHAPTER 5

TRADITIONAL FORENSIC SCIENCES: THE SCIENCE OF THE UNDERDOG DISCIPLINES

5.1 INTRODUCTION

In Sir Arthur Conan Doyle's tale, *The Copper Beeches*, the iconic literary detective, Sherlock Holmes, proclaims in frustration at being probed for answers to a case of which he had no information:

> Data! data! data!... I can't make bricks without clay.[1202]

This proclamation represents an appreciation of the importance of integrating all available and relevant data in the process of abductive reasoning during a criminal investigation, already understood by Sir Conan Doyle as early as 1892, when *The Copper Beeches* was first published.[1203]

Criminal litigation too, benefits from the judicial decision-maker's access to all admissible evidence and information submitted during the course of a trial. Ligertwood[1204] maintains that the concept of proof in criminal litigation is an inductive consideration and that, ultimately, the high standard of proof to be satisfied in criminal trials, that is, proof beyond reasonable doubt, necessitates the presentation of all reliable evidence

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1202 Conan Doyle 2005:318.

1203 For a discussion on the processes of logical reasoning in criminal investigation, including abductive reasoning, see 3.2.1.

1204 2011:3.

to court to facilitate an accurate probabilistic determination, and that reliance on only one type of evidence should be avoided.

In a recent South African judgment in *S v Ganda,*[1205] Daffue J[1206] held the following regarding the final assessment of evidence in criminal litigation:

> In assessing the evidence, a court must in the ultimate analysis look at the evidence holistically in order to determine whether the guilt of the accused is proved beyond reasonable doubt.

This assertion echoes that of the Supreme Court of Appeal in *S v Mbuli*,[1207] where Nugent JA[1208] stipulated that the onus to prove the accused person's guilt compliant with the standard of proof in criminal proceedings rests upon the prosecution and that upon deciding the guilt or innocence of the accused the court must be thus satisfied "…upon a consideration of *all the evidence*." (Own emphasis)

> Just as a court does not look at the evidence implicating the accused in isolation to determine whether there is proof beyond reasonable doubt, so too does it not look at the exculpatory evidence in isolation to determine whether it is reasonably possible that it might be true.[1209]

In common law systems the standard of proof in litigation is founded by the law of evidence and is the burden imposed on either side of the

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1205 (A182/2011) [2012] ZAFSHC 59 (5 April 2012).

1206 *S v Ganda* (A182/2011) [2012] ZAFSHC 59 (5 April 2012) at [4]. In this regard see also: *S v Hadebe and Others* 1998 (1) SACR 422 (SCA) at 426F-H.

1207 2003 (1) SACR 97 (SCA).

1208 *S v Mbuli* 2003 (1) SACR 97 (SCA) at 57. This sentiment was confirmed in *S v Trainor* 2003 (1) SACR 35 (SCA) at [9] by Navsa JA.

1209 *S v Mbuli* 2003 (1) SACR 97 (SCA) at 57. See also the judgment in *Fletcher and Another v S* [2010] 2 All SA 205 (SCA) at 209.

dispute attempting to prove facts.[1210] Zeffertt *et al*[1211] describes the burden of proof as being a metaphorical expression indicating the obligation resting upon one party to persuade the judicial decision-maker that he should succeed in his defence. The party seeking to thus prove a fact must present the court with persuasive evidence of sufficient quality and quantity to discharge this burden of proof and render the facts proven beyond reasonable doubt.[1212]

In contemplation of numerous judicial decisions, Schwikkard and Van der Merwe[1213] postulate that the burden of proof that rests on the state includes the obligation of proving the required fault, the commission of the criminal act, the unlawfulness of the act, the absence of grounds of justification, as well as the identity of the perpetrator as being that of the accused, beyond reasonable doubt.

The progressive establishment of standards of proof, both in science and law, has taken centuries.[1214] In science, it extends from the Aristotelian notion that scientific truth is determinable by logical reasoning, and then advances to the viewpoints of Francis Bacon, that scientific truth can be demonstrated by the formulation of a hypothesis and the direct, observational illustration of its accuracy.[1215]

1210 Meintjes-Van der Walt 2000:321; 2003:90.

1211 2003:45.

1212 Meintjes-Van der Walt 2000:322.

1213 2009:560.

1214 Loevinger 1991-1992:324.

1215 Loevinger 1991-1992:324. A valuable instrument to illustrate the accuracy of the hypothesis is replication, which is generally accepted to be the trademark of scientific acceptability – Loevinger 1991-1992:328.

Loevinger[1216] suggests that scientific hypotheses can be tested and falsified, but cannot be proved or finally established, merely corroborated. Scientific theory can constantly be modified or discarded and the level of corroboration that may be achieved for a hypothesis ultimately relies on the scrupulousness and accuracy of its testing.[1217] All scientific operation contains some subjectivity, regardless of its proposed objective methodology.[1218]

There is a difference, however, between the process of proof in science and that in law. Proposed theories in science are inescapably predictive and should at all times be replicable and measurable, while in law the allegations to be proved are always "postdictive."[1219]

While standards of proof in science are founded upon generally accepted principles and protocols of validity,[1220] such standards in legal proceedings originate from practical, ethical and social considerations.[1221]

Depending on the nature of court proceedings, differing standards of proof must be discharged. In civil proceedings in all jurisdictions under discussion, the quantum of evidence required to render the burden of

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1216 1991-1992:327.

1217 Loevinger 1991-1992:327-328.

1218 Loevinger 1991-1992:328.

1219 Loevinger 1991-1992:328

1220 Statistical data, for instance, is considered more authoritative than clinical or anecdotal reports – Loevinger 1991-1992:332.

1221 Loevinger 1991-1992:330.

proof discharged, is a preponderance of probabilities, while in criminal trials, this burden is elevated to proof beyond reasonable doubt.[1222] While these burdens and courts' decision-making paradigms pertaining to these burdens have been considered and explained, it remains, for the most part, largely misunderstood and diversely applied.[1223]

While an accurate and specific delineation of the term 'reasonable doubt' seem to fall just beyond the realm of possibility, it may abstractedly be described as "…a doubt which exists because of probabilities or possibilities which can be regarded as reasonable on the ground of generally accepted human knowledge and experience."[1224]

In the United States Supreme Court case of *Addington v Texas*,[1225] the court held that the purpose of a standard of proof in legal proceedings is to assign risk of error, to direct the judicial decision-maker regarding the degree of certainty society expects him to possess when making factual conclusions. Since the interests of any person standing trial on criminal charges enjoy such paramount importance, it stands to reason that the burden of proof would demand of the presiding officer to venture along a path of decision-making that would eliminate the possibility of erroneous judgment.[1226]

1222 Loevinger 1991-1992:333; Kaplow 2012:741. See in this regard also *S v Zuma* 1995 (1) SACR 568 (CC).

1223 Loevinger 1991-1992:334.

1224 Schwikkard and Van der Merwe 2009:569.

1225 441 US 418 (1979).

1226 Loevinger 1991-1992:334; Meintjes-Van der Walt 2000:322.

The burden of having to prove facts 'beyond reasonable doubt' demands that the entirety of evidence submitted as proof must corroborate the accused person's guilt and be incompatible with any other rational inference or reasonable theory.[1227] Simply put, all possible alternative answers to the 5WH formula investigative questions[1228] must be reasonably inconsistent with the proffered evidence.

This is consistent with the rules as set out in the South African case of *R v Blom*.[1229] According to the court in this matter, whatever conclusion the court arrives at must be consistent with all the facts of the case. Should only one fact be inconsistent with the court's finding, the conclusion is incorrect.[1230] The court's conclusion should be the only possible conclusion supported by the proved facts. If another conclusion can be supported by the facts, reasonable doubt is established.[1231]

In assessing all the proffered evidence to ascertain whether the onus of proof has been discharged by the prosecution, judicial fact-finders are tasked with the duty of also considering the scientific evidence submitted during trial, deciding which items of evidence must be disregarded and what probative value must be assigned to those pieces of evidence lawfully admitted.[1232]

1227 Loevinger 1991-1992:335.

1228 Namely: who, what, where, when, why, how. See 3.2.2 above for a discussion on the 5WH formula questions in criminal investigations.

1229 1939 AD 188. As discussed in 3.4.2 above.

1230 *R v Blom* 1939 AD 188:202-203.

1231 *R v Blom* 1939 AD 188:202-203.

1232 Meintjes-Van der Walt 2003:88.

According to Schwikkard and Van der Merwe,[1233] the process of determining admissibility, reliability and probative weight of evidence is a matter of common sense, logic and experience, and subject to rules of logical inferential reasoning.

Loevinger[1234] suggests that proof ultimately relies on the decision-maker's capacity to make proper and constructive associations among data and evidence.

> The final difficulty for law, and to a lesser degree for science, is that after we have engaged in the daunting task of determining which elements of a situation we must disregard as irrelevant or unimportant and which elements we will use to determine probability for purposes of judgment, we still have no ready means of comparing the significance or weight that different individuals will give to any expression – statistical or categorical – of probability.[1235]

Bearing in mind the fallible nature of eyewitness testimony,[1236] the limited yet disconcerting risks inherent in DNA evidence as well as its inability to satisfy the occasionally unrealistic expectations it has been endowed with to prove guilt beyond reasonable doubt in every instance it is used, it is imperative that judicial fact-finders have at their disposal a range of additional data they may draw upon to generate accurate decisions from a process of inferential reasoning.

1233 2009:527.

1234 Loevinger 1991-1992:343.

1235 Loevinger 1991-1992:343.

1236 See 4.3 above.

This additional data may come in the form of evidence generated by any of the traditional forensic sciences.[1237] Besides providing the presiding officer with supplementary data, such physical evidence detected at scenes of offences can assist the initial investigation by serving as corroboration of witness statements and thus directing the investigation, but can also contribute vitally to the reconstruction of the criminal event.[1238]

It has been reported that there exists a pervasive ignorance amongst police investigators and legal decision-makers regarding the forensic sciences and the information to be harvested from it, and that this unawareness may inhibit the optimal employment of this type of evidence.[1239] This is unfortunate, as the forensic sciences can aid criminal investigation to a great extent. Besides its corroborative and reconstructive capabilities, it can also aid in the implication and exculpation of suspects, it may induce admissions or confessions, indicate criminal incidents that are part of a series and should consequently be subjected to collective investigation and can also be employed in the interrogation of suspects with the purpose of obtaining additional evidence from them.[1240]

In fact, already in 1964[1241] and then in 1966[1242] in the United States of America, the U.S. Supreme Court held by implication that objective,

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1237 See 3.3.3.3 above for a description of traditional forensic sciences.

1238 Miller 2008:143. See also Tilley and Ford 1996:28.

1239 Tilley and Ford 1996:46.

1240 Tilley and Ford 1996:28.

1241 In the case of *Escobedo v Illinois*, 378 U.S. 478 (1964), where an inadmissible confession was elicited from the defendant in a murder case without his legal representative present, despite the defendant's constant pleas for a lawyer. The accused's conviction was finally

scientific methods of crime resolution is superior to suspect interrogation and other police pursuits.[1243] Increasingly, investigating police have been encouraged to embrace a more scientific approach in their investigations and to escalate their dependence on physical evidence as opposed to victim and eyewitness reports.

While the traditional forensic science disciplines, including ballistic comparisons, fingerprint identification, trace evidence as well as bite and toolmark identification evidence, have been employed in the criminal justice systems across the globe for a long time, the dawn of the age of second generation forensic sciences, like tried and tested DNA evidence, have exposed the unreliability of these first generation forensics.[1244] In the United States of America in 2004, DNA evidence exonerated a man convicted of multiple charges, including attempted murder, after being inculpated in the crimes through fingerprint evidence, the previous golden standard of forensic evidence.[1245] Such was the devastation at the realisation of fingerprints' fallibility that the local police commissioner closed down the fingerprinting laboratory in this particular part of the USA for two years.[1246]

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overturned when the Supreme Court excluded the confession since *no other evidence* confirming his guilt was offered and the police was criticised for their subjective investigation of the accused.

1242 In *Miranda v Arizona*, 384 U.S. 436 (1966), now famous due to its creation of the so-called 'Miranda rights' for arrested persons in the United States of America, the court confirmed the decision in the *Escobedo*-case.

1243 Horvath and Meesig 1996:968.

1244 Murphy 2007:724.

1245 Dobbs 2006. http://www.popularmechanics.com/science/health/forensics/3010536. Accessed on 23/05/2010. See also Mnookin 2009:1217, Meintjes-Van der Walt 2006:156.

1246 Dobbs 2006. http://www.popularmechanics.com/science/health/forensics/3010536. Accessed on 23/05/2010.

In addition to its fallibility, traditional forensic sciences also have limited application. Notwithstanding its historic use in criminal litigation, it typically appears in support of other evidence, like eyewitness testimony or accused admissions or confessions.[1247]

Despite this, traditional forensic sciences are not wholly without purpose. A prosecutor in the United States of America,[1248] was reported as conceding the dangers of traditional forensic evidence, yet did not advocate the absolute exclusion thereof:

> …a good case is made up of a bunch of little things.[1249]

In order to engage in meaningful discussions of traditional forensic sciences bloodstain pattern analysis and trace evidence will be reviewed in this section. These disciplines have been selected due to their ability to assist in issues other than identity, that is, "who?" had committed the offence in question. Friction ridge analysis, or fingerprinting evidence, has been omitted from this deliberation due to its customary employment in criminal proceedings, its wide judicial acceptance and its use as measure for identification, though various references may be made to this type of evidence where deemed beneficial.[1250] Preceding the discourse on the traditional forensic sciences, will be a review of recent criticisms and concerns that these categories of forensic evidence have suffered.

1247 Murphy 2007:726.

1248 District attorney, Joshua Marquis, in an interview with David Dobbs in 2006.

1249 Dobbs 2006. http://www.popularmechanics.com/science/health/forensics/3010536. Accessed on 23/05/2010.

1250 For meticulous discussions on the topic of fingerprint evidence, see Hawthorne's manuscript, *Fingerprints: Analysis and understanding* published in 2009. See also Knoetze 2007:139-194.

5.2 PROBLEMS RELATING TO TRADITIONAL FORENSIC SCIENCES

5.2.1 Introduction

> If the traditional arts of fingerprinting, bite-mark analysis, hair analysis, voice recognition and even ballistic analysis cannot gain accuracy, they might vanish from the legal process forever.[1251]

The unkind reference to the traditional "arts" of fingerprinting (instead of "sciences"), hair analysis and other first generation forensic sciences is immensely telling of the doubtful reputation that have befallen this type of evidence. Research conducted during the course of the last two decades have suggested that defective scientific evidence have contributed to more than half of wrongful convictions in the United States of America.[1252]

Many traditional forensic analysts and laboratories have become subject to disgrace due to erroneous scientific methodologies.[1253]

Cries for the improvement of the reliability of traditional forensic sciences have been heard the world over for roughly the last decade,[1254] and in 2005, America enacted legislation[1255] which

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1251 Dobbs 2006. http://www.popularmechanics.com/science/health/forensics/3010536. Accessed on 23/05/2010.

1252 Murphy 2007:724. See also Mnookin 2010:1211.

1253 Murphy 2007:745.

1254 Mnookin 2010:1210.

1255 Science, State, Justice, Commerce, and Related Agencies Appropriations Act of 2006.

empowered the United States Congress to direct the National Academy of Sciences (NAS)[1256] to conduct a study on forensic science, especially non-DNA forensics, to ultimately equal the immense volume of DNA analysis texts available.[1257] The NAS established a committee comprising of forensic scientists, legal practitioners and general scientists of varying specialities, to execute the directive put forward by the United States Congress.[1258]

Some of the challenges put to this committee included assessing the basic scientific methodology and technologies employed in forensic practice, evaluating resource needs, error rates, bias, training and proficiency testing, reviewing laboratories, assessing the employment of forensic science in criminal litigation, examining the different forensic sciences and many more.[1259]

5.2.2 Results of the NAS report

Embarking upon the route to meet these challenges the investigating committee appreciated the importance of first understanding the different forensic sciences before any attempts were made to render

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1256 The National Academy of Sciences (NAS) is a private, non-profit organisation, consisting of distinguished scholars engaged in scientific and engineering research. The purpose of this entity is the advancement of science and technology, as well as the employment of science for general welfare. The NAS is also mandated to provide advice to the federal government of the United States of America on issues relating to science and technology - National Academy of Sciences 2009. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1257 National Academy of Sciences 2009:S2. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1258 Mnookin 2010:1235; National Academy of Sciences 2009:S1-2. http://www.nap.edu/catalog.php?record_id= 12589. Accessed on 19/04/2011.

1259 National Academy of Sciences 2009:S2. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

judgments regarding its use and value.[1260] Following a lengthy period of meticulous research into a wide array of aspects pertaining to the operations of forensic science, a report containing the committee's findings was compiled and published in 2009.[1261]

During the course of the investigation the committee identified several main hindrances in the employment of forensic sciences in the criminal justice system. Some of these include, for instance, existing inconsistencies in forensic science operations on federal, state and local level in the United States of America, including differences in accreditation, instrumentation, funding, as well as the availability of proficient and well-trained personnel.[1262]

Amongst the numerous recognised difficulties in the use of forensic science in the American justice system, the committee expressed utmost concern regarding the inadequate knowledge base upon which the forensic operations function.[1263] The committee noted that, at the time of the investigation, there were "…fundamental limitations in the

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1260 National Academy of Sciences 2009:S4. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1261 The full report is available at http://www.nap.edu/catalog.php?record_id=12589.

1262 National Academy of Sciences 2009:S4. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011. From this problem emanates a plethora of additional difficulties, including staggering backlogs in some jurisdictions in the United States of America - National Academy of Sciences 2009:S10. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011. It is doubtful, however, that the problem of fragmented forensic applications, as documented in the NAS report, will be experienced with similar intensity in South Africa, since the Forensic Science Laboratory does not function on different levels of authority, but is centralised with the Criminal Record Centres as the Criminal Record and Forensic Science Service (CRFSS), forming a branch to the South African Police Service – Omar 2008:29.

1263 National Academy of Sciences 2009:S11. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011. See also Pardo 2010:367.

capabilities of forensic science disciplines to discern valid information from crime scene evidence."[1264]

Additionally, the NAS committee observed that research within the realm of forensic science is poorly supported, with no actionable, integrated plan for cross-level research, and limited funding prospects.[1265] Tertiary institutions have not been engaged in forensic science research, since funding for academic research is inadequate and law enforcement collaboration rare.[1266]

Adding to the anaemic forensic science knowledge base is the tremendous disaggregation in forensic practice, illustrated by the numerous types of practitioners with varying levels of education and training, the conflicting standards for performance, professional philosophies and in-house training, as well as insufficient professional opportunities like publishing or presenting research.[1267]

The NAS report further notes that erroneous convictions or acquittals can quite readily occur where evidence is mismanaged or inadequately analysed, where the significance of the scientific evidence over-stated (as is often the case where experts testify in zealous confidence at their interpretations of the evidence), or where there is prejudice,

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1264 National Academy of Sciences 2009:S11. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1265 National Academy of Sciences 2009:S11. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1266 National Academy of Sciences 2009:S11. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1267 National Academy of Sciences 2009:S11. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

incompetence or deficient internal controls for the evidence.[1268] In this regards, the report warns that it is of the utmost importance that the practices of the traditional forensic sciences be enhanced, standardised and observed, so that an expanded and meticulous knowledge base, as well as a sophisticated research culture may ultimately be achieved.[1269]

The advent of DNA analysis in crime resolution has unearthed numerous wrongful convictions and has exposed severe inadequacies in the application of some traditional forensic sciences.[1270] Many of these sciences have never been subject to the same scientific testing and scrutiny as DNA.

> Most of these techniques were developed in crime laboratories to aid in the investigation of evidence from a particular crime scene, and researching their limitations and foundations was never a top priority.[1271]

It can thus be argued that DNA's exposure of the fallibility of the traditional forensic sciences has enormous constructive potential, since never before have forensic scientists been compelled to consider and test the authentic scientific reliability of their analyses. Experts' ability to withstand cross-examination during the subsequent trial was considered sufficient proof of the reliability of their tests.[1272]

1268 National Academy of Sciences 2009:1-2. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1269 National Academy of Sciences 2009:1-3. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1270 National Academy of Sciences 2009:1-6. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1271 National Academy of Sciences 2009:1-6. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1272 National Academy of Sciences 2009:1-6. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

However, the NAS report maintains that the application of traditional forensic sciences, as compared to that of DNA profiling, is still disposed to erroneous results. These types of forensic evidence, including fingerprint evidence, simply do not satisfy the fundamental conditions of science regarding reproducibility, validity and falsifiability.[1273]

Some traditional forensic science disciplines, like shoe impressions, tool marks and ballistic comparisons, contend that they have individualisation capabilities, suggesting that their methodologies distinguish unique markings from a source item in such an indiscriminate and random manner that uniqueness is reliable and the source item is identified as the origin of the evidence to the exclusion of all other possible sources.[1274] The misconception here is that the determination of uniqueness is subject to calculation of the item in question's features, data collection on the population frequency of variation in these features, analysis of feature individuality, and determinations regarding the probability that other items share a common set of observable features.[1275] Additionally, and vitally, the results of research relating to such determinations and analyses must be published for purposes of peer-review and revision. And it is in this unfortunate fact that the dilemma of traditional forensic sciences reside, since no such publications have been put forward for most of these

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1273 National Academy of Sciences 2009:1-6. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1274 National Academy of Sciences 2009:1-7. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1275 National Academy of Sciences 2009:1-7. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011, from a discussion in William J. Bodziak's treatise on footwear impression evidence, *Footwear impression evidence – Detection, recovery and examination*, published in 1999.

disciplines.[1276] The forensic science community, especially those within the realm of the traditional sciences, have been unable to thus far conduct the pervasive and extensive research required to support its practices.[1277]

In this regard, Mnookin[1278] suggests that these types of forensic sciences are in fact not rooted in the formally validated methodologies ordinarily acquainted with substantiated science, and that disturbingly little is known regarding the error rates produced in the implementation of these types of 'sciences'.

Moreover, the fog of uncertainty veiling the traditional forensic fields is made worse by the insistence of some practitioners that their spheres of speciality use methods delivering flawless accuracy with zero error rates. This has resulted in an inability to determine the actual usefulness of these disciplines.[1279] In fact, Mnookin[1280] avers the following:

> …the traditional forensic sciences…find themselves at a crossroads… For many…including fingerprint identification, firearms identification, handwriting identification, and toolmark identification, experts' claims about their field, the

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1276 National Academy of Sciences 2009:1-7. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1277 National Academy of Sciences 2009:1-7. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011. This is true for several reasons, including the existence of deficient enforceable standards for data interpretation for the traditional forensic disciplines, as well as insufficient funding. While several research opportunities are commissioned by the American government's Department of Justice, little to none of these studies enjoy participation by the traditional forensic community - National Academy of Sciences 2009:1-7. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1278 2010:1210.

1279 National Academy of Sciences 2009:1-10. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1280 2010:1209-1210.

> authority of their methodologies, and their own abilities have dramatically outstripped what has actually been established by persuasive research and careful study. Forensic scientists have regularly testified in court to matters that are, quite honestly, both less proven and less certain than they are claimed to be. They have overstated their degree of knowledge, underreported the chances of error, and suggested greater certainty than is warranted.

The NAS report applauds criminal courts for their progression, even if such progression is slow, towards considerations of reliability of expert evidence, but calls attention to judicial officers' inability to honestly assess the research basis of some forensic sciences, especially pattern identification sciences like fingerprint comparisons.[1281]

5.2.2.1 Fingerprint evidence and its limitations

Fingerprint evidence, previously considered highly reliable and an exact method for proving identity, has suffered severe misgivings regarding its scientific foundation.[1282] In fact, in a court case decided in 2007,[1283] an American circuit court judge refused the testimony of a fingerprint expert, stating that the specific mode of fingerprint analysis employed in the case was "…a subjective, untested, unverifiable identification procedure that purports to be infallible."[1284]

1281 Mnookin 2010:1237; National Academy of Sciences 2009:5-9. http://www.nap.edu/catalog.php?record_id= 12589. Accessed on 19/04/2011.

1282 Epstein 2002:605-606.

1283 *State of Maryland v Bryan Rose* (2007) In the Circuit Court for Baltimore County. Case No. K06-545. In this matter it was alleged that the accused person shot and killed the victim after also having stolen a vehicle some time prior to the shooting. No other evidence but the fingerprint evidence was submitted as proof of guilt. The presiding judge held that since the State requested the death penalty upon conviction, the considerations of evidence admissibility and evidential burden should weigh even heavier than in non-death penalty cases - *State of Maryland v Bryan Rose* (2007) at page 1-2.

1284 *State of Maryland v Bryan Rose* (2007) In the Circuit Court for Baltimore County. Case No. K06-545 at page 31. National Academy of Sciences 2009:1-7. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

Fingerprints, palm prints and sole prints have been employed in criminal identification in excess of a century in many parts of the world.[1285] The process of analysing these prints is referred to as 'friction ridge analysis,' which entails experience-based comparisons of impressions left by fingers, palms or the soles of feet.[1286]

The employment of fingerprint impressions in criminal prosecution relates to the identification of an individual, whether such identification occurs during an arrest, during a death investigation, or to show that the donor of the print touched the specific surface where the fingerprint was obtained.[1287] Such identification is achieved if the examiner, after perusal of the unknown and known print impressions, is of the opinion that a sufficient amount of common 'ridge characteristics', both in terms of type and location, is present on both prints.[1288]

The justification for its use in identification is founded on the premise propagated by many fingerprint examiners, that friction ridge analysis is individualising, indicative of a single individual as the donor of the print impression to the exclusion of all others.[1289]

1285 See para 2.2.2.1 for an in-depth discussion on the historical development of fingerprint evidence in criminal justice systems.

1286 National Academy of Sciences 2009:5-7. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011; Shelton 2011:39.

1287 Shelton 2011:39.

1288 Epstein 2002:607.

1289 Shelton 2011:40.

Legal challenges to the acceptance of fingerprint evidence are by no comparison a new phenomenon.[1290] It would appear, however, that while challenges used to centre on issues of print collection and maintenance,[1291] it is slowly progressing more towards issues of accuracy and reliability of friction ridge analyses.[1292] Traditional claims that fingerprint evidence is perfectly sound in its individualising capacity have been shown to be scientifically implausible and the myth of zero error rates in friction ridge analysis no longer endures.[1293]

Friction ridge comparisons are conducted by way of a process of analysis, comparison, evaluation and verification (ACE-V).[1294] While this ACE-V process affords a broadly defined framework for fingerprint

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1290 Hawthorne 2009:109.

1291 Hawthorne 2009:109.

1292 National Academy of Sciences 2009:5-12. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011. This also appears clear from the incidence of court decisions like that found in *State of Maryland v Bryan Rose* (2007) In the Circuit Court for Baltimore County. Case No. K06-545, as well as *United States v Llera Plaza I* 179 F Supp 2d 492, 504 (ED Pa Jan 2002).

1293 National Academy of Sciences 2009:5-12. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011. Mnookin calls the allegation that friction ridge analysis has a zero error rate "…exceedingly unscientific" – Mnookin 2010:1226.

1294 Hawthorne 2009:99; National Academy of Sciences 2009:5-8. http://www.nap.edu/catalog.php?record_id= 12589. Accessed on 19/04/2011. See also Mnookin 2010:1217. During the 'analysis' phase of fingerprint comparison, the examiner is provided with data regarding the quality of the print to be compared. The 'comparison' phase signifies the study of the fingerprint impression, including aspects such as the pattern type present in the impression, friction ridges, the flexion creases, ridge deviations, and so forth. The print is then compared to a known fingerprint. Following this, the uniqueness and individuality of the print is examined to determine if there is agreement between the unknown and known fingerprints to an extent sufficient enough to exclude all other print donors. This is referred to as the 'evaluation' phase. Finally, during the 'verification' phase, the examiner submits his results and opinion to another friction ridge expert for peer-review. Should this additional expert disagree with the initial findings, a third specialist must be consulted – Hawthorne 2009:99-100. Although Automated Fingerprint Identification Systems (AFIS) allow for fully automated fingerprint identifications, assessment of prints from crime scenes is still principally performed by means of human interpretation - National Academy of Sciences 2009:5-9. http://www.nap. edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

comparisons, the committee compiling the NAS report considered this process to be sadly lacking any significant scientific validity.[1295]

> ACE-V does not guard against bias; is too broad to ensure repeatability and transparency; and does not guarantee that two analysts following it will obtain the same results.[1296]

Mnookin[1297] is of the opinion that the process of ACE-V amounts to nothing more than two different examiners looking carefully at a set of fingerprints, and that this is *not* tantamount to scientific method, but rather a "…careful, semi-structured observation."

> While careful observation and the recording of one's observations may be a necessary *part* of many scientific practices, careful observation in and of itself cannot be meaningfully said to constitute a *method*. Moreover, the simple act of labeling this process of careful observation as a methodology does not make it into one. Nor does bestowing upon it the label "scientific" tells us, through the moniker, anything about its likely validity or error rate.[1298]

While the NAS committee and scientists engaged in constructive criticism of the forensic sciences have expressed their unequivocal distress regarding the accuracy and reliability of fingerprint evidence, almost every American trial judge considering the admissibility of fingerprint evidence under the *Daubert*-ruling[1299] has declared it to meet

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1295 National Academy of Sciences 2009:5-12. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011. This, despite the fact that many fingerprint examiners deem this process scientifically sound and that it has passed judicial scrutiny under *Daubert* – Mnookin 2010:1218. See also Shelton 2011:45-46.

1296 National Academy of Sciences 2009:5-12. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1297 2010:1219.

1298 Mnookin 2010:1219.

1299 Referring to the judgment in *Daubert v Merrel Dow Pharmaceuticals, Inc.* (1993) 509 U.S. 579.

the applicable standards of admissibility of expert evidence.[1300] In fact, Meintjes-Van der Walt[1301] remarks that other traditional forensic sciences too, have been accepted with very limited scrutiny, and that these types of evidence have been thus received even before the reliability and scientific standards contained in the *Daubert*-decision were introduced.

In 2002, the presiding judge in the case of *United States v Carlos Ivan Llera Plaza I*,[1302] limited the testimony of fingerprint experts, as no objective and uniform standards existed to test the results of specific friction ridge analysis.[1303] Here, the presiding judge disregarded the substantial volume of literature that existed at the time on fingerprinting methodology as inadequate in satisfying the requirements set by the *Daubert*-ruling, and fundamental science of friction ridge analysis had not been subjected to rigorous, systematic scientific research.[1304] The court also took issue with the lack of well-documented error rates, as well as the vastly differing requirements for what courts considered adequate points of similarity to render a fingerprint match.[1305] The presiding judge disallowed the testifying expert to render his opinion on whether the accused person's print matched the crime scene

1300 Mnookin 2010:1234. Donald E. Shelton, chief justice of the Michigan 22nd Judicial Circuit Court in the United States of America, affirms that courts in the U.S. accept not only the unique nature of fingerprints but also the infallible nature of such evidence as mode of forensic identification – Shelton 2011:39. In fact, Epstein reports that the very first claim that friction ridge analysis is a 'science' was offered in the first American fingerprint case, *People v Jennings*, 96 N.E. 1077, 1083 (III, 1911). This claim subsists today – Epstein 2002:605 at fn 2. See also Saks 1998:1100.

1301 2006:153.

1302 179 F Supp 2d 492, 504 (ED Pa Jan 2002).

1303 *United States v Llera Plaza I* 179 F Supp 2d 492, 504 (ED Pa Jan 2002) at 516.

1304 Pyrek 2007:278.

1305 Wise 2004:427. See also the discussion on this case in Pyrek 2007:278-279.

impressions, but did allow testimony regarding the methodology employed in comparing the prints, the similarities observed and rebuttal evidence by defence experts.[1306]

The prosecution in this matter, fearing the future implications this decision would have on prosecutions based on fingerprint evidence, urged the court to reconsider its decision.[1307] The presiding judge reassessed the evidence on record and considered novel evidence by fingerprint experts from both the United States of America as well as the United Kingdom. Of persuasive force seemed to be testimony regarding the decision in the English case of *R v Robert John Buckley*,[1308] in which the Criminal Division of the British Court of Appeal held that sixteen points of similarity are no longer essential for a 'match,' and that fingerprint examiners in the United Kingdom follow the same friction ridge analysis procedures as those from America. This seemed to satisfy the presiding judge in the *Llera Plaza*-case that recognised standards of analysis exist in the scientific community to satisfy the *Daubert*-prerequisites and the evidence was subsequently allowed.[1309]

While the court in *State of Maryland v Bryan Rose*[1310] made history in excluding the "unreliable" and subjective fingerprint evidence in 2007, it

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1306 Wise 2004:427.

1307 *United States v Llera Plaza II* 188 F Supp 2d 549 (ED Pa 2002) at 552-553.

1308 (1999) 163 J.P. 561.

1309 Wise 2004:427-428.

1310 *State of Maryland v Bryan Rose* (2007) In the Circuit Court for Baltimore County. Case No. K06-545. While this case represents the first judicial decision excluding fingerprint evidence, it was not the first case in which defence counsel challenged the reliability of fingerprint evidence. This distinction belongs to the case of *United States v Byron Mitchell*, No. 96-407 (E.D. Pa. Feb. 2000). In this matter, the fingerprints recovered from the crime scene (here, a getaway vehicle) and allegedly belonging to the accused, were submitted by the prosecution

is, as a legal decision, according to Mnookin,[1311] merely "…a voice in the wilderness."

In South Africa, no known challenges have been launched against the validity and reliability of fingerprinting evidence.[1312]

Meintjes-Van der Walt[1313] proposes, however, that fingerprinting evidence in South Africa could be contested on the fundamental science of fingerprints and friction ridge analysis in terms of the *Daubert*-ruling in the United States of America. While challenges pertaining to the underlying science of this type of evidence have not been particularly successful in America, the accumulative data suggesting the unreliability of friction ridge analysis should be a point of challenge for legal practitioners.[1314]

Moreover, Meintjes-Van der Walt[1315] suggests that in addition to the expected challenges pertaining to fingerprint evidence, namely issues of evidence collection, integrity of the chain of evidence, and laboratory procedures, legal practitioners may also attack such evidence on the

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to 53 fingerprint examiners for identification in response to the defence's *Daubert*-challenge regarding the fingerprint evidence. While the subsequent friction ridge analyses results confirm the subjectivity and unreliability of this type of evidence, the presiding officer disallowed the testimony of defence experts on the fallacious nature of fingerprint evidence and even reinforced the individualising nature of this evidence in his judgment. For a discussion of this court case, see Epstein 2002:628-631 and Wise 2004:427.

1311 2010:1234.

1312 Meintjes-Van der Walt 2006:156. This has been confirmed by the present study. Specific issues regarding admissibility of fingerprint evidence will be discussed at greater length in Chapter 6.

1313 2006:171-172.

1314 Meintjes-Van der Walt 2006:172.

1315 2006:172.

basis of the expert's opinion itself. Since deficient research exists on the standardisation of analyses, criteria for declaring a match and reproducibility, evidence will be exposed to challenge in this area.[1316] In 2002, Epstein[1317] reported that Israeli fingerprint examiners discovered the print impressions of two different individuals containing seven matching ridge characteristics, prompting those examiners to admit that any expert could have produced false identification results using those prints. This is dire news indeed, considering the fact that South African courts require only seven points of similarity in ridge characteristics to be deemed a match.[1318]

The first criminal case in which fingerprint evidence was admitted in South Africa was heard in 1905 in *Crown v Umtubavana*.[1319] South African courts have since conformed to reliance on experts and their opinions in the determination of admissibility and reliability of fingerprint evidence. In application of the case of *R v Morela*,[1320] Steyn J[1321] held in the case of *R v Nzama and Another*:[1322]

1316 Meintjes-Van der Walt 2006:172.

1317 2002:610-611.

1318 Meintjes-Van der Walt 2006:166. This stands in contrast to the United Kingdom requiring at least eight points of similarity, Australia requiring twelve points (the FBI in the United States of America, while having no minimum number requirement, rely on a twelve point match), France and Italy demanding 16 point, and 30 point similarity requirement in Brazil and Argentina – Meintjes-Van der Walt 2006:166.

1319 Meintjes-Van der Walt 2005:280, as obtained from Lansdown, Hoal and Lansdown's publication, *South African Criminal Law and Procedure*, published in 1957. Interestingly, the very first case in which fingerprint evidence was employed in England, was in 1902 in a case of housebreaking, while the first use of such evidence in a murder trial followed in 1905 in the Central Criminal Court in London, where two brothers were convicted and hanged for the murder of an English couple – South Wales Police Museum *s.a.* http://www.southwalespolicemuseum.org.uk/en/content/cms/history_of_the_force/history_of_fingerpri/history_of_fingerpri.aspx. Accessed on 29/11/2012.

1320 1947 (3) SA 147.

1321 1953 (2) SA 628 (W) at 630. See also *S v Nala* 1965 (4) SA 360 (A) and *S v Malindi* 1983 (4) SA 99 (T).

> Die behoorlike vergelyking van vingerafdrukke met die doel om identiteit of nie-identiteit vas te stel, is ‘n saak waarvoor ‘n hoogs gespesialiseerde opleiding nodig is wat ‘n judisiële beampte normaalweg nie gehad het nie; ‘n Hof is gevolglik nie bevoeg om op sy eie ‘n selfstandige oordeel oor die identiteit of nie-identiteit van vingerafdrukke te vorm nie.

By the late twentieth century, however, subtle indications arose that South African courts were growing weary of the virtually unimpeded fashion with which fingerprint evidence was being admitted in criminal trials. One such a court decided in a matter on review in *S v Khanyile*:[1323]

> It seems to me that where a Court is dealing with a case in which the accused is an unsophisticated and probably illiterate person, in which there is only one rather unclear fingerprint for comparative purposes and, as here, the number of points of identity found by the expert is near the minimum required for a positive identification, the Court cannot properly be satisfied on the experience of the expert alone that his conclusion can “in broad terms be said to be acceptable and reasonable.” Such a case is one in which the expert evidence “should be closely scrutinised to eliminate, as far as humanly possible, all risk of error.”

It still remains though that fingerprint evidence in criminal litigation in this country represents strong evidence of identity.[1324]

In the United Kingdom, case law has also been greatly influential yet slowly transforming regarding fingerprint evidence. In *R v Robert John Buckley*,[1325] the court described the historical development of fingerprint evidence standards in England and Wales, and maintained that

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1322 1953 (2) SA 628 (W).

1323 1984 (3) SA 756 (N) at 759.

1324 *S v Nzimande* 2003 (1) SACR 280 (O), where the accused was convicted of murder on fingerprint evidence alone.

1325 (1999) 163 J.P. 561.

fingerprints are unique and remain so throughout an individual's entire life. At the time Lord Justice Rose delivered his decision in this matter, fingerprint 'matches' required sixteen points of ridge characteristic similarity.

In consideration of research on fingerprint impressions and friction ridge analysis performed in the last few decades, the court in this case formulated novel standards for fingerprint evidence. Where fewer than eight points of similarity existed between prints, courts are to reject the evidence without discretional consideration. Where prints exhibited more than eight points of similarity, the court may employ its discretion to allow the evidence to be admitted, subject to contemplation of the following: the level of expertise of the witness, the presence of dissimilar features, as well as the size, quality and clarity of the prints under investigation.[1326]

Since this decision, very few cases arose where fingerprint evidence was challenged.[1327] Yet in 2011, such a case was heard in the Criminal Division of the Court of Appeal in England. In *R v Smith*,[1328] the court was confronted with an appeal on conviction following the appellant's arrest and conviction on a charge of murder.[1329]

In deciding on the submission and validity of new fingerprint evidence, the court in this instance compared such evidence with evidence

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1326 *R v Robert John Buckley* (1999) 163 J.P. 561.

1327 *R v Smith* [2011] 2 Cr. App. R. 16.

1328 [2011] 2 Cr. App. R. 16.

1329 *R v Smith* [2011] 2 Cr. App. R. 16 at 176.

generated by other forensic sciences in England and Wales and found substantial differences.[1330] Among these disparities are the fact that while other forensic practices function independently from police forces, fingerprint comparisons occur within organisational structures of the police. Additionally, the court made reference to the significant dissimilarities in the training and qualifications required for fingerprint experts as opposed to those from other forensic sciences, the worrying trend that local fingerprint examiners did not document their findings like specialists from other disciplines, the stagnated condition of fingerprints standards compared to those of other sciences and the antiquated mode of presentation in court.[1331]

The presiding judge, in overturning the conviction based on the initially presented fingerprint evidence, remarked on the necessity of the fingerprint regulatory bodies in the United Kingdom to examine the issues that the court had cited, to evaluate the status of such evidence and to guarantee the formulation of common quality standards implemented by an accountable system.[1332]

With reference to research performed by Francis Galton *circa* 1892, the NAS committee conceded that the individuality of fingerprint patterns is supported by some scientific substantiation,[1333] but maintained that, while this individuality is essential for friction ridge identification, the core dilemma is the difficulty with which analysts successfully discern,

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1330 *R v Smith* [2011] 2 Cr. App. R. 16 at 188.

1331 *R v Smith* [2011] 2 Cr. App. R. 16 at 187-188.

1332 *R v Smith* [2011] 2 Cr. App. R. 16 at 188.

1333 Scholars like Epstein, for instance, maintain that the individuality of fingerprints have never been scientifically established – Epstein 2002:612.

subjectively, whether two fingerprint impressions belong to the same person.[1334] Therein resides the recently exposed unreliability of fingerprint evidence.

However, while hints of evidence might point to fingerprint impression individuality, no research has been performed to establish the probability of two different individuals possessing the same number of fingerprint ridge features.[1335] While DNA typing requires statistical analysis and interpretation to render such evidence relevant to a criminal trial, fingerprint evidence compels no such requirement, and examiners can therefore not provide a verifiably reliable or scientifically accurate opinion on the probability that two prints were made by the same person.[1336]

In addition to these already significant problems, cognitive bias, too, impacts upon the accuracy of friction ridge analyses.[1337] Fingerprint examiners are frequently exposed to data that are not imperative to their subsequent analyses of prints. For instance, the investigating officer might divulge that there is other compelling evidence implicating the suspect in the crime, thereby generating an unconscious biasing effect on the examiner and jeopardising the accuracy of analyses.[1338]

1334 National Academy of Sciences 2009:5-13. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011. See also Mnookin 2010:1225. While Mnookin echoes the problem with examiners' ability to successfully discern whether two prints belong to the same person, she also strongly criticises the averment that fingerprints are individualising, explaining that while some research suggests that fingerprints are highly varied, there is no empirical evidence indicating the exclusive uniqueness of fingerprint impressions – Mnookin 2010:1225.

1335 Meintjes-Van der Walt 2006:160.

1336 Meintjes-Van der Walt 2006:160.

1337 Mnookin 2010:1230.

1338 Mnookin 2010:1230.

In 2002, even before the publication of the NAS report, Epstein[1339] identified another dilemma in friction ridge analysis neglected by researchers: distortion and artefacts. Pressure distortion, for instance, can alter the fingerprint impression left behind on a surface and cause ridge characteristics to appear different to what they actually are, just as the shape and texture of the surface, as well as the specific dust and medium used to develop the prints can distort the final impression.[1340] Deficient research exists on the frequency with which these distortions occur, which is immensely lamentable since a high amount of fingerprints obtained from crime scenes are distorted.[1341]

5.2.3 Recommendations included in the NAS report

The NAS investigating committee submitted several recommendations in response to the main problems identified during the course of its investigation.

In retort to the dilemmas of the fragmented nature of the forensic science community and practices, as well as the wanting scientific foundation and research culture in the forensic milieu, the committee proposed the development of forensic science into a mature field of multidisciplinary study and practice, founded upon the methodical collection and analysis of information.[1342] To achieve this objective, it

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1339 2002:609.

1340 Epstein 2002:609.

1341 Epstein 2002:609.

1342 National Academy of Sciences 2009:2-21. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

was suggested that the U.S. government establish and subsidise an independent federal entity with an advisory board possessing the appropriate expertise in research and education, all the forensic science disciplines, pathology, engineering, natural and life sciences, information technology, law, public policy and more.[1343]

Furthermore, it was advised that this independent research body regulate the formation and implementation of best practice protocols for forensic practitioners and laboratories across the United States of America.[1344] Additionally, the body would regulate mandatory accreditation of forensic laboratories and certification of practitioners, promote improved and peer-reviewed research and technical advance of all the different forensic disciplines, generate adequate and suitably allocated funding, manage education standards and the accreditation of forensic science programmes in tertiary institutions, as well as design programmes aimed at improving legal practitioners' appreciation of all the forensic spheres and their restrictions.[1345]

These recommendations were widely considered to be both bold and imperative, but since the publication of the NAS report it has been reported that the establishment of an independent, federal entity is neither economically nor politically feasible.[1346]

[1343] Mnookin 2010:1236; National Academy of Sciences 2009:2-21. http://www.nap.edu/catalog.php?record_id= 12589. Accessed on 19/04/2011.

[1344] National Academy of Sciences 2009:2-21. http://www.nap.edu/catalog.php?record_id= 12589. Accessed on 19/04/2011.

[1345] National Academy of Sciences 2009:2-21. http://www.nap.edu/catalog.php?record_id= 12589. Accessed on 19/04/2011.

[1346] Mnookin 2010:1237.

5.2.4 Reliability issues of expert evidence in England and Wales

Early in the twenty-first century, before the National Academy of Sciences in America launched their investigation, the House of Commons in the United Kingdom founded and directed the Science and Technology Committee to investigate the aspects of forensic science practices in England and Wales, including the provision of forensic services to the criminal justice system, the quality of the forensic science education and training, degree of research and development in the forensic science arena, and much more.[1347]

The extent of the investigation into aspects of criminal justice was expansive, while the focus on the individual forensic sciences was tremendously limited. A meticulous exploration of the traditional forensic sciences was completely absent.

The report generated following the investigation by the Science and Technology Committee was careful in conceding that the possibility of miscarriages of justice by inadequacies in expert evidence and the manner in which it is presented and evaluated in the England and Wales legal system, could not be entirely excluded.[1348] The report describes these inadequacies as a "systems failure" and laments the public criticism that expert witnesses frequently suffer when their

1347 House of Commons 2005:5.

1348 House of Commons 2005:3. In the United Kingdom, the degree to which expert evidence is culpable in failures of justice is fiercely contested – Heffernan and Coen 2009:488.

evidence is called into question, and the ease with which presiding officers and legal practitioners evade reproach.[1349]

Corresponding with issues raised in the later NAS report in America, the House of Commons' report recommended that clearly defined tests and standards be constructed to enable courts to assess whether a specific theory or technique is founded upon rigorous and valid scientific research to justify its submission in trials.[1350] It was suggested that a proper and effective "gate-keeping" test be developed for expert evidence in collaboration with judges, scientists, legal practitioners and other stakeholders in the criminal justice system, while employing the *Daubert*-criteria as foundation for the new criteria.[1351]

The problems and recommendations offered by the House of Commons' report were answered with the United Kingdom Law Commission's consultation paper,[1352] published in 2009. The specific objective of the paper was to formulate suitable methods of admissibility and reliability determinations for scientific evidence in criminal litigation.[1353]

While the Law Commission formulated numerous suggestions regarding the establishment of the admissibility and reliability of expert evidence, it did not consider the individual forensic sciences, and did

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1349 House of Commons 2005:75.

1350 House of Commons 2005:76.

1351 House of Commons 2005:76.

1352 Consultation Paper No. 190, available at http://www.justice.gov.uk/lawcommission/areas/expert-evidence-in-criminal-trials.htm.

1353 Law Commission 2009:1.

not contemplate the fallacies, benefits or the needs of the traditional forensic sciences as tools of proof.

Heffernan and Coen[1354] applaud the efforts of the Law Commission and accentuate the need for courts in England and Wales to approach scientific evidence with care and consideration, bearing in mind that the collection, analysis and presentation of scientific evidence are intricate, subjective processes.

However, while the Law Commission's report and the recommendations it generated for greater precision in allowing valid and reliable scientific evidence in courts are both essential and commendable, it does not address the mounting anxiety regarding the accuracy and reliability of the sciences themselves.

The legal fraternity in South Africa is yet to enter into discussions on these issues and it remains to be seen how the local legal and forensic community will respond to these international realisations and transformations.

5.2.5 Conclusion

The imperative need for traditional forensic sciences to improve appears distinctly from the NAS report and the immense amount of wrongful convictions effected by these disciplines.

[1354] 2009:489.

Mnookin[1355] succinctly describes the 'culture' within the realm of traditional forensic science which is held responsible for so much of the problematic issues generated by these types of forensics:

> This forensic science culture – a culture in which claims derived from experience are often accepted as a substitute for data; a culture in which interpretations are often framed in absolute terms rather than in more limited or modest language; a culture in which potentially biasing information is not systematically kept from the forensic examiner; and a culture in which institutionally cozy relationships between detectives, forensic analysts, and prosecutors may encourage unconscious partisanship – remains very much the norm within forensic science laboratories today.

While the spheres of traditional forensic science have suffered justified disillusion and attacks on its reliability, its enduring significance, both in criminal litigation as well as in criminal investigation, necessitates a thorough examination of some of these types of forensics.[1356] Some legal scholars remain of the opinion that traditional forensic sciences should not abruptly be excluded from employment in the criminal justice system, but that exhaustive research could render these types of forensic sciences highly probative, and thus valuable in criminal litigation.[1357] According to Mnookin,[1358] the lack of data on traditional forensic sciences, and therefore the need for a culture of research on the subject, is not in itself evidence of the failings of traditional forensics, but such a research culture should be employed to improve the understanding of the uses and limitations of this sphere of forensics. This may result in a greater sense of credibility and legitimacy endowed

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1355 2010:1215.

1356 National Academy of Sciences 2009:5-1. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1357 Mnookin 2010:1216.

1358 2010:1216.

upon traditional forensic techniques and practices, which will ultimately increase reliability and probative value of the evidence in court.[1359]

It remains to be seen what the effect in the United States of America will be regarding motions to exclude expert evidence based on the *Daubert*-judgment following the NAS report. If courts accede to the contents of the NAS report pertaining to the rejection of the notion of a zero error rate, then evidence that were traditionally admitted under *Daubert* will now be excluded.[1360]

Regardless, Mnookin[1361] insists that:

> For courts to continue to treat forensic science evidence in the same manner that many of them did prior to the NAS report would be worse than cowardly… There truly is an insufficient basis in research for many of the strong claims that forensic scientists have been making for years. The courts should squarely confront that fact and decide in a thoughtful way what consequences it creates for these forms of evidence; what effects it has on admissibility; and whether it means that the evidence should, at a minimum, be limited, and if so, how.

If forensic and legal communities are to engage in strengthening the scientific foundations of traditional forensic sciences, and formulate effective standards for determinations of validity and reliability of these sciences respectively, then both these communities must dive into investigations of what these 'sciences' are and what, if anything, they can contribute to criminal justice systems.

1359 Mnookin 2010:1216.

1360 Mnookin 2010:1238.

1361 2010:1239.

5.3 BLOODSTAIN PATTERN ANALYSIS[1362]

5.3.1 Introduction

Bloodstain pattern analysis, much like other forensic disciplines, seeks all the factual truths surrounding some criminal event under investigation, and is most commonly implicated in investigations of crimes of a violent nature.[1363]

Peschel *et al*[1364] describe this forensic science discipline as follows:

> …the examination of shapes and the categorization and distribution of bloodstain patterns in order to provide an interpretation of the physical events of a crime which gave rise to their origin.

Observing and interpreting the "static aftermath" of a crime, that is, the distribution, shape characteristics, pattern, volume, and number of bloodstains, as well as their connection with the surroundings, may provide the investigating officer with indispensable data.[1365] The examination and interpretation of these stains and patterns can inform the investigator of the directionality, angle and distance of a moving blood droplet, the nature and directional origin of the force that caused bloodshed, the nature of any object used, the approximate number of

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1362 A complete discussion of all aspects of this forensic discipline falls beyond the scope of this research, but an attempt is made to deliberate on the most important facets thereof to enable an understanding of its potential in criminal investigation and prosecution.

1363 Bevel and Gardner 2002:1. Shelton 2011:98; De Bruin *et al* 2011:1476. For a discussion on the historical development of bloodstain pattern analysis, see para 2.2.3 above.

1364 2011:257.

1365 Bevel and Gardner 2002:1-2; James *et al* 2005:1; National Academy of Sciences 2009:5-38. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

blows struck with such object, the relative positions in the crime scene of the victim and attacker, and much more.[1366]

Bloodstain pattern analysis is thus indispensable in responding to the questions of "what" happened during the criminal event, as well as "how" it happened.[1367] For this reason it is a valuable tool in the reconstruction of a crime.[1368]

According to Peschel *et al*,[1369] bloodstain pattern analysis can also be of tremendous value to the detective during the crime investigation, as it can be useful, in addition to aiding with crime reconstruction, in serving as corroboration of witness and suspect statements.

This type of forensic analysis is by no means an effortless or straightforward exercise free of any ambiguity. Rather, it is severely complicated by the immense variability of sources that generate and manipulate bloodstain patterns.[1370]

According to the NAS investigating committee, proficiency in crime reconstruction using the data yielded from bloodstain pattern analysis requires, at the very least, suitable scientific education and insight into

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1366 Bevel and Gardner 2002:2; James *et al* 2005:1; Peschel *et al* 2011:257.

1367 In terms of the "how" inquiry, bloodstain pattern analysis may reveal if a particular bloodstain resulted from arterial spurting, blood dripping, coughed up blood, back spatter, angular deposits, flight paths, and more – Shelton 2011:98.

1368 Bevel and Gardner 2002:2; National Academy of Sciences 2009:5-38. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011; Peschel *et al* 2011:257.

1369 2011:257.

1370 National Academy of Sciences 2009:5-38. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

aspects of applied mathematics, familiarity regarding the terminology employed in this type of analyses, an appreciation of the limitations of the measurement instruments, and knowledge of the physics of fluid transfer, wound pathology and the typical patterns blood forms when leaving the body.[1371]

James *et al*[1372] assert that the principal spheres of science employed in bloodstain pattern analysis are biology, physics and mathematics, and that these disciplines are used in a process entailing direct crime scene assessment, along with a meticulous examination of scene photographs and any available articles like clothing, weapons, or other pieces of physical evidence.

Bevel and Gardner[1373] agree but warn that the necessity to appreciate all these scientific disciplines does not imply that the bloodstain analyst must be an expert in all of them. As a generalist, the analyst must recognise when and how the experience and expertise of other forensic specialists are required and must be able to integrate all data yielded from these experts to finally arrive at a reconstruction of the crime with as little subjectivity as is humanly possible.[1374]

As a vital component of crime reconstruction, bloodstain pattern analysis is founded upon the application and effect of physical laws on blood. Systematic scientific research should be persistently performed

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1371 National Academy of Sciences 2009:5-38. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1372 James *et al* 2005:1-2.

1373 2002:4.

1374 Bevel and Gardner 2002:4.

in order to understand these laws, as well as any laws not yet comprehensively grasped.[1375] It seems rational, however, that to understand the laws that impact upon blood, blood itself must be understood as well.

5.3.2 Physical properties of blood and bloodstain formation

According to James *et al,*[1376] blood remains "…one of the most significant and frequently encountered types of physical evidence associated with the forensic investigation of death and violent crime."

Adam,[1377] in turn, describes the importance of understanding the nature of blood before attempting to perform bloodstain pattern analysis.

> A detailed understanding of blood dynamics and stain formation is an essential prerequisite to the interpretation of both individual bloodstains and spatter patterns.

From the substantial volume of literature on bloodstain pattern analysis, it appears clear that an immense array of blood drops, spatter, stains, swipes, wipes, and spots can be observed on a scene of violent crime.[1378] James *et al*[1379] explain that the classification of bloodstains is primarily based on the appearance of the stains as they exist on the

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1375 Bevel and Gardner 2002:4.

1376 James *et al* 2005:1. According to Wecht and Rago, blood is the *most* frequently encountered type of biological evidence at scenes of violent crime – Wecht and Rago 2006:413.

1377 2012:76.

1378 For instance, cast off stains are created where blood is projected from an object in motion, while ricochet stains refer to blood impacting a secondary surface and then bounce to another surface. For a terminological discussion of all these forms of stains, spatter or spots, see Bevel and Gardner 2002:69-106.

1379 2005:68-70.

crime scene, but secondarily, on the mechanism of their creation. In this manner, stains can be divided into three primary categories, namely passive bloodstains, spatter stains and altered bloodstains.[1380] In turn, each of these categories can be subcategorised based on their mechanisms of formation, that is, what creational forces they were subjected to.[1381]

For purposes of the present study, only four types of blood stains will endure scrutiny: regular blood drops from the passive bloodstain category, as well as low-velocity, medium-velocity and high-velocity impact spatter, all from the class of bloodstain spatter.[1382]

However, prior to exploring these types of stains it is prudent to observe the nature and physical properties of blood, as well as the resultant bloodstains.

Blood is a complex fluid, comprising an intricate composition of plasma and cells, which constitutes about 8% of a person's total body weight, enjoys a higher viscosity than water, and exhibits an adhesive quality that is of special interest to analysts, since it allows the creation of a variety of pattern transfers on the crime scene.[1383]

1380 James *et al* 2005:68-69.

1381 James *et al* 2005:69. For example, passive stains, whose physical features indicate they were created without significant external force other than gravity, may be subdivided into contact stains, ordinary blood drops, blood flow, or blood pooling, depending on the mechanism of creation – James *et al* 2005:69.

1382 Bevel and Gardner 2002:104-105, 112-117.

1383 Bevel and Gardner 2002:107-108; Peschel *et al* 2011:258. Human males have approximately 5 to 6 litres of blood in their circulatory systems, while females have about 4 to 5 litres – Peschel *et al* 2011:258. Adhesion, as referred to in this context, denotes the tendency of certain opposing molecules to become attached to each other due to attractive forces – Peschel *et al* 2011:258.

Cooper[1384] warns that blood, although it is a fluid, should not be expected to act like water, and refers to blood as "a non-Newtonian fluid", implying that blood is not subject to Newton's Laws of Motion.

In the body, blood is contained in the circulatory system, that is, veins and arteries. This circulatory system is a closed system which serves the body by providing it with oxygen and nutrients, as well as removing waste.[1385] When this system is ruptured in any manner, it represents a substantial threat to survival and the body responds in one of three ways in order to prevent as much damage as possible, namely vessel contraction, platelet plug formation, and blood coagulation.[1386]

A single, free-falling blood drop, subject to gravitational force, is slightly elongated when initially detaching from its presumably damaged source, but eases into a spherical shape due to its own surface tension reducing the surface of the fluid to the smallest space it can achieve.[1387] Falling through air, the viscosity of blood aids in the retention of the spherical shape it initially assumed, though studies have demonstrated that the shape may alter slightly due to internal oscillations and air resistance, with the level of alteration depending on its size.[1388]

1384 2009:10. See also Adam 2012:77.

1385 Bevel and Gardner 2002:108.

1386 Bevel and Gardner 2002:109-110.

1387 James *et al* 2005:61. See also Bevel and Gardner 2002:113.

1388 Bevel and Gardner 2002:115; James *et al* 2005:62. Research has revealed that larger drops, like those tested by Bevel and Gardner of 5,3 mm in diameter, will exhibit more internal oscillation than the 'typical' drop described by Herbert MacDonell of 4,6 mm in diameter, and even more than smaller drops of, for instance, 2 mm in diameter – James *et al* 2005:62. For a discussion on droplet sizes and the effect of oscillation, see Bevel and Gardner 2002:112-120.

Blood, as a fluid, is incompressible. This implies that when a specific force (such as a hammer in a case of blunt force trauma) is applied to a mass of blood (for instance, blood contained in vessels in the scalp), the blood must be displaced in response to the applied force.[1389] Once the applied force has overcome the viscosity and considerable surface tension of the displaced blood, it will degenerate into slighter blood drops of smaller diameter than typical, free-falling blood drops.[1390]

The dynamics of blood drops impacting a surface have been scrupulously studied but are still inadequately understood.[1391] Once again, impact dynamics in falling blood drops and bloodstain spatter are distinguished from one another.

Hypothetically, free-falling blood drops of spherical shape impacting onto a flat, horizontal surface are circular in shape with varying sizes, depending on the volume of the drop, the distance fallen and the texture of the surface impacted.[1392]

In contrast, free-falling drops colliding with angular surfaces exhibit an oval, elongated shape that becomes progressively more elongated the

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1389 Bevel and Gardner 2002:111.

1390 Bevel and Gardner 2002:111; James *et al* 2005:62. These smaller drops will also display less oscillation than typical drops, and thus less distortion moving through the air – James *et al* 2005:62.

1391 Bevel and Gardner 2002:120-121.

1392 James *et al* 2005:71. Rough or porous textured surfaces will result in stains demonstrating distortion, irregular shapes, and spiny edges – *James et al 2005*:71. For an in-depth discussion on research performed regarding the appearance of blood drop dynamics on a variety of different surfaces, see Bevel and Gardner 2002:121-131.

more acute the angle of impact.[1393] The narrowest end of an elongated stain from free-falling drops in these circumstances points in the direction of travel. Depending on the texture of the impacting surface, the narrowest end of the stain may also demonstrate spinal protrusions and rough edges.[1394]

Bloodstain spatter, defined as a diffusion of blood spots of variable size, created when an external force strikes a source of blood, possesses the unique advantage of displaying directionality characteristics that indicate the position from which they originated.[1395]

The quantity of spatter as well as the size range[1396] thereof depends on the volume of the original source of the blood, the amount of blows or force applied to this source, as well as type of force exercised on the source.[1397] Accordingly, a fastidious examination of the spatter quantity and size range on a crime scene can assist the analyst in establishing the mechanism by which a spatter pattern was produced.[1398]

1393 James *et al* 2005:73.

1394 James *et al* 2005:73-75.

1395 James *et al* 2005:99.

1396 This refers to the size of the surface covered by the blood spatter.

1397 James *et al* 2005:100.

1398 James *et al* 2005:100. For instance, to establish whether the spatter was produced by high-velocity mechanisms, like firearm discharge, or medium-velocity mechanisms, such as blunt force trauma.

The particular shape of the individual spatters within the spatter pattern can be enormously informative to the investigator regarding the area of convergence and origin of a collection of spatters.[1399]

Additionally, the directionality of spatter travel, as well as the angle of surface impact can be established by their shape.[1400] As the blood droplet impacts its target surface, it starts collapsing, while the momentum of the mass of the droplet propels it forward in the same direction it was moving.[1401] The mass of the droplet flows towards the outer edges of the forming stain. What results is either a circular stain if the blood collides with the surface on a perpendicular axis,[1402] or an elliptical stain if the droplet impacts at an angle.[1403]

Determinations of directionality are thwarted if the surface upon which the bloodstains have impacted is an exceedingly absorbent or irregular surface, such as a carpet.[1404]

If the bloodstain fell into an elliptical shape, it would have both a major axis[1405] as well as a minor axis.[1406] It is the major axis that will ultimately

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1399 James *et al* 2005:103. The area of convergence and origin of spatter is indicative of the three-dimensional position in the crime scene where the blood source, such as the victim's head, was impacted. This will be discussed in para 5.3.4.

1400 James *et al* 2005:103.

1401 Bevel and Gardner 2002:140.

1402 That is, impacting at a 90º angle.

1403 Bevel and Gardner 2002:140-141; James *et al* 2005:103.

1404 Bevel and Gardner 2002:140.

1405 If one were to draw a straight line through the length of the oval shape, one would have the major axis since it is the longest axis of the stain.

1406 Bevel and Gardner 2002:141. The minor axis signifies the straight line through the breadth of the stain.

assist the analyst in establishing the direction in which the blood travelled, which, in turn, will assist the analyst in reconstructing the violent events that lead to the bloodshed.[1407]

5.3.3 Bloodstain pattern analysis as forensic tool

Bloodstain pattern analysis requires experience as well as intensive and constant experimentation to ultimately establish how blood will behave on a specific surface.[1408] Barry A.J. Fisher[1409] stresses the importance of proper training before attempting such experimentation or analyses:

> Training and experience will allow for the greatest amount of useful information to be derived from this technique. Crime scene reconstruction through the use of blood spatter pattern interpretation is a useful technique but only those who have the necessary amount of training should use it.[1410]

The NAS report highlighted the need for appropriate scientific education before assuming bloodstain pattern analyses.[1411] In discussing the two primary professional bodies regulating standards and certification of bloodstain pattern analysts, namely the International Association of Identification (IAI) and the Scientific Working Group on Bloodstain Pattern Analysis (SWGSTAIN), the NAS committee condemned the fact that the IAI does not require educational qualification for certification in

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1407 Bevel and Gardner 2002:139-141.

1408 Fisher 2000:222.

1409 Barry Fisher is currently the director of the forensic laboratory of the Los Angeles County Sheriff's Department in the United States of America, holds a Master of Science degree in organic chemistry from Purdue University, and published the venerable treatise on crime scene investigation, *Techniques in Crime Scene Investigation*.

1410 Fisher 2000:222-223.

1411 National Academy of Sciences 2009:5-38. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

this type of forensic analysis, since meticulous and objective hypothesis testing and the complex nature of fluid dynamics are so important in achieving accurate results in analysis.[1412]

Karger *et al*[1413] intimate that bloodstain pattern analysis and post-mortem examinations exist in close proximity, as the type, quantity and location of wounds on a victim are of significant importance to the interpretation of the bloodstain patterns on the crime scene. It was thus suggested that bloodstain pattern analysis should be performed by the same person conducting post-mortem investigations, and if this was not possible, that close interaction and information exchange between the two parties be ensured.[1414]

Bloodstain pattern analysis can be performed either at the crime scene itself, or at the laboratory.[1415] Peschel *et al*[1416] aver that while the initial, preliminary examination of the scene should comprise only the possible relevant areas, stain analysis of a potential crime scene should ultimately consist of the entire area under investigation, including artefacts as well as the three-dimensional space.

It is crucial that the bloodstains' size, shape, dispersion, exact position and its general appearance be recorded and documented as clearly

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1412 National Academy of Sciences 2009:5-39. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011. See also Shelton 2011:101-102.

1413 2008:17.

1414 Karger *et al* 2008:17. In most cases this person would be the forensic pathologist conducting the autopsy.

1415 James *et al* 2005:263.

1416 2011:267.

and accurately as possible.[1417] The recording of these data can be conducted by way of sketches, photographs, video recordings or any combination of these methods, but must be conducted with precision, as failure to record information on the crime scene correctly can adversely affect the accuracy of later reconstruction.[1418]

Following evidence documentation, the analyst must categorise the bloodstains in order to ascertain the fundamental nature of the event that caused the bloodstain patterns.[1419]

Analysts will recognise free-falling blood drops by examining their shape, appearance and size. If the drops fell at a perpendicular angle on a smooth, non-porous surface, they are likely to be circular, but if these droplets impacted the surface at various angles, for instance, when the bleeding victims walked or stumbled a distance, the stains will be elliptical.[1420]

While it is hazardous to attempt reconstruction of the height and volume of the falling droplets, the angle of impact can be successfully determined. Here, the major and minor axes of the stains will be measured and the measurements employed in a mathematical calculation to establish the angle of impact.[1421] The specific angle

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1417 James *et al* 2005:263.

1418 James *et al* 2005:264-274.

1419 Bevel and Gardner 2002:193.

1420 Peschel *et al* 2011:261. See also Bevel and Gardner 2002:147. It is vital to remember that the nature and condition of the surface upon which bloodstain impact will substantially influence the appearance and shape of bloodstains and experimentation might become indispensable to accurately predict the events that transpired.

1421 Peschel *et al* 2011:261. Dr. Victor Balthazard, French professor in forensic medicine at the Sorbonne University in the early twentieth century, is generally credited for having realised

computed is the internal angle formed between the flight path of the blood drop and the surface it collided with, and can be obtained using the following formula:

Angle of impact = *arc sin w/l*[1422]

Bevel and Gardner[1423] caution that the precision of the mathematical formula should not entice the analyst into affording similar reliable accuracy to the impact angle of bloodstains. The science of flight and oscillation impede such exact determinations. Generally, the accuracy of these calculated impact angles can be considered correct within 5 to 7 degrees.[1424]

When determining the directionality of the fallen stain, two possible and opposing directions can be identified by observing the major axis. The bloodstain pattern analyst must thus examine the appearance of the edges of the longest axis of the stain to determine which of the two directions signifies the blood drop's direction of travel.[1425] The side of the major axis that possesses the highest number of spines or satellite stains[1426] is indicative of the direction of movement of the blood drop.[1427]

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the relationship between the length and width of a stain and the angle with which the droplet impacts. Herbert MacDonell later perfected this concept into a mathematical formula - Bevel and Gardner 2002:153. The devices employed to perform the measurements range from standard rulers or micrometres, photographic loupe or any device the analyst is comfortable with - Bevel and Gardner 2002:171.

1422 Where *w* is the minor axis, and *l* refers to the major axis – Peschel 2011:261.

1423 2002:165.

1424 Bevel and Gardner 2002:165.

1425 Bevel and Gardner 2002:141.

1426 Satellite stains are formed when the blood drop collides with the surface at such an acute angle and speed that the inertia or momentum of the volume of the drop breaks the surface tension of the drop, which causes small droplets to break free from the parent drop - Bevel and Gardner 2002:141-142.

When, upon observing the bloodstains on the scene of the offence, the bloodstain analyst is of the opinion that the stains are not free-falling in nature but of projected or impacted nature, the subcategories to which the spatter patterns belong, namely low-, medium- or high-velocity spatter, should, at first, be determined.[1428] This categorisation is founded upon the nature of the force colliding with the blood source and causing the stains.[1429] The higher the level of kinetic energy transferred onto the blood source, the smaller the resulting blood spatter stains.[1430]

Low-velocity spatter stains are comparatively large in size, since the low level of energy applied to the blood source, typically an average gravitational force of maximum 1,5 meters per second, cannot succeed in degenerating the larger drops into smaller spatter.[1431] The resulting bloodstains are generally at least 4 mm in diameter.[1432]

Possible occurrences that would justify the presence of low-velocity bloodstain spatter on a crime scene include damage to the victim's venous system which would result in the blood naturally falling to the ground.[1433]

1427 Bevel and Gardner 2002:142.

1428 Bevel and Gardner 2002:193.

1429 Bevel and Gardner 2002:193. These spatter pattern stains are also referred to as impact pattern spatter – De Bruin *et al* 2011:1476.

1430 Peschel *et al* 2011:263-264.

1431 Peschel *et al* 2011:264. See also Bevel and Gardner 2002:193.

1432 Bevel and Gardner 2002:193; Peschel *et al* 2011:264.

1433 Bevel and Gardner 2002:193-194; Peschel *et al* 2011:264. It appears thus that even free-falling blood drops would strictly be classified as low-velocity bloodstains - Bevel and Gardner 2002:194.

Medium-velocity blood spatter is descriptive of bloodstains ranging in size between 1 and 4 mm in diameter, which are caused by the application of force of approximately 1,5 to 7,5 meters per second to the source of blood.[1434] These stains are typically representative of blunt force trauma, such as blows with a solid object, or stabbing.[1435]

When examining medium-velocity spatter patterns, it is prudent to bear in mind that a single blow delivered during an incident of blunt force trauma, is insufficient in generating any substantial blood spatter. The blood source, for instance the veins and arteries in a victim's scalp, must first be exposed before spatter can occur.[1436]

The size, shape and dispersal of medium-velocity blood spatter are capricious attributes, altered by an array of aspects such as the shape and type of weapon, the amount of blows struck, the level and direction of force applied, the position of the wounds (blows to the head typically generate much more blood spatter than blows to the abdomen), movement of the victim or aggressor during the course of an attack, and the amount of blood available for a particular impact.[1437]

1434 Peschel *et al* 2011:264.

1435 Peschel *et al* 2011:264. In these cases, overlapping spatter patterns are frequently observed – Peschel *et al* 2011:264. Students in the field of bloodstain pattern analysis study medium-velocity spatter by reproducing such spatter in the laboratory by way of a modified mouse trap on which a bloody cloth serves as bloody 'victim' to the force of the trap – James *et al* 2005:119.

1436 James *et al* 2005:122. Exposure can result due to the first blow of the assault, for example.

1437 James *et al* 2005:129.

When a particular blood source is subjected to a force of kinetic energy in excess of 35 meters per second, the ensuing bloodstains are expected to be less than 1 mm in diameter and are classified as high-velocity blood spatter.[1438] These bloodstains are frequently described as 'mist-like' staining[1439] and are habitually acquainted with gunshot injuries where tremendous amounts of energy are applied to a small, focused area.[1440]

According to James *et al*,[1441] this type of spatter patterns will also be observed in incidents involving explosions and power tools, such as chain saws and radial saws, but also in certain types of motor vehicle accidents.

In cases where such spatter stains are present on the crime scene, their directionality can also be determined by way of examination of the physical appearance of the stain edges, that is, for the presence of spines, satellite spatter, and other direction-indicative features, as well as the mathematical calculation of the angles of impact. The bloodstain pattern analyst will then arrive at the next vital step in event reconstruction: ascertainment of the points of convergence of blood spatter, as well as their origin.[1442]

1438 Bevel and Gardner 2002:194-195; Peschel *et al* 2011:264. Here too, overlapping of stain sizes may occur with infrequent appearances of larger stain sizes – Peschel *et al* 2011:264.

1439 Bevel and Gardner 2002:195.

1440 Peschel *et al* 2011:264.

1441 2005:131. Motor vehicle accidents in which high-velocity blood spatter have been observed include vehicle-pedestrian collisions, as well as certain air bag deployment impacts – James *et al* 2005:131.

1442 Bevel and Gardner 2002:159; James *et al* 2005:122.

Positions in space where bloodstains originated can be established in one of three ways, depending on the circumstances of the case and the specific requirements of the analyst.[1443]

Firstly, the bloodstains' origin can be determined by examining the area of spatter from overhead. Here, the directionality of each and every bloodstain will be determined, followed by drawing a straight line extending backward from the stain as far as possible in the opposite direction of the stain's travel. This is repeated with all discernible stains until the point where all the stains intersect is visible.[1444] By drawing lines from multiple stains of known position and direction, a previously unknown location, likely to be the origin of the blood spatter, will be defined where the lines cross.[1445]

The dilemma inherent in this overhead-analysis is its inability to recognise multiple events from a few bloodstains. Therefore, if the bloodstains were created by more than one application of force, drawing the lines in this technique will produce points of convergence that are simply coincidental and have no investigative significance.[1446]

Secondly, bloodstain pattern analysts may also consider using both the overhead, as well as the side view technique. Employing these methods will necessitate the determinations of both directionality, as well as

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1443 Bevel and Gardner 2002:159.

1444 Bevel and Gardner 2002:159-160. This technique is similar to resection in map reading. Drawing lines in this technique may be performed on photographs of the scene of the bloodshed.

1445 Bevel and Gardner 2002:160.

1446 Bevel and Gardner 2002:160-161.

impact angle of bloodstains.[1447] Each stain on the scene will be measured and its impact angle calculated using the sine formula. The angle determinations will be followed by the methods employed in the overhead analysis, that is, drawing lines from the stain back in opposite direction to that stain's original trajectory.[1448] When all stains have been analysed, the information regarding the angles and possible converging points are illustrated by using either graph models or trigonometry formulae to determine this point in space mathematically.[1449] It is then possible to visualise the estimated position on the crime scene where the bloodshed originated.

The third method of establishing point of origin entails three-dimensional evaluations, which can be performed either by physically 'stringing' the crime scene, or by using computer software to generate electronic analyses.[1450]

While stringing used to be the method of choice employed by bloodstain analysts, computer-based technology is fast becoming the preferred technique.[1451]

1447 Bevel and Gardner 2002:176.

1448 Bevel and Gardner 2002:176-179. It must be noted, however, that it is unlikely that bloodstain pattern analysts will employ and measure ever single bloodstain present on a crime scene. Analysts will peruse the surface under investigation for the best developed stains. That is, those that are distinctly measurable - Bevel and Gardner 2002:163. It must also be noted that scallops, satellite spatter or spines attached to the stain will not form part of the measurement - Bevel and Gardner 2002:166.

1449 Bevel and Gardner 2002:179-182.

1450 Bevel and Gardner 2002:184; Rowe 2006:47.

1451 Bevel and Gardner 2002:184.

Implementation of the stringing method involves the same directionality and impact angle determinations as with the first two techniques. Thereafter, string is taped to the impact surface at the base of the stain and extended back along the indicated path and angle.[1452] It is an arduous and time-consuming task to string all the bloodstains and the process requires great deliberation.[1453]

Due to the intricacy and effort required by the stringing method, software applications have been developed that would ultimately substitute stringing altogether.[1454] Data pertaining to each well-formed stain's position, width, length and directional angle is measured and entered into a computer software programme, which calculates and illustrates convergence points within three-dimensional spheres.[1455]

De Bruin *et al*,[1456] in conducting research on the improvement of point of origin determinations in bloodstain pattern analysis, slated the above-mentioned methods as they do not adequately consider the impact of natural forces on the blood drops traveling through air.

> Most of these methods are based on the assumption that the path of a blood drop away from the blood source follows a straight line, hereby neglecting influence of gravity and air resistance.[1457]

1452 Bevel and Gardner 2002:184; De Bruin *et al* 2011:1476.

1453 Bevel and Gardner 2002:184.

1454 Bevel and Gardner 2002:186.

1455 Bevel and Gardner 2002:186-187. The first analysis programme created for this purpose was called *Trajectories*. Since then, it was improved upon by the same developer and released as *Backtrack*®, which also enjoyed perfection over the last two decades - Bevel and Gardner 2002:186-190. At present, two commercially available computer programmes exist that determine point of origin, namely *HemoSpat* and *Backtrack*® - De Bruin *et al* 2011:1476.

1456 De Bruin *et al* 2011:1476.

1457 De Bruin *et al* 2011:1476.

In 2011, research showed that height estimations of the blood source produced by the computer-based programmes are consistently overvalued since computer software fails to consider gravity and air resistance.[1458] In the same research, it was discovered that specific alterations to the conditions under which data is obtained to employ in computer-based programmes, will significantly improve the accuracy of point of origin determinations.[1459] Some of these alterations include selecting more distinctly elliptical and larger bloodstains to measure, using stains presumably closest to the blood source, and so forth.[1460]

Regardless, these techniques aid the criminal investigation by estimating the location where some type of blow or impact occurred, which, in turn, assists the investigator in placing the victim and attacker at specific locations within the scene.[1461] For example, where a victim was discovered on the ground near a wall, beaten to death purportedly with a wrench or similar instrument, the bloodstain spatter on the adjacent wall with upward directionality from a few centimetres above the floor, would be indicative of the victim having been struck while lying on the floor, and here, stringing or computer-based origin determinations would be unnecessary.[1462]

1458 De Bruin *et al* 2011:1476.

1459 De Bruin *et al* 2011:1481-1482.

1460 De Bruin *et al* 2011:1481-1482.

1461 Bevel and Gardner 2002:191.

1462 James *et al* 2005:122. Such information would be highly relevant if, for example, the accused in a case of murder such as in the incident described here, claimed private defence. Striking a victim repeatedly while incapacitated on the floor would, in most instances, disqualify claims of self-defence.

By discriminating two or more distinctive points of origin from what seems to be a single spatter pattern, the analyst may also identify additional blows that might not have been evident, or in fact provable, otherwise.[1463] Multiple incidences of blunt force trauma to the head frequently generate extensive amounts of impact blood spatter, frequently accompanied with tissue and skull fragments.[1464] On the other hand, multiple stabbing events, which also yield medium-velocity spatter, typically do not produce the same volume of spatter as beatings.[1465]

Moreover, these data, especially in correlation with additional information from the crime, such as post-mortem or laboratory reports, and so forth, can be employed in corroborating or repudiating claims and statements made by suspects or witnesses.[1466]

There are a multitude of aspects regarding blood and bloodstains that may aid the analyst in providing information the criminal investigator might employ in substantiating hypotheses or the prosecutor in proving cases in court.[1467] However, blood needs to be understood if it is to continue being a benefit to the criminal justice system.

1463 Bevel and Gardner 2002:191.

1464 James *et al* 2005:123.

1465 James *et al* 2005:123.

1466 Bevel and Gardner 2002:191.

1467 Of the concepts not discussed here, but valuable in practice, is motion determination based on wipe (movement through a pre-existing bloodstain) or swipe (blood transfer from a bloody object to another surface) analysis, fly spots and blood expiration - Bevel and Gardner 2002:149-155, 219-222.

The NAS report concedes that aspects of bloodstain pattern analysis are substantiated by scientific research.[1468] Much of the usefulness of this type of forensic analysis, however, resides in the necessity to conduct experiments in order to ascertain which characteristics of a particular bloodstain were caused by which particular forces during a crime, and to justify causal connections and their inconsistencies.[1469]

In their report the NAS committee warns that because bloodstain pattern analysis is so vehemently experiment-based "…extra care must be given to the way in which the analyses are presented in court. The uncertainties associated with bloodstain pattern analysis are enormous."[1470]

Bevel and Gardner[1471] too, yield to the point that, to avoid courtroom challenges, bloodstain interpretation ought to be authenticated by more research on blood drop dynamics, and other facets of the discipline.

In 2006, scientists described mathematical formulae capable of determining errors in the location of the point of origin of bloodstains following the three-dimensional model.[1472] This may empower analysts to establish uncertainties in point of origin detection, which could

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1468 National Academy of Sciences 2009:5-39. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1469 National Academy of Sciences 2009:5-39. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011. See also Karger *et al* 2008:20.

1470 National Academy of Sciences 2009:5-39. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1471 2002:121.

1472 Rowe 2006:47.

undoubtedly equip these experts to better endure challenges in criminal litigation.[1473]

In 2012 in the United Kingdom, Adam[1474] instigated research into mathematical models for the behaviour of bloodstains and spatter on perpendicular, as well as non-perpendicular surfaces. Following this research, it was suggested that there exist fundamental mathematical expressions adequately illustrating the characteristics of bloodstains in accordance with rules of physics and mathematics which ultimately places bloodstain pattern interpretation on a sound theoretical basis.[1475] It was also recommended that additional research be conducted regarding the relationship between the surface properties and bloodstain characteristics, in order to fulfil the forensic community's understanding of this intricate discipline of forensic science.[1476]

Following the NAS report, there certainly seems to be significant proliferation in the volume of bloodstain pattern analysis research. Kettner *et al*[1477] describe the motivation behind such intensified study:

> Bloodstain pattern analysis has gained in importance in the reconstruction of crime scenes over the last years… Detailed knowledge of stain patterns and their diagnostic value is of eminent importance for medical examiners and police experts and may serve to reduce police investigation efforts.

1473 Rowe 2006:51.

1474 2012:76-87.

1475 Adam 2012:87. It remains to be seen, however, if the complicated mathematical formulae employed in this research will become popular amongst police investigators, bloodstain pattern analysts in general, as well as legal practitioners.

1476 Adam 2012:87.

1477 2010:842.

Moreover, the perceived subjectivity contained in this type of forensic analysis is reported to be slowly, yet definitively, fading.[1478] Wonder[1479] suggests that it is a misconception that bloodstain pattern analysis is "all subjective" and maintains that the practice thereof is wholly founded upon science and technology. Regrettably, training in this discipline has been highly subjective in nature in the past, thus creating analysts with subjective approaches, but this improve as training becomes formalised and more inclined to objective approaches.[1480]

The upsurge of bloodstain-related research and improvements in related training can greatly assist the criminal justice system in crime resolution.

> The presence of bloodstains at the crime scene can be of major importance for the investigation and reconstruction.[1481]

It is therefore troublesome that the NAS committee reported on the severely inadequate funding in the United States of America (USA) for development and strengthening of the different forensic disciplines.[1482] Cooper[1483] warns that if funding for the development of forensic fields like bloodstain pattern analysis is so scarce in developed and economically powerful countries like the USA, it can be safely predicted that similar financing in South Africa is not likely to be significant.

1478 Wonder 2003:168.

1479 2003:168.

1480 Wonder 2003:168.

1481 Karger *et al* 2008:15.

1482 National Academy of Sciences 2009:2-19. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1483 2009:16.

5.3.4 Bloodstain pattern evidence in court

Bevel and Gardner[1484] explain that bloodstain pattern analysis, as an essential instrument in the process of crime reconstruction, cannot stand separately from other evidence. Viewed comprehensively, all the evidence in a case should move its audience to arrive at similar conclusions.[1485]

The approach to bloodstain pattern analysis, from the initial crime scene attendance to final testimony in court, should adhere to scientific method and the final opinion tendered during testimony must be in strict accordance with scientific fact and be free of any speculative content or, specifically, overstatement.[1486]

In the United States of America, reliability hearings regarding bloodstain pattern analysis have been abundant. In *Farris v State*,[1487] the accused contested the reliability of the technique and its acceptance in the scientific community. The court found that since the methodology used is employed, not only in the Oklahoma Bureau of Investigation, but also by the Federal Bureau of Investigation and Scotland Yard, it is both accepted in the scientific community and reliable.[1488]

1484 2002:3.

1485 Bevel and Gardner 2002:3.

1486 James *et al* 2005:2.

1487 670 P 2d 995 (Okla.Cr. 1983).

1488 *Farris v State* 670 P 2d 995 (Okla.Cr. 1983) at 997-998.

It would appear that, despite warnings and criticisms by the NAS committee regarding the immense uncertainties in bloodstain pattern evidence,[1489] this type of expertise is consistently accepted into evidence in criminal litigation, even where experts exhibit minimal qualification, despite the *Daubert*-ruling's directives regarding experts' required credentials.[1490]

In America, the courts' preparedness to accept bloodstain pattern analysis and to regard witnesses with minimal qualifications as experts, was clearly demonstrated in the case of *Holmes v State*.[1491] In this case, the accused was convicted on two charges of aggravated assault[1492] after stabbing his former wife and her adult son. On appeal in the Texas appellate court, the accused challenged the admissibility, based on the deficient qualifications of the expert, as well as the reliability of the bloodstain pattern evidence accepted at his trial where there was no testimony regarding the validity or verification of the scientific techniques involved.[1493]

In considering the expert witness's training and whether he in fact did qualify as an expert, the court applied the dictum in *Alvarado v State*,[1494] where the accused also challenged the expertise of the testifying

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1489 National Academy of Sciences 2009:5-39. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1490 Shelton 2011:102.

1491 135 SW 3d 178 (Tex Ct App 2004). Shelton 2011:102.

1492 This is the American version of South Africa's 'assault with intent to do grievous bodily harm.'

1493 *Holmes v State* 135 SW 3d 178 (Tex Ct App 2004) at 181. The expert in this case was a detective in the Waco Police Department in the special crimes unit and had received 40 to 50 hours of bloodstain pattern analysis training at a workshop - *Holmes v State* 135 SW 3d 178 (Tex Ct App 2004) at 183.

1494 912 SW 2d 199 (1995).

bloodstain pattern analyst. In this matter, the court applied the Federal Rules of Evidence, Rule 702, and held that, in view of this legislation, the expert, who himself had only 60 hours of bloodstain pattern analysis training, read a book on the subject, and testified that the techniques he employed in his analysis are the same methodology relied upon by analysts across the world, did in fact qualify as an expert.[1495]

In the *Holmes*-case, the court could find no distinguishable differences between the challenged expertise in either the matter before it or the *Alvarado*-case, and similarly held that the court deemed the expert adequately qualified to provide expertise to the court.[1496]

Regarding the reliability challenge, the court found that the evidence was indeed based on scientifically sound underpinning, and ruled it sufficiently reliable.[1497] In its judgment the court contemplated Federal Rules of Evidence, Rule 702,[1498] setting out requirements for evidence to be considered reliable. These prerequisites include valid fundamental scientific theory, valid methodology, and the proper application of such methodology.[1499]

In South Africa, very few reported cases exist regarding the employment of expertise in bloodstain pattern analysis. One such case, *S v Karolia*,[1500] is representative of South African courts' disposition to

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1495 *Alvarado v State* 912 SW 2d 199 (1995) at 215-216.

1496 *Holmes v State* 135 SW 3d 178 (Tex Ct App 2004) at 184-185.

1497 *Holmes v State* 135 SW 3d 178 (Tex Ct App 2004) at 195.

1498 As interpreted in *Kelly v State of Texas* 824 SW 2d 568 (Tex.Crim.App. 1992).

1499 Shelton 2011:102.

1500 2006 (2) SACR 75 (SCA).

accept such evidence without question. In this matter, the accused was convicted of murder, attempted murder and assault with intent to do grievous bodily harm. The court accepted the bloodstain pattern evidence and applauded the opportuneness with which such evidence corroborated the witnesses' version of events.[1501]

5.4 TRACE EVIDENCE

5.4.1 Introduction

There is an emerging view that trace evidence distinguishes forensic science as a discipline for the reason that it comprises the most fundamental material or physical data of an offence.[1502] This type of forensic evidence can assist investigating officials in seeking answers to the 'what' happened query, and to a lesser extent, the question of identity of the participants to the crime ('who').[1503] It has been suggested that trace evidence may be indispensable in the investigative stage of crime resolution due to its aptitude in "…identifying relevant hypotheses and providing investigative leads."[1504]

1501 *S v Karolia* 2006 (2) SACR 75 (SCA) at 82-83.

1502 Ribaux *et al* 2010:10. See also Robertson and Roux 2010:18. An exhaustive examination of the historical development of trace evidence can be perused at para 2.2.4 above.

1503 Robertson and Roux 2010:18, 22; Shelton 2011:67. It has been reported that in the age of DNA analysis, the role of trace evidence in identification has been subdued, but it is still crucial in defining 'what' happened during the criminal event , which is a fundamental enquiry in crime reconstruction - Robertson and Roux 2010:21.

1504 Robertson and Roux 2010:22.

The emergence of DNA profiling as the golden child of scientific proof in criminal trials redirected much of the time, focus and funding for forensic research away from traditional forensic sciences towards DNA technology, prompting many to question the sustained importance of trace evidence analysis.[1505] However, Grieve and Wiggins[1506] maintain that this is a fallacy and that trace evidence still fulfils a vital function in criminal investigation and adjudication.

Robertson and Roux[1507] define the field of trace evidence along two lines, the conceptual as well as the practical delineation. Conceptually, trace evidence can be defined as a microscopic amount of material, frequently too diminutive to actually be measured, as well as being the remaining evidence of a previous occurrence or action of some event or agent.[1508] Practically, and more to the point, trace evidence can be described as:

> …the analysis of materials that, because of their size or texture, transfer from one location to another and persist there for some period of time. Microscopy, either directly, or as an adjunct to another instrument, is involved.[1509]

Any discussion pertaining to trace evidence would be obsolete without reference to the Locard Exchange Principle.[1510] The crux of Edmund Locard's principle that "every contact leaves a trace," establishes in

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1505 Grieve and Wiggins 2001:835.

1506 2001:835.

1507 2010:18.

1508 Robertson and Roux 2010:18.

1509 Robertson and Roux 2010:18.

1510 For a comprehensive discussion regarding the Locard Exchange Principle, please see para 3.3.1 above.

effect the foundation of the discipline of trace evidence analysis. According to Robertson and Roux,[1511] however, it also conceals a more intricate truth regarding the discipline, which is that the trace material that has been exchanged must first be recognised before it can be recovered.

Robertson and Roux[1512] maintain that trace evidence recognition, recording and recovery are the most imperative exercises in accurate and effective trace analysis. It is dangerous practice to collect the 'obvious' evidence from the scene, only to later return to seek additional evidence as the case advances.[1513]

The scene of crime is vital to the potential value and accuracy of trace evidence analysis. The recognition of possible trace evidence on the crime scene, due to its size and transitory nature, is frequently one of the greatest challenges for crime scene analysts.[1514] For this reason, Robertson and Roux[1515] maintain the following:

> …the recovery of trace evidence relies heavily on understanding *how* such traces are transferred and persist and how best to collect what may remain from a contact event. (Own emphasis added)

1511 2010:18.

1512 2010:19.

1513 Robertson and Roux 2010:21. In fact, to underscore this point, Robertson coined the GIFT principle: Get It The First Time. In this regard, Robertson and Roux are critical of the NAS committee's focus on laboratory-based forensic application at the expense of any adequate focus on forensic practices on crime scenes - Robertson and Roux 2010:21. Since the mid-1990's, Australia has had formal accreditation of crime scene examinations and formal certification of crime scene examiners, while much of the rest of the world is only starting to consider such quality assurance in crime scene analysis - Robertson and Roux 2010:21.

1514 Robertson and Roux 2010:18.

1515 2010:18.

5.4.2 Types of trace evidence

Forensic trace evidence is primarily an observational discipline, and the application thereof is thus wholly dependent upon advances in microscopy.[1516] Additional techniques, like chemical and instrumental analyses are also employed under certain circumstances, but always subsequent to microscopic examination.

According to Fisher,[1517] the term 'trace evidence' is generic in nature, referring to any small, frequently microscopic matter, and comprises items such as fibres, hairs, as well as trace amounts of building material, paint, metals, textiles, bondage material, cigarettes, soil, plant material, glass, or any materials of sufficiently small size that have been transferred between the offender, the victim and the crime scene.

Although the realm of trace evidence is immense, only fibre and hair analysis will be discussed for purposes of the present study.

5.4.2.1 Fibre examinations

Fibre analysis carries particular significance due to their pervasive nature and strong indication of personal taste.[1518] Its employment within

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1516 Kiely 2001:95. A brief overview of the history of microscopy can be found in para 2.2.4 above. While the discussion that follows here is not meant to provide the reader with exhaustive knowledge on the sphere of hair and fibre analysis, it does aim to inform to the extent that the reader can better appreciate the foundational science of the disciplines, as well as the value that these type of sciences may have in the criminal justice system.

1517 2000:161, 169-198, 214. See also Owen 2000:174; Wecht and Rago 2006:328.

1518 Grieve and Wiggins 2001:835. The different textiles observable in a person's wardrobe and environment is strongly revealing of that person's preferences and therefore decidedly individual – Grieve and Wiggins 2001:835.

the criminal justice system is only limited by the extent of the analyst's imagination and the availability of forensic means.[1519]

Fibre analysis refers to a microscopic examination of individual fibres in order to observe all the relevant properties of such fibres, to classify the particular fibres into one of two classes, namely natural or synthetic, and to ultimately establish an evidentiary connection between people, as well as between people and a specific environment.[1520]

Both natural and synthetic fibres are employed in the production of a wide assortment of commercial products (available in an even wider range of colours and styles), ranging from clothing, vehicle seat covers, furniture, carpets and many more.[1521] The vast majority of these fibres, as well as the processes that produce the fibres, are patented and accumulated in enormous trademarked databases maintained by the specific manufacturers.[1522]

Natural fibres may be separated into three distinct subcategories, namely animal, vegetable and mineral fibres.[1523] Animal fibres used in commercial manufacture include wool, silk, camel hair and a wide variety of furs.[1524] Cotton, linen, hemp, sisal, and jute represent the

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1519 Grieve and Wiggins 2001:835.

1520 Wecht and Rago 2006:329. All fibres employed in the production of clothing of furnishing are natural, synthetic, or a combination of the two – Owen 2000:178. See also Fisher *et al* 2009:137.

1521 Kiely 2001:104.

1522 Kiely 2001:104.

1523 Kiely 2001:104.

1524 Owen 2000:178; Kiely 2001:104. Amongst the animal fibre class, wool is the most common type within this class – Fisher *et al* 2009:139.

class of vegetable fibres, while mineral fibres involve asbestos, glass wool and fiberglass.[1525]

The identification of synthetic or man-made fibres is greatly simplified by the existence of immense FBI and commercial database collections employed for both investigative and proprietary purposes.[1526] This class of fibres comprise rayon, nylon, polyesters, acrylics and much more.[1527]

Due to its immense propensity for transference, fibres may be recovered from any number of sources on a crime scene, including clothing, footwear, nails, bodies, tools, vehicles, and many others.[1528] As the particular investigation develops, known fibre samples must be collected for comparison with questioned samples later.[1529] Grieve and Wiggins[1530] propose that crime scene technicians, as well as investigating officers, have access to fibre experts in order to compound their ability to assess the quality of colour and probable composition of fibres, as well as the ease with which it can be transferred, which will ultimately allow for the selection of superior target fibres with high evidential value.

1525 Owen 2000:178; Kiely 2001:104.

1526 Kiely 2001:104.

1527 Owen 2000:178; Kiely 2001:104; Fisher *et al* 2009:141-144.

1528 Fisher 2000:161; Fisher *et al* 2009:137. The fibres of unknown origin and composition found on crime scenes are referred to as 'questioned fibres,' while those of known origin with which the questioned samples are compared, are called 'known or representative samples' – Fisher 2000:13.

1529 Grieve and Wiggins 2001:836.

1530 2001:837.

Once the fibre evidence has been recovered from the relevant scene of crime,[1531] it will be prepared for microscopic viewing, as well as instrumental and chemical analysis, and an abundance of data regarding the characteristics of these fibres will be harvested.[1532] The fibres will be identified and, where possible, the polymer subclasses pinpointed.[1533] Following this, the questioned fibres will also be microscopically and optically compared to any available known samples.[1534]

During the process of light microscopy,[1535] the physical features of the individual questioned fibre will be examined, and data pertaining to the fibre's colour, length, diameter, cross-section, or any additional features, will be noted by the examiner.[1536]

Examination of the cross-section of a particular fibre, can, for example, provide the analyst with valuable information regarding the origin of that fibre. Cross-sections exhibiting solid round appearances are most frequently detectable in synthetic fibres due to its inexpensive production rate, while fibres with trilobal cross-sections are generally

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1531 This collection of fibre material usually comprises blotting the area in which the fibre can be found with adhesive tape or applying a vacuum filter to the area. In the laboratory, the fibres will be carefully removed from the tape or filter with forceps and carefully preserved for examination – Wecht and Rago 2006:329. While earlier methods consisted of the removal of all fibres for analysis, contemporary methods, formulated in large part due to financial and manpower constraints, dictate that only certain 'target' fibres be removed for purposes of analysis. In addition, the vacuuming method of collection is burdened with more shortcomings than benefits, and is thus only used in exceptional circumstances – Grieve and Wiggins 2001:837.

1532 Wecht and Rago 2006:329; Fisher *et al* 2009:145.

1533 Grieve and Wiggins 2001:836.

1534 Grieve and Wiggins 2001:836.

1535 This denotes the use of the typical light microscope for visual examination.

1536 Wecht and Rago 2006:329; Fisher *et al* 2009:145.

employed in carpets because of the rigidity and resilience the trilobal structure brings to the fibre.[1537] Other cross-sectional forms include ribbon-like, 4-DG and bowtie appearances, each with their own particular features and functions.[1538]

Optical features of fibres, such as refractive index[1539] and birefringence,[1540] can be determined by chemical analysis.[1541] Instrumental analysis to determine identifying features of fibres are also employed, including visible light spectrophotometry, infrared spectrophotometry, thin-layer chromatography and mass spectrometry.[1542]

It is crucial that all facets of fibre analysis be conducted as accurately as possible, since the correct classification of fibres is essential in establishing its frequency in the fibre population, which, in turn, determines its probative value.[1543]

1537 Fiber Innovation Technology, Inc. *s.a.* http://www.fitfibers.com/cross_sections.htm>. Accessed on 13/12/2012.

1538 Fiber Innovation Technology, Inc. *s.a.* http://www.fitfibers.com/cross_sections.htm>. Accessed on 13/12/2012.

1539 Refraction index refers to the extent to which a ray of light bends as it passes through a medium – Business Dictionary.com 2012. http://m.businessdictionary.com/defintion/refractive-index.html. Accessed on 05/12/2012.

1540 Birefringence is the resolution or splitting of a light wave into two unequally reflected or transmitted waves by an optically anisotropic (having a physical property that has a different value when measured in different directions) medium – The Free Dictionary 2012. http://wwwthefreedictionary.com/_/dict/aspx?word=birefringence. Accessed on 05/12/2012.

1541 Fisher *et al* 2009:146.

1542 Fisher *et al* 2009:147. See also Grieve and Wiggins 2001:840.

1543 Grieve and Wiggins 2001:838.

The more recurrent a particular fibre is deemed to be, the lower the probative value of that fibre. Cotton, for instance, is perhaps the most frequently employed fibre in clothing to the extent that the presence of undyed cotton fibres has practically no evidentiary value at all, while colouring would slightly lower the probability of finding such fibres on unrelated material.[1544] Synthetic fibres typically have higher probative value than natural fibres, while the different subclasses of synthetic fibres vary in their evidential value.[1545]

Fibre evidence finds application in the investigation of a variety of offences. In a case of murder, for instance, the fibres found on the body of the deceased bear witness to the last interaction and contacts of that individual.[1546] Where the identity of the deceased is known, fibres unrelated to the victim or his environment may have been transferred by the offender or from a textile-rich environment that the victim was in contact with during the criminal event.[1547]

Fibre evidence may be immensely effective in the resolution of property crimes. In the North of England specifically, law enforcement have had tremendous success in detecting and prosecuting car thieves by

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1544 Owen 2000:178.

1545 Grieve and Wiggins 2001:837-838. In this regard, even similar fibres may have vastly differing colour combinations and the accurate determination of the exact colouring of a questioned fibre might provide information regarding the manufacturer, which, in turn, can be employed to identify the source of the fibre. In some instances, the fibre colouring might even be linked to a particular dye batch. Once it is established where and how much of the particular batch was sold, the investigating officer will be able to ascertain exactly what clothing was manufactured from the fibres, as well as its point of retail – Grieve and Wiggins 2001:839.

1546 Grieve and Wiggins 2001:835.

1547 Grieve and Wiggins 2001:835.

recovering fibres from their clothing matching the fibres from the interior of the vehicle in question.[1548]

5.4.2.2 Hair examinations

Hair, notable for the ease with which it can be transferred from one organism to the next, are often discovered at crime scenes and may belong to the victim, the perpetrator or even animals associated with either party, thereby creating causal links between parties and between parties and physical environments.[1549]

The construction of hair allows it to maintain its structure intact for a comparably long time. The credit for this sustained endurance belongs to the durable external layer covering the hair shaft, the cuticle, which consists of overlapping scales which point away from the root in the direction of hair growth. These scales, comprising dead cells hardened due to keratin protein secretions, exhibit species-specific patterns.[1550]

Beneath the layer of cuticle cells is the cortex, a regular arrangement of cells extending along the length of the hair, containing the pigmentation particles that allow for distinctive hair colour and affords hair its strength, elasticity and curl.[1551]

1548 Grieve and Wiggins 2001:836.

1549 Fisher *et al* 2009:130; Owen 2000:176. See also National Academy of Sciences 2009:5-22. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1550 Fisher *et al* 2009:131; Owen 2000:176. While the scales' overlapping patterns are specie-specific, they are not individual specific and cannot be employed for purposes of individualisation – Fisher *et al* 2009:131.

1551 Fisher *et al* 2009:131; Owen 2000:176.

The medulla, a series of non-pigmented cells or an air-filled channel in the centre of the hair shaft, may be continuous, interrupted or fragmented, but may also be absent altogether.[1552]

The follicle, deeply buried in the skin, is a cup-shaped organ from which the hair shaft grows and, unlike the shaft, is provided with blood supply which allows the growing hair-shaft to exhibit a record of the person's environment and habits over time.[1553] Within this follicle is the nucleus-containing bulb, which functions by producing cells that would ultimately become the developing hair.[1554]

Hair is not individualising,[1555] nor is all the hair from the same individual of similar structure, particularly if they originate from different parts of the body.[1556] Hairs from the head, eyelashes and eyebrows, for instance, have a circular cross-sectional appearance, while those from the beard are triangular and from the underarms, oval.[1557] For this reason, when hair shaft comparisons are conducted, the widest possible range of comparison samples is taken for analysis.[1558]

Subsequent to its recovery from a crime scene, the unknown hair must first be established to, in fact, be hair. Thereafter, the species it belongs

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1552 Fisher *et al* 2009:131.

1553 Fisher *et al* 2009:131.

1554 Fisher *et al* 2009:131.

1555 This is true of the hair shaft. When the bulb of the root is attached, nuclear DNA can be extracted and individualisation would be possible. Without the bulb, however, the examiner must rely on microscopic morphological examinations.

1556 Fisher *et al* 2009:130; Owen 2000:176.

1557 Owen 2000:176.

1558 Owen 2000:176.

to must be determined based on the cuticle structures.[1559] Once confirmed to be human hair, attempts will be made to identify the area of the body from whence it was shed and then the race of the donor will be considered. This is done by examination of the hair's cross-section, pigmentation patterns, and general appearance.[1560] Assessment of the inner medulla, for instance, may offer significant information regarding the race of the donor of the hair. For instance, hairs of people of traditionally Asian origin[1561] are more likely to possess continuous medullae than people of European origin.[1562]

Morphological examination of the structures of hair, by way of microscopy, can provide significant information to the investigator. The study of hair shafts can provide for speciation, while comparative microscopes are employed in hair comparisons with the purpose of identifying points of similarity.[1563]

Furthermore, and in reference to the ability of hair to exhibit a person's habits,[1564] microscopic hair shaft analysis may indicate the level of colouring or other chemical treatment of the donor's hair. In this manner, the elapsed time since the last bleaching or colouring action

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1559 Houck and Budowle 2002:1; Fisher *et al* 2009:131.

1560 Houck and Budowle 2002:1.

1561 While Owen still refers to "mongoloid" in reference to the old anthropological classification of the Asian people, the immense debate on the antiquated nature of this classification system has warranted the exclusion of such classification from the present study.

1562 Owen 2000:176.

1563 Fisher *et al* 2009:134.

1564 Fisher *et al* 2009:130.

may be garnered from the distance between the root of the hair and the position on the shaft where the colouring ends.[1565]

Once the morphological examinations are completed and its suitability for further microscopic analysis established, the questioned hair is then meticulously compared to known sample hairs.[1566] Such a comparative study may reflect one of three possible results. Firstly, the questioned hair may be found to exhibit the same microscopic features as the known samples, in which case the unknown hair cannot be excluded as coming from the known source.[1567] Secondly, the analyst may aver that no inference may be drawn since both similarities as well as unexplainable differences occur between the known and unknown hairs.[1568] Lastly, the questioned hair can be pronounced to be unrelated to the known hairs and not at all connected to the known reference sample.[1569]

With the coming of age of DNA evidence, there has been some reservation within the forensic science community regarding the enduring purpose of microscopic hair morphology examinations.[1570] However, Houck and Budowle[1571] maintain that this kind of forensic discipline has still much value to contribute to the criminal justice

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1565 Owen 2000:177.

1566 Houck and Budowle 2002:2.

1567 Houck and Budowle 2002:2.

1568 Houck and Budowle 2002:2.

1569 Houck and Budowle 2002:2.

1570 Robertson and Roux 2010:21. See also Grieve and Wiggins 2001:835.

1571 2002:2.

process. The microscopic examination of a large number of questioned hairs harvested from a crime scene can be conducted in a short period of time, with relatively low expenditure and time-consumption.[1572] But perhaps the greatest benefit that morphological hair examinations can provide the criminal investigator, which DNA evidence cannot, is data regarding the criminal event itself. Traces and features of hair can indicate the forceful removal of hair, whether it was burnt, or whether it was crushed by some yet unknown mechanism.[1573]

Shelton[1574] suggests that hair analysis, although no longer tremendously relevant in identity determinations, can have signification value in excluding suspects during the investigative phase of crime resolution.

Apart from its ability to provide answers to the question of 'what' happened, as well as its exclusionary power, hair analysis can, combined with mitochondrial DNA analysis, be of immense value to criminal investigation and prosecution with regards to identity determinations.[1575]

> It is therefore not possible to dispense with the microscopic examination of hairs. Such a situation could only be envisaged if DNA profiling became so simplified that all hairs which were found could be analysed with little effort and with the certainty that the analysis would have evidentiary value.[1576]

1572 Houck and Budowle 2002:2.

1573 Houck and Budowle 2002:2.

1574 2011:68. See also National Academy of Sciences 2009:5-22. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1575 Houck and Budowle 2002:4. While neither hair analysis nor mitochondrial DNA analysis are individualising, they do provide significant proof of identity when employed concurrently – Houck and Budowle 2002:1.

1576 Kiely 2001:73, discussing the statements pertaining to hair analysis made at the *Proceedings of the 12th INTERPOL Forensic Science Symposium* in 1998, held in New York.

5.4.3 Trace evidence in court

In 1984, the Royal Commission of Australia published a report on the conviction of Edward Charles Splatt, a man accused of the murder of an elderly woman in South Australia, and convicted primarily on the presence of trace materials found on his work clothes and matched to that found on the crime scene.[1577] After scrupulous and comprehensive examination of the case, the trial and the discipline of forensic trace analysis, the Commission issued a report[1578] identifying some concerns regarding the recognition, recording and recovery of the evidence in the case, as well as problems with the expertise provided to the court in this instance.[1579]

Significantly, the Commission's report laid down unyielding requirements for testifying scientists and lawyers in cases where scientific evidence is presented to courts in criminal litigation.[1580]

Firstly, the Commission highlighted the testifying scientist's responsibility in clarifying for the judicial decision-maker in unambiguous and well-defined terms, the precise weight and significance which should be attached to the scientific tests and

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1577 Robertson and Roux 2010:19.

1578 *Royal Commission Report Concerning the Conviction of Edward Charles Splatt*, Government Printer, South Australia, 1984.

1579 Robertson and Roux 2010:19.

1580 Robertson and Roux 2010:20.

analyses they employed, as well as the limitations and hazards ascribed to their techniques.[1581]

Moreover, the duty of legal practitioners in leading expertise in court is to put such detailed and probing questions to the experts as are likely to provoke the type of evidence they are under obligation to provide.[1582]

Following the Royal Commission of Australia's illuminating report on trace evidence, another commission of enquiry concerning trace evidence was launched in Canada. Robertson[1583] served on both these investigative commissions and reported on the resemblance of the issues identified by both the Australian and Canadian commissions.

> The common themes in terms of what went wrong are remarkably 'similar'. They include:
>
> - too early a focus on the 'prime suspect' based on an over reliance on preliminary forensic examination of apparently critical recovered trace material
> - charging of a suspect on limited evidence and building the 'case' post charge
> - poor initial control of the crime scene resulting in compromised evidence (often not recognised until much later)
> - 'silo' treatment of individual aspects of the forensic picture
> - over-emphasis on identification (whether of a person or a material) but at the cost of a lack of a criminalistics approach.[1584]

Forensic expertise and training are two additional areas of concern regarding the yielding of reliable microscopic hair analysis.[1585] The NAS

1581 Robertson and Roux 2010:20.

1582 Robertson and Roux 2010:20.

1583 Robertson and Roux 2010:20.

1584 Robertson and Roux 2010:20.

1585 Robertson and Roux 2010:20.

committee confirmed the recommendation that minimal training for hair examiners must include a bachelor's degree in natural or applied science, in-house training and annual proficiency testing,[1586] if hair analysis evidence is to continue resisting challenges in criminal trials.

5.4.3.1 Fibre evidence in court

Fibre evidence is employed in criminal investigations across the globe and its discussion and unimpeded acceptance in judicial decisions have been noted for at least the last few decades.[1587]

One of the earliest and perhaps the best-known fibre evidence cases in the United States of America was decided in 1982, in the case of *Williams v State,*[1588] a trial that emanated from a series of murders of young African-American men in the state of Georgia.[1589] In this case, the accused person was convicted of two of the several murders committed, and condemned to two consecutive life imprisonment sentences, after the prosecution admitted matching fibre evidence in support of the inference that the accused had been in contact with the victims prior to their deaths, and that he was thus responsible for their deaths.[1590] Carpet fibres from the accused person's home, fibres from

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1586 National Academy of Sciences 2009:5-22. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1587 Kiely 2001:114, 125 at fn 41.

1588 *Williams v State*, 251 Ga. 749, 312 S.E. 2d 40 (1984). Kiely calls this the "best-reasoned" fibre case in the United States of America – Kiely 2001:105.

1589 Kiely 2001:105.

1590 *Williams v State*, 251 Ga. 749, 312 S.E. 2d 40 (1984) at 749-750.

his bed linen, as well as hairs from his pet animals were found on all of several murdered young men's bodies.[1591]

On appeal, the appellant alleged *inter alia* that the prosecution had failed to adequately demonstrate the scientific validity and reliability of the techniques employed by the fibre experts, and that, for this reason, the evidence was in fact inadmissible during trial.[1592]

On appeal, the accused alleged that the prosecution had failed to adequately demonstrate the scientific reliability of the fibre analysis techniques employed by die expert witnesses, and that, as a consequence of this, the evidence was, in fact, inadmissible.[1593]

After an immensely meticulous recitation and analysis of the testimony presented by the fibre expert in the case, the Supreme Court of Georgia, in its majority decision, denied the appellant's request for a re-trial and confirmed the trial court's decision to accept the fibre evidence as reliable and admissible.[1594] The Court held that:

> …experts are permitted to give their opinions, based upon their knowledge, including mathematical computations.[1595]

1591 *Williams v State*, 251 Ga. 749, 312 S.E. 2d 40 (1984) at 749; Platt 2003:92-93.

1592 *Williams v State*, 251 Ga. 749, 312 S.E. 2d 40 (1984) at 750.

1593 *Williams v State*, 251 Ga. 749, 312 S.E. 2d 40 (1984). Page number unavailable. Case obtained from http://ga.findacase.com/research/wfrmDocViewer.aspx/xq/fac.19831205_0010.GA.htm/qx. Accessed on 28/11/2012.

1594 *Williams v State*, 251 Ga. 749, 312 S.E. 2d 40 (1984).

1595 *Williams v State*, 251 Ga. 749, 312 S.E. 2d 40 (1984) at 786.

Remarkably, the sole dissent in this matter,[1596] disagreed with the majority court's validation of the scientific reliability and consequent admissibility of trace evidence.[1597]

> My review of the record, however, indicates that the state failed to lay a foundation sufficient to establish that the methodologies its experts used to draw their inferences of significance are scientifically valid. For that reason I would hold that the trial court erred when it allowed the introduction of the fiber evidence.[1598]

Fibre evidence has since been accepted readily in American courts.[1599]

In England and Wales in 2011, fibre evidence was estimated to be admissible in criminal proceedings. In the case of *R v Hall*,[1600] the Criminal Division of the Court of Appeal held that the techniques employed in fibre analysis is of sufficient scientific reliability to justify admission in court.[1601]

From research it would appear that in South Africa too, fibre analysis is readily accepted in criminal trials without substantial challenge.

5.4.3.2 Hair analysis evidence in court

1596 Justice Smith - *Williams v State*, 251 Ga. 749, 312 S.E. 2d 40 (1984) at 810-830.

1597 *Williams v State*, 251 Ga. 749, 312 S.E. 2d 40 (1984) at 821.

1598 *Williams v State*, 251 Ga. 749, 312 S.E. 2d 40 (1984) at 821.

1599 See *People v Miller*, 173 Ill.2d 167, 670 N.E.2d 721 (1996) and *Wogenstahl v Mitchell*, 668 F.3d 307, C.A.6 (Ohio), February 02, 2012 (NO. 07-4285).

1600 [2011] EWCA Crim 4.

1601 *R v Hall* [2011] EWCA Crim 4 at para 15. See also *R v D* (2001) WL 415471.

The microscopic examination and comparison of morphological features of hair has been accepted both in the scientific community, as well as in the legal milieu for decades.[1602]

The court, in *State v West*,[1603] allowed hair analysis evidence as 'generally accepted' evidence. *In casu*, the accused was convicted of several charges pertaining to the murder of a seven year-old boy, and attempted murder of his two year-old sister.[1604] On appeal, the accused claimed, *inter alia*, that the trial court improperly accepted into evidence state expert testimony regarding hair analysis of two hairs found on the scene and the discovery that these hairs were microscopically similar to the accused person's hair.[1605]

The court in this instance rejected the accused person's claim and confirming that the trial court had not inappropriately accepted the hair analysis evidence, since the validity of the techniques underlying microscopic hair analysis has properly been established. Such evidence was thus confirmed to be both admissible and reliable.[1606]

As far as the present research can reveal, no successful challenges to microscopic hair analysis have been made in South African criminal courts.

1602 Houck and Budowle 2002:1.

1603 877 A 2nd 787 (Conn 2005).

1604 *State v West* 877 A 2nd 787 (Conn 2005) at 792.

1605 *State v West* 877 A 2nd 787 (Conn 2005) at 794 and 804.

1606 *State v West* 877 A 2nd 787 (Conn 2005) at 809.

5.5 CONCLUSION

According to Schwikkard and Van der Merwe,[1607] the burden of proof in criminal litigation rests on the state to prove the accused person's guilt beyond reasonable doubt. This includes the obligation of proving the required fault, the commission of the criminal act, the unlawfulness of the act, the absence of grounds of justification, as well as the identity of the perpetrator as being that of the accused, beyond reasonable doubt.

In criminal trials, the judicial decision-maker must have access to all admissible evidence and information submitted during the course of a trial to be able to render a fair and accurate finding.

In *S v Ganda,*[1608] Daffue J[1609] held that the court must approach the assessment of evidence holistically to determine if the prosecution satisfied the heavy burden placed upon it to convict an accused. In *S v Mbuli*[1610] too, the court stipulated that when a judicial tribunal acquits or convicts an accused, that court must be certain of its finding "…upon a consideration of *all the evidence*." [1611]

In assessing all the presented evidence to ascertain whether the onus of proof has been discharged by the prosecution, judicial fact-finders

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1607 2009:560.

1608 (A182/2011) [2012] ZAFSHC 59 (5 April 2012).

1609 *S v Ganda* (A182/2011) [2012] ZAFSHC 59 (5 April 2012) at [4]. In this regard see also: *S v Hadebe and Others* 1998 (1) SACR 422 (SCA) at 426F-H.

1610 2003 (1) SACR 97 (SCA).

1611 *S v Mbuli* 2003 (1) SACR 97 (SCA) at 57. This sentiment was confirmed in *S v Trainor* 2003 (1) SACR 35 (SCA) at [9] by Navsa JA.

are also confronted with the arsenal of scientific evidence that is admitted into trial progressively more often.

Not only must courts decide on the admissibility of this scientific and technical evidence, but must also ascertain the appropriate probative value that must be assigned to those pieces of evidence lawfully admitted.[1612]

In light of the fallibilities and limitations of eyewitness testimony and DNA evidence, the golden standard of evidence in South African criminal litigation, it is crucial that other disciplines of forensic science, especially traditional forensic sciences, be employed in the holistic determination of evidence against an accused. While DNA is decisive in identity determinations (and thus satisfying the 'who' question in criminal investigations), there are, as confirmed by Schwikkard and Van der Merwe,[1613] other elements that the prosecution is obliged to answer. These elements, represented by questions like 'what' happened, and 'how' did it happen, cannot be resolved with the presentation of DNA evidence. And with the elevated burden of proof in criminal courts, the prerequisites of fairness and accuracy surely cannot be satisfied by reliance on eyewitness testimony alone.

Yet, while the traditional forensic science disciplines have been applied to crime resolution for a long time, the advancement of DNA evidence has exposed the potential hazards contained in traditional forensics.[1614]

1612 Meintjes-Van der Walt 2003:88.

1613 2009:560.

1614 Murphy 2007:724.

Subsequent to several DNA exonerations in the United States of America, as well as the publication of the NAS report by the National Academies of Science in America,[1615] it appears that traditional forensic sciences are in utter disarray.

The NAS report reveals several immense problems in the application of forensic science in the United States of America. Some of these include, for instance, existing inconsistencies in forensic science operations on federal, state and local level in the United States of America, including differences in accreditation, instrumentation, funding, as well as the availability of proficient and well-trained personnel.[1616]

But of utmost concern to the NAS committee was the inadequate knowledge base upon which the forensic operations function.[1617] The committee noted that, at the time of the investigation, there were "…fundamental limitations in the capabilities of forensic science disciplines to discern valid information from crime scene evidence."[1618]

Fingerprint evidence, the previous gold standard of proof, also suffered criticism in the NAS report, but perhaps its greatest fall from grace came in the form of a judgment in *State of Maryland v. Bryan Rose*,[1619]

1615 National Academy of Sciences 2009:S4. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1616 National Academy of Sciences 2009:S4. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1617 National Academy of Sciences 2009:S11. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011. See also Pardo 2010:367.

1618 National Academy of Sciences 2009:S11. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1619 *State of Maryland v Bryan Rose* (2007) In the Circuit Court for Baltimore County. Case No. K06-545.

in which fingerprint evidence was historically excluded as being "unreliable" and subjective evidence.

It remains to be seen what this watershed case will bring to criminal litigation in the United States of America. Similarly, its consequences on local criminal proceedings, though not felt yet, might bring comparable challenges to a forensic discipline tried and trusted in South African courts.

The NAS report justifiably laments the deficient knowledge base of particularly the traditional forensic sciences.[1620] If forensic and legal communities are to engage in strengthening the scientific foundations of traditional forensic sciences, and formulate effective standards for determinations of validity and reliability of these sciences respectively, then both these communities must dive into investigations of what these 'sciences' are and what, if anything, they can contribute to criminal justice systems.

The Royal Commission's enquiry, reported upon by Robertson and Roux,[1621] made interesting and potentially valid comments regarding requirements for testifying scientists and lawyers in cases where scientific evidence is presented to courts in criminal litigation. Firstly, the testifying scientist should clarify for the judicial decision-maker in clear terms, the precise weight and significance which should be attached to the scientific tests and analyses they employed, as well as the

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1620 National Academy of Sciences 2009:5-1. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1621 Robertson and Roux 2010:20.

limitations and hazards ascribed to their techniques.[1622] Secondly, legal practitioners, when leading expertise in court, should put questions in such detail that experts are likely to provide the type of evidence they are under obligation to provide.[1623]

This underlines an important point: that while the forensic community is engaged in advancing the foundational knowledge base of traditional forensic sciences, the police and legal fraternity should adjust to the progress in forensic science by improving their own knowledge on the subject. Traditional forensic science can only serve the criminal justice system where it is wisely applied.

1622 Robertson and Roux 2010:20.

1623 Robertson and Roux 2010:20.

CHAPTER 6

DECISION-MAKING IN THE CRIMINAL JUSTICE SYSTEM PERTAINING TO FORENSIC SCIENCE

6.1 INTRODUCTION

Science and law, as collaborators in the ancient birth of Western civilisation,[1624] also share some resemblance pertaining to their institutions, practices and dogmas.[1625] Nevertheless, while this association remains authentic, an uneasy relationship has formed between science and law in the contemporary use of forensic science in legal proceedings, with the two disciplines "…locked in a love-hate relationship."[1626] Though forensic science makes indispensable contributions to crime investigation and prosecution, it has likewise been shown that over-reliance on ostensibly trustworthy scientific evidence can result in grave miscarriages of justice.[1627]

> …scientific methods have been used in the administration of justice since a very long time, but the problem was usually conceived as concerning only the practical use of expert witnesses or experts as advisors of the court, without paying special attention to the quality and the reliability of the evidence obtained by means of scientific or technical methods.[1628]

1624 Wecht and Rago 2006:3. In this regard, see Chapter 2 for a comprehensive discussion on the historical development and partnership of law and science.

1625 Roberts 1994:469.

1626 Roberts 1994:469. See also National Academy of Sciences 2009:3-1. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1627 Roberts 1994:469. See also Meintjes-Van der Walt 2000c:58.

1628 Taruffo 2011:VIII.

Serres and Latour[1629] suggest that law has lost its dominion over science since the latter has been elevated to a position of supremacy, relishing all the power, knowledge and rationality. They persist that the degeneration of some facets of modern civilisation, including religion and law, can be impugned to:

> …the whole set of relationships between the law and science. We must reinvent the place of these relations…so that lawyers can invent a new system of laws, and perhaps scientists a new science.[1630]

While this seems to encourage the self-elevation of law to once more mandate accountability from science,[1631] the twenty-first century arrived with a host of legal scholars advocating the obligation upon those practicing law to encumber themselves with the inconvenience of understanding science.[1632]

In the United States of America, Dobbin *et al*[1633] discovered that presiding officers, the "gate-keepers" of scientific evidence according to the *Daubert* formulation,[1634] are deficient of a legitimate understanding of science, finding:

1629 1990:86-87.

1630 Serres and Latour 1990:137. See also the discussion in Caudill 2011:11.

1631 Caudill 2011:11.

1632 See in this regard Pyrek 2007:230-233; National Academy of Sciences 2009:8-13-15. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011; Caudill 2011:11; Imwinkelried 2011:8; Lee 2011:31.

1633 2002:247. In their research Dobbin *et al* employed the *Daubert*-test for valid scientific knowledge as point of reference for judges' grasp of the subject – Dobbin *et al* 2002:247. See also the discussion in Caudill 2011:45.

1634 *Daubert v Merrel Dow Pharmaceuticals, Inc.* (1993) 509 U.S. 579 at 593-594.

> …that judges lacked the general scientific literacy required for full application of the *Daubert* guidelines… Indeed, many judges did not recognize their lack of understanding.[1635]

Caudill[1636] implies that within the sphere of law there has been much idealisation of science, being considered a stabilising force on which law and its practitioners can depend. But this picture of science as a "disinterested arbiter of legal controversies," is mistaken, as science revolves upon hypothesis, data, procedure, and inference.[1637]

In light of this lacking appreciation of the intricacies of science, the unavoidable over-reliance on scientific techniques to resolve disputes, and all that have been discussed so far, one is wary to predict the future of forensic science and law of evidence and the alliance between the two.

Allen[1638] prefers to focus his predictions regarding the future of this alliance solely on law of evidence, maintaining that this is an endorsement of the stability of the future of forensic science.

> …forensic scientists of the world are quite clear what their future is, and they are right to pursue it. Their future is to continue the incredible explosion of scientific knowledge that has occurred in particular over the last century and to domesticate that knowledge so that it can be used to advance the primary objective of any sane legal system, which is to *facilitate the accurate resolution of disputes.*[1639] (Own emphasis)

1635 Dobbin *et al* 2002:247.

1636 2011:46.

1637 Caudill 2011:46.

1638 2011:I.

1639 Allen 2011:I.

This declaration of the principle importance of accuracy in dispute resolution as primary objective of legal systems is certainly not a common one, since the protection of rights and the enforcement of obligations are typically believed to be its main purpose.[1640]

Yet Allen[1641] stresses fervidly that:

> ...acts are prior to and determinative of rights and obligations. Without accurate fact finding, rights and obligations are meaningless… Neither rights or obligations, on the one hand, or policy choices on the other, can be pursued in the absence of knowledge of the actual, relevant states of affairs.

In South African evidence scholarship, Schwikkard and Van der Merwe[1642] echo this sentiment by declaring that courts have an obligation to make findings regarding the "…existence or non-existence of certain facts before pronouncing on the rights, duties and liabilities of the parties engaged in a dispute."

Moreover, Joubert[1643] concedes that the objective of criminal trials is to determine the accuracy of the allegations put before the court by the two parties before it.

Forensic science's authentic pursuit of the truth is held to be the paragon of what legal scholars and practitioners should endeavour to

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1640 Allen 2011:I. Yet the Centre of Crime and Justice Studies in the United Kingdom define the purpose of a criminal justice system as the deliverance of justice for all, "…by convicting and punishing the guilty and helping them to stop offending, while protecting the innocent" – Centre of Crime and Justice Studies 2012. http://www.crimandjustice.org.uk/opus548.html. Accessed on 22/12/2012.

1641 Allen 2011:I.

1642 2009:1. See in this regard also Meintjes-Van der Walt 2000c:58.

1643 2010:335.

achieve.[1644] Like forensic science, attaining truth should thus be the prevailing principle of evidence law and evidence scholarship.[1645]

Evidence law must, however, also contemplate several other, often conflicting, interests concurrently.[1646] Thus, when constructing a generic set of rules of evidence, a plethora of issues must be considered, the most important of which is the pursuit of factual accuracy.[1647]

It is typically assumed that processes of logical reasoning, founded upon intrinsic epistemological[1648] capabilities, is sufficient to achieve factual accuracy in legal disputes.[1649]

Yet circumstances may exist in which logical reasoning alone fails to exclude errors in fact-seeking.[1650] Moreover, significant doubt exists regarding the critical competence of judicial decision-makers lacking scientific understanding.[1651] Indeed, in the absence of expert guidance, judicial fact-finders are subject to their own "stock of knowledge," which is an unclear accumulation of beliefs comprising information, memories,

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1644 Allen 2011:I-II.

1645 Allen 2011:II.

1646 Allen 2011:II-III.

1647 Allen 2011:III.

1648 This pertains to epistemology, which denotes a branch of philosophy that studies the nature of knowledge, its presuppositions and foundations, as well as its extent and validity – The Free Dictionary 2012. http://www.thefreedictionary.com/_/dict.aspx?word=epistemological. Accessed on 22/12/2012.

1649 Allen 2011:III.

1650 Allen 2011:III.

1651 Imwinkelried 2011:8.

paradigms, impressions, myth, prejudices and more, all of which obscures the separation of fact from value and fiction.[1652]

According to Allen,[1653] this ambiguity justifies the formulation of so-called exclusionary rules[1654] and other rules of evidence employed in accusatorial trials. While many countries still follow a philosophical approach of "free proof" in criminal proceedings allowing the judicial decision-maker to consider any relevant evidence,[1655] others, most notably those countries engaged in the common law tradition, have developed these exclusionary rules restricting the admission of relevant evidence.[1656]

However, Allen[1657] holds the view that rules designed to protect the decision-maker in criminal proceedings from reaching a particular decision should be regarded with some apprehension, since the justification for such a rule is nothing but the expectation of irrationality.

> But why would the rule makers be systematically more rational than the people who decide cases? This is why the emphasis in my country on keeping evidence from a jury in order not to prejudice the jurors is so

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1652 Taruffo 2011:IX.

1653 Allen 2011:III.

1654 Allen 2011:III. Exclusionary rules are legal rules prohibiting certain types of evidence from being used in court proceedings – Merriam-Webster Dictionary 2012. http://www.merriam-webster.com/dictionary/esxclusionary%20rule. Accessed on 22/12/2012.

1655 Countries that follow the free system of evidence typically belong to the Continental, or civil law order of evidence, based upon inquisitorial principles – Schwikkard and Van der Merwe 2009:6.

1656 Imwinkelried 2011:8. Examples of these exclusionary rules also employed in the South African context are the rules prohibiting the admission of hearsay evidence, unconstitutionally obtained evidence and character evidence – Imwinkelried 2011:8; Schwikkard and Van der Merwe 2009:60, 182-186, 269. See also Meintjes-Van der Walt 2001a:226-227.

1657 2011: V.

> fundamentally misguided, and also why, thankfully, in reality it does not occur very much.[1658]

Despite the abolition of trial by jury in South Africa, the essence of the English law of evidence that has been rooted here, endures. This confirms the school of thought that another factor accountable for the origin and persistence of many of the exclusionary rules is the adversarial system of procedure itself.[1659]

In turn, Damaška[1660] makes thought-provoking statements regarding the nature of free systems of proof, but seems to focus less on admissibility rules and more on probative determinations. He argues that a system of free proof also follows where there are no regulations forcing probative value onto a certain amount or quality of evidence, and where there are no provisions dictating that greater evidential weight must be attached to direct than to circumstantial evidence.[1661] Exclusionary rules, while diminishing the volume of available evidence, has no bearing on the decision-maker's assessment of information allowed into evidence.[1662]

With regards to scientific evidence, common law countries have cultivated tests to ascertain which scientific testimony should be submitted to the judicial decision-maker.[1663] While these tests ideally serve to ensure the reliability and scientific integrity of the techniques

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1658 Allen 2011:V.

1659 Meintjes-Van der Walt 2001a:226.

1660 1997:17.

1661 Damaška 1997:17.

1662 Damaška 1997:17.

1663 Imwinkelried 2011:8.

used, they have historically served as “proxies” or substitutes for validity.[1664] The general acceptance test formulated in the case of *Frye v United States*[1665] in 1923, serves as the best-known example of such a proxy.[1666]

Imwinkelried[1667] deliberates upon the possible rationalisations for using proxies. Under *Frye*,[1668] courts are at ease leaving considerations of validity to experts to serve as a type of “technical jury”, since they are in the best position to assess the merits of scientific theory and methodology.[1669]

Unsurprisingly, Imwinkelried[1670] also suggests that the parties to the adversarial proceedings, including the presiding officer, lack the scientific education and training to undertake and decide legal contests, obliging the court to employ indirect proxies. In an era of escalating academic and professional specialisation, courts are placated by the use of proxies, since legal practitioners and judicial fact-finders are more comfortable dealing with these legal formulations than the science.[1671] This has allowed presiding officers and lawyers alike to

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1664 Imwinkelried 2011:8; Black *et al* 1994:731.

1665 (1923) 54 App. D.C. 46, 293 F. 1013, 34 A.L.R. 145.

1666 Imwinkelried 2011:8-9. See para 2.3.3 above for a considered discussion on the historical development of the *Frye*-standards, as well as other tests for admissibility in the United States of America.

1667 2011:9-10.

1668 In reference to the general acceptance test framed in *Frye v United States* (1923) 54 App. D.C. 46, 293 F. 1013, 34 A.L.R. 145.

1669 Imwinkelried 2011:9.

1670 Imwinkelried 2011:10.

1671 Imwinkelried 2011:10.

escape the encumbrance of having to become acquainted with science and scientific principles.[1672]

Due to this excessive dependence on scientific experts' views, as well as the elevated status that science sometimes inhabit in criminal litigation,[1673] judges and juries often defer ultimate issue decisions to their judgments.[1674] But Godden and Walton[1675] criticise this practice, stating that this is akin to allowing trials to be decided by experts, rather than by courts, which, if multiple experts express conflicting opinions, would create a "battle of the experts" which judicial fact-finders are incapable of adjudicating. This, together with an alarming escalation in the volume of "junk science" appearing in courts, necessitates the regulation of expert knowledge in court.[1676]

In 1993, the court in *Daubert v Merrell Dow Pharmaceuticals, Inc*.[1677] formulated novel standards to apply to considerations of scientific admissibility. It both abandoned the *Frye* proxy and articulated a new validation test, thereby heralding a new age in which judges no longer enjoy the indulgence of relying on proxies, and where they are

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1672 Imwinkelried 2011:10. Which might account for why *Frye* is still applicable in so many states. The *Daubert*-test has been adopted in only 32 American states, with the *Frye*-standard still being applied in many of the remaining states – Ambrogi 2011. http://www.ims-expertservices.com/blog/2011/two-more-states-adopt-daubert-bringing-total-to-32>. Accessed on 22/12/2012.

1673 Serres and Latour 1990:86-87.

1674 Godden and Walton 2006:264.

1675 2006:264.

1676 Godden and Walton 2006:264.

1677 (1993) 509 U.S. 579.

compelled to conduct assessments of proffered scientific evidence to evaluate admissibility.[1678]

Judges in all jurisdictions under investigation are now the decision-makers in law, and in a different context, in science.

6.1.1 Decision-making regarding admissibility *versus* probative value in Anglo-American and Continental legal systems

The influence of the *Daubert*-standard employed in admissibility deliberations in the United States of America has started to extend to courts across Europe, where the Continental legal system is said to exhibit inadequately developed admissibility tests and poorly defined differential lines of assessment of both admissibility and probative value.[1679] According to Vuille,[1680] this position has resulted from the procedural custom in inquisitorial systems, where the obligation upon judicial decision-makers to provide reasons for their decisions[1681] is considered sufficient precaution against irrelevant and unreliable evidence.

From the Continental perspective, Damaška[1682] offers a purposeful reflection on the common law tradition of evidence and its most

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1678 Imwinkelried 2011:13-14.

1679 Vuille 2011:41-42.

1680 2011:42. See also Damaška 1997:22.

1681 This is in contrast to jury systems in the adversarial system, where conviction or acquittal is pronounced without the duty to give reasons for their decisions, rendering themselves invulnerable to challenge for erroneous evidence assessment - Damaška 1997:17.

1682 1997:8.

distinctive characteristics. Firstly, and in agreement with Vuille,[1683] the volume, level of organisation and technicality of evidentiary regulation in the Anglo-American countries greatly outweigh that of the Continental countries.[1684]

Secondly, Damaška[1685] notes the Anglo-American tradition's insistence on filtering the evidence that the judicial decision-maker ultimately observes, in other words, establishing the admissibility and inadmissibility of evidence, and astutely refers to this trait as "the prophylactic orientation" to fact-finding.

The English law of evidence, which forms the basis of the South African law of evidence, is primarily concerned with the issue of admissibility, and as such, eliminates much evidence at the start of criminal proceedings in order to avoid misinforming the judicial fact-finders.[1686] The Continental system, on the other hand, focuses on probative value and disallows very little information into evidence.[1687]

Thus, while Anglo-American systems are preoccupied with relevance determinations when considering admissibility, Continental systems

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1683 2011:42.

1684 Damaška 1997:8. It is interesting to note that Damaška considers the difference in the volume of evidentiary regulations between the two systems as being grossly overstated in the view of the fact that Anglo-American judicial precedent is binding, while not so in the Continental system. If it had been, the volume of evidential regulation in the latter system would have been greatly amplified - Damaška 1997:8-10.

1685 1997:8, 12.

1686 Meintjes-Van der Walt 2001a:227.

1687 Meintjes-Van der Walt 2001a:227.

deliberate upon relevance as a factor of probative weight of the evidence.[1688]

The third distinctive feature of common law legal systems then, is the structuring of evidence analysis.[1689] While the common law, or Anglo-American legal traditions, enjoy some 'freedom of proof,' it represents not *per se* the absence of admissibility rules, but the lack of rules prescribing how or when probative weight must be attached to evidence.[1690]

> …the common law appears to celebrate the freedom of the fact finder to evaluate the weight of evidence and to reason from it.[1691]

But Damaška[1692] warns that this "appearance" of free evaluation lacks normative status in common law countries since these jurisdictions, in reality, function upon several doctrines with the specific objective of influencing decision-making by lay fact-finders. In turn, the Continental system enjoyed a radically free system of proof in which the decision-maker was liberated from any binding legal rules concerning the assessment of evidence.[1693]

While there are legal instruments in the Continental systems employed to confirm the reliability of evidence, they are viewed with

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1688 Damaška 1997:55. See also Meintjes-Van der Walt 2001a:228.

1689 Damaška 1997:8, 17.

1690 Damaška 1997:17.

1691 Damaška 1997:17.

1692 1997:17-19.

1693 Damaška 1997:21.

circumspection.[1694] It then follows that the arsenal of Anglo-American regulations prescribing to the judicial decision-maker how to evaluate evidence has been rejected as unsuitable by the Continental tradition.[1695]

If this is indeed the case, what would be the rationale behind Vuille's[1696] assertion that American rules of evidence admissibility have begun extending their influence in courts across Europe?

In the Continental criminal justice system, forensic evidence is still thought to be decidedly reliable, with exceedingly low error rates.[1697] To avoid prejudice to the accused, it is essential that forensic evidence be presented in a fair manner.[1698] Yet, the truly equal nature of the Continental principle of 'equality of arms'[1699] is subtly being questioned in light of the fact that forensic investigations, analyses in forensic laboratories and interpretation of analysis results are primarily conducted by police experts employed by the state, and therefore provide services to the prosecution.[1700] And while defence experts may be appointed to represent the interests of the accused, no regulatory

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1694 Damaška 1997:22. Perhaps the most commonly used instrument is appellate review of judicial decisions, although these are described as rather a source of justification of the trial court's judgment rather than a source of guidelines to be followed - Damaška 1997:23. This is one of the aspects that are so important in this system that judges provide written reasons for their decisions - Damaška 1997:22.

1695 Damaška 1997:24.

1696 2011:41.

1697 Vuille 2011:42.

1698 Vuille 2011:42.

1699 This principle demands that equality exists between the parties to a trial, implying that each must have a reasonable opportunity to have access to information and present its case, and the two sides' scientific experts must be given equivalent status – Vuille 2011:42.

1700 Vuille 2011:43.

provisions exist to guide courts in the assessment of contrasting scientific views.[1701]

In view of these problems, many countries on the Continent have warmed to the idea of evidence assessment criteria to equalise the outcomes of evidence evaluation throughout Europe.[1702]

Additionally, it may be argued that, in light of the increased complexity and relevance of scientific evidence in criminal proceedings,[1703] the historical rationale for free system of proof[1704] is no longer applicable. In accordance with these systems, classically associated with the inquisitorial trials, the judicial decision-maker is burdened, not with the task of determining admissibility, but rather with the more complicated task of establishing probative weight.[1705]

It then stands to reason, that while professional judges have thus far been comfortable assessing evidence in the absence of evidentiary regulations, those same judges may be less inclined to make similar assessments regarding increasingly complicated and substantial scientific evidence, which could eventually result in the formulation of some evidentiary rules.

1701 Vuille 2011:42-43.

1702 Vuille 2011:43.

1703 See in this regard Meintjes-Van der Walt 2003:89; 2003a:352; 2000c:58; 2006a:276.

1704 The free system of evidence in inquisitorial trials typically developed in countries where little to no lay adjudicators generally participated in judicial fact-finding and it was thus considered unnecessary to impede professional judges with artificial exclusionary rules or rules of evidence admissibility – Schwikkard and Van der Merwe 2009:11-12.

1705 Schwikkard and Van der Merwe 2009:11-12.

In common law systems of evidence admissibility is a significant concern and a question of law, while probative weight of evidence is a question of fact.[1706] Schwikkard and Van der Merwe[1707] describe the typical approach in Anglo-American countries:

> …the Anglo-American approach is to make admissibility dependent upon the potential weight of the evidence.

Ultimately, in the Anglo-American system of evidence, as it is practiced in South Africa, the processes of proving facts and judicial decision-making in criminal trials are regulated by the law of evidence.[1708] In order to evaluate the decision-makers and decision-making paradigms pertaining to forensic science within the larger criminal justice system, that is, including criminal investigations, a meticulous understanding of the current rules of evidence is necessitated.

6.2 FORENSIC SCIENCE AND DECISION-MAKING PERSPECTIVES OF POLICE INVESTIGATORS AND LEGAL PRACTITIONERS

6.2.1 Introduction

> All role-players in the criminal justice process should have an understanding of what qualifies as scientific knowledge.[1709]

1706 Schwikkard and Van der Merwe 2009:12.

1707 2009:12.

1708 Schwikkard and Van der Merwe 2009:1.

1709 Meintjes-Van der Walt 2003:91.

In criminal investigations, typically, the prosecution constructs a case to which the accused and his defence must respond.[1710] This creates three levels of pre-trial decision-making pertaining to the employment of science in crime resolution. These include, decision-making by investigating police during the investigation itself, by the prosecutor in preparing and presenting the case at trial, and finally, the defence counsel in employing forensic science in answering the case against the accused.

From the beginning of the investigation several stages of decision-making have to be confronted that will ultimately affect the outcome of the case at litigation.[1711] These stages include the decision whether scientific support will be employed,[1712] finding an appropriate expert,[1713] submission of forensic exhibits to a forensic laboratory for analysis, providing the experts with instructions, performing scientific analysis and writing reports on the results, determining pre-trial influences of the accused person's legal practitioners and, if available, scientific specialists, and pre-trial conferences.[1714]

Each of these stages is inundated with decision-making prerogatives and obligations of the investigating officers, forensic scientists,

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1710 Roberts 1994:471.

1711 Roberts 1994:471; Meintjes-Van der Walt 2000b:348-349.

1712 In South Africa, this step can be performed by the prosecutor (for instance, by activating DNA analysis) or by investigating officers or crime scene analysts – Omar 2008:31.

1713 In South Africa, experts in many of the forensic disciplines are located within the Criminal Record and Forensic Science Service (CRFSS) – Omar 2008:29. It is thus unnecessary to recruit specialists from outside the government service of the South African Police Service. However, if special expertise is deemed necessary, the police, and even members of the CRFSS itself, have approached experts at tertiary institutions, for example, for assistance.

1714 Roberts 1994:471; Meintjes-Van der Walt 2000b:349.

prosecutors and legal representatives.[1715] These pre-trial procedures are vital to the ultimate admissibility, reliability and probative value of the forensic evidence.[1716] It is therefore vital that these role-players, like judicial decision-makers, immerse themselves in understanding the foundations and dangers of forensic science.

6.2.2 Forensic science in police investigation

Members of the police are responsible for decisions regarding which items to collect, preserve and submit to the forensic laboratory for analysis.[1717] Omar[1718] laments the fact that the full resources of the South African Police Service are not always available for every crime scene, which results in loss or deterioration of some potential pieces of evidence.

> The critical duty of the investigator in charge is to ensure that the most valuable evidence is collected, so that good forensic reconstruction is possible.[1719]

The importance of police officials in evidence collection has been recognised by the South African legislature, in the drafting of the new 'DNA Bill.'[1720] While the Bill will expedite the creation and expansion of a

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1715 Roberts 1994:471.

1716 Meintjes-Van der Walt 2000b:349.

1717 Meintjes-Van der Walt 2000b:351 regarding the England and Wales, as well as the South African position. Horvath and Meesig 1996:964-966.

1718 2009:66.

1719 Omar 2009:66.

1720 The 'DNA Bill,' or the Criminal Law (Forensic Procedures) Amendment Bill B2-2009, was drafted and adopted by the South African Cabinet in December 2008. The Bill is anticipated to facilitate the amplification of the National DNA Database to the extent that it can properly assist the police in detecting more crimes and matching more suspects to crime scenes, to identify unknown perpetrators, exonerate innocent accused persons and identify missing

DNA database, the only effective manner in which the National DNA Database of South Africa (NDDSA) can be moulded into efficacy is by optimising the quality and quantity of DNA samples that are submitted to forensic laboratories for DNA profiling.[1721] Despite the fact that this proposed legislation has not yet been enacted, training programmes to enhance the general awareness of the science of DNA profiling, as well as specific issues regarding the detection, collection and preservation of DNA-containing material from crime scenes, have already been launched.[1722]

Lynch and Hancock[1723] propose that, in order to minimise the volume of cases in which the scientific evidence has been jeopardised, first responders on crime scenes must be thoroughly trained in identifying, collecting and preserving DNA evidence.[1724] Additionally, legal practitioners must also be educated in the scientific foundations of DNA technology to enable them to adequately represent their cases.[1725]

Of course, this represents largely an ideal situation. Research conducted by Horvath and Meesig[1726] in the United States of America, revealed that of all the crimes investigated by detectives, including

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persons or unidentified human remains – Lynch and Hancock 2009:42. See para 4.4.3.6 above for a discussion on DNA databases in the different countries under investigation.

1721 Lynch and Hancock 2009:43.

1722 Lynch and Hancock 2009:43-44.

1723 2009:47.

1724 Although it is submitted here that this is true of all forensic science disciplines. Proper collection and preservation of all scientific samples from scenes of offences must be a priority.

1725 Lynch and Hancock 2009:47.

1726 1996:963.

cases that result in convictions, the vast majority do not involve physical evidence.[1727] Even where scientific analysis is involved, it does not appear to significantly influence the outcomes of cases to the extent that was previously believed.[1728]

However, Horvath and Meesig[1729] suggest, and one is hard-pressed to disagree, that this state of affairs does not represent any failings on the side of forensic science, but rather the manner of practice and limitations of police investigations.

> …investigators and judicial personnel who are not familiar with the potential value of scientific evidence are less likely to use it effectively in their work.[1730]

The true value of physical evidence relies upon the detective's ability to interpret it, to realise its potential application and possible meaning.[1731] Without such ability, scientific evidence would be dead to a criminal investigation.[1732]

6.2.3 Prosecutorial decision-making and the influence of defence counsel

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1727 Most investigators were found to prefer relying on traditional modes of case resolution, such as admissions and confessions – Horvath and Meesig 1996:964.

1728 Horvath and Meesig 1996:963.

1729 1996:968.

1730 Horvath and Meesig 1996:968.

1731 Horvath and Meesig 1996:964.

1732 Horvath and Meesig 1996:964.

Saks[1733] reports that immense changes in laws of evidence regulating the admissibility of expert evidence, as well as mounting public concern regarding the disconcerting incidence of wrongful convictions, have inescapably altered the duties of both prosecutors and legal representatives pertaining to expert evidence.

Before a case appears in court for litigation purposes, the prosecutor dealing with the case docket must ensure that adequate and valid evidence has been generated throughout the different stages of the investigation to prove all the elements against the accused.[1734]

In South Africa, the prosecutors in the National Prosecuting Authority (NPA) participate in so-called 'prosecutor-guided investigations.'[1735] This arrangement allows for a conference between prosecutors and investigating detectives early in the investigative process, during which time the investigation is structured in a manner that would allow for as little court postponements as possible, that would ultimately ensure the inclusion of all necessary evidence in the case docket, and also improve the important relationship between prosecutors and the police.[1736] It would arguably be impossible for prosecutors to guide and advise investigating officers in matters pertaining to forensic evidence if they themselves do not have some proficiency on the subject.

1733 2001:436-437.

1734 Roberts 1994:471; Meintjes-Van der Walt 2000b:348-349. See also Saks 2001:425.

1735 National Prosecuting Authority s.a.(c):19.

1736 National Prosecuting Authority s.a.(c):19-20.

Prosecutors in the United States of America, England and Wales, as well as in South Africa, enjoy wide discretion in deciding to institute prosecutions on behalf of the state.[1737] In finally assessing which dockets are 'trial-ready,' prosecutors must remain cognisant of the fact that they are under obligation to prosecute if there is a *prima facie* case against the accused and no valid reason to abandon the prosecution.[1738]

> In this context *'prima facie* case*'* would mean the following: The allegations, as supported by statements and real and documentary evidence available to the prosecution, are of such a nature that if proved in a court of law by the prosecution on the basis of admissible evidence, the court should convict.[1739]

The reference to 'admissible evidence' in this description suggests that prosecutors are at least required to make some preliminary value judgment on the level of admissibility of the evidence that is to be offered to court. It stands to reason that this necessarily entails an estimation of the reliability of the evidence and underlying science of the evidence.

Saks[1740] maintains that if legal practitioners recognise expert evidence in a case to be invalid or even falsified, they are under obligation to keep such evidence from entering the court. In a manner similar to

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1737 Bekker *et al* 2009:69; Crown Prosecution Service s.p. http://www.cps.gov.uk/legal/s_to_u/statutory_duties_and_powers_/. Accessed on 31/12/2012; American Bar Association 2013. http://www.americanbar.org/publications/criminal_justice_section_archive/crimjust_standards_pfunc_blk.html. Accessed on 05/01/2013.

1738 Bekker *et al* 2009:69.

1739 Bekker *et al* 2009:69.

1740 2001:425.

prosecutors' pre-trial determinations of eyewitness credibility,[1741] a prosecutor is also responsible for establishing that the specialist actually possesses the skill and qualification to meet the criteria for expert witnesses, as well as to ensure that the materials upon which the expert worked, if any, complies with the rules of authentication.[1742]

In conducting research on the extent to which legal practitioners must ensure that only valid science is presented in court, Saks[1743] suggests that while legal practitioners might consider themselves shielded from the responsibility of testing science, this is not necessarily the case. There is no reason why lawyers intending to offer expert evidence during trial cannot take the time to research the science involved and themselves ascertain the strength of the scientific foundation and the logic from which the expert drew his conclusions.[1744]

> It is hard to think of principled reasons why an attorney should not be obligated to acquire a good faith basis for believing either that the proffered expertise is valid or that the specific facts or skills brought to bear on the task-at-hand in the trial are valid as a precondition for ethically offering such expert evidence to a court.[1745]

Prosecutors in the United States of America are under obligation to investigate criminal activity if the primary investigating agencies, that is, the police and other investigating bodies, fail to adequately perform

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1741 That is, establishing whether the witness knows the accused or was in a position to properly observe the accused in the criminal event and is thus capable of reliably identifying the accused.

1742 Saks 2001:426.

1743 2001:426-427.

1744 Saks 2001:426.

1745 Saks 2001:426.

investigations.[1746] Moreover, prosecutors in America are pertinently forbidden from offering the courts any false, inadmissible or any other evidence not permitted for any reason.[1747] Both the investigation of crime and the screening of evidence, including scientific evidence, for admissibility require some knowledge and understanding of the foundations of forensic science.

With the high burden of proof the prosecution has to satisfy, it is essential that prosecutors have sufficient proficiency in matters of science to effectively present, cross-examine and argue on issues pertaining to expert evidence.[1748] Meintjes-Van der Walt[1749] submits that the primary function of prosecutors, namely to assist the court in reaching a just verdict, demands familiarity with forensic science:

> …potential problems inherent in the use of expert evidence for the prosecution of crime can be far-reaching and of paramount importance to the primary function of the prosecuting authority to institute criminal justice proceedings on behalf of the State.[1750]

1746 American Bar Association 2013. http://www.americanbar.org/publications/criminal_justice_section_archive/crimjust_standards_pfunc_blk.html. Accessed on 05/01/2013. These rules are a product of the formulated standards that are intended to guide the ethical conduct of prosecutors in the United States of America.

1747 American Bar Association 2013. http://www.americanbar.org/publications/criminal_justice_section_archive/crimjust_standards_pfunc_blk.html. Accessed on 05/01/2013.

1748 Meintjes-Van der Walt 2006a:277. It would appear that the National Prosecuting Authority (NPA) is well aware of its responsibility to familiarise its prosecutors with forensic science. In the early twentieth century, the NPA approached Professor Lirieka Meintjes-Van der Walt at the South African Unit for Expert Evidence and Forensic Skills, based in the Faculty of Law at Rhodes University in Grahamstown, with the request to engage in collaborative research on forensic science. The research report, entitled *Science for Prosecutors*, was published in 2005. While it was not intended to be a training manual for prosecutors, it is hoped that this would inform prosecutors to the extent that they would become informed users of forensic science – Meintjes-Van der Walt 2006a:277.

1749 2006a:278.

1750 Meintjes-Van der Walt 2006a:278.

Cross-examination is considered to be one of the accusatorial system's most effective instruments in testing the reliability of scientific evidence, and great faith is thus invested in the competence of the cross-examiner.[1751] While this procedure has been criticised as being potentially misleading,[1752] it can be tremendously valuable to the judicial decision-maker. Effective cross-examination of specialist witnesses, however, may require a careful understanding of the nature of expertise and the specific science.[1753]

Reviews of the extensive research conducted on wrongful convictions and DNA exonerations in the United States of America[1754] reveal that in astonishingly few cases of wrongful convictions based on fallacious forensic evidence, defence counsel actually cross-examined experts concerning their invalid testimony.[1755] In addition, defence counsel rarely obtain funding to retain own experts, all of which ensures a failure of the accusatorial instruments that are supposed to filter dubious yet admissible evidence.[1756]

In the England and Wales legal system too, the inability of legal representatives to properly test forensic evidence during cross-examination has been criticised by presiding officers.[1757] Judge

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1751 Meintjes-Van der Walt 2003:100.

1752 Meintjes-Van der Walt 2003:100.

1753 Meintjes-Van der Walt 2003c:61-62.

1754 See Edmond and Roach 2011:358-367.

1755 Edmond and Roach 2011:361.

1756 Edmond and Roach 2011:362.

1757 See in this regard also Shaw 2011:371.

Gilbart[1758] has condemned the poor quality of some scientific evidence in criminal trials and especially the incapability of legal practitioners to challenge such evidence when they have no experts of their own to guide them.[1759]

Research conducted by Lieberman *et al*,[1760] revealed that jurors, in executing the virtually impossible task of assessing complicated DNA evidence, can, in fact, be educated on the limitations and dangers of DNA, "…depending on the expertise and effectiveness of the defense attorney."

> Without adequate cross-examination, most jurors were not cognizant of the potential for observer effects or the importance of proficiency testing and therefore were unable to accurately assess the reliability of the lab… Thus, the way in which the defense attorney questioned the quality of the lab in the cross-examination is what ultimately affected verdicts.[1761]

Lay jurors can therefore be informed of issues of science by proper and intelligent cross-examination by legal practitioners for the defence.[1762]

But legal representatives' failure in understanding and critically evaluating scientific evidence, especially traditional forensic sciences, can have devastating bearing on the outcome of the accused person's case. In the case of *Seyisi v The State,*[1763] the court maintained that if

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1758 Judge Andrew Gilbart QC is the Honorary Recorder of Manchester – Law Commission (UK) 2011:5.

1759 Law Commission (UK) 2011:5.

1760 2008:50.

1761 Lieberman *et al* 2008:50-51.

1762 Lieberman *et al* 2008:52.

1763 (117/12) [2012] ZASCA 144 (28 September 2012).

an acknowledged expert provides it with credible evidence, the court is compelled to accept that evidence as *prima facie* proved, and that an onus then descends onto the defence to dispute facts that are *prima facie* proved before court.[1764]

> Our law is quite clear that if evidence is *prima facie* evidence and it is not discredited or placed in dispute by the defence in any manner then it must be accepted as proven evidence.[1765]

Defence counsel should be as vigilant and informed about the opposition's proffered forensic science as the opposition presenting it.[1766] According to Saks,[1767] legal representatives must assume the worst when preparing to cross-examine the opposition's specialist, meaning that the defence must presume that the prosecution's expert is partial and lacks a proper understanding of the scientific methodology used and the inferences drawn. The cross-examination must thus be structured in a manner that would test the underlying scientific content, not credibility or opportunity to observe.[1768]

The submission of scientific evidence into court by way of section 212 of the Criminal Procedure Act 51 of 1977[1769] is an unlikely anti-hero in the endeavour to only submit reliable scientific evidence into trial, by reason of defence counsel's inability to appropriately address scientific evidence.

1764 *Seyisi v The State* (117/12) [2012] ZASCA 144 (28 September 2012) at para 12.

1765 *Seyisi v The State* (117/12) [2012] ZASCA 144 (28 September 2012) at para 12.

1766 Saks 2001:431.

1767 2001:431.

1768 Saks 2001:431.

1769 For an explanation on the contents of section 212 of Act 51/1977, as well as its application and criticisms, please see para 4.2 above.

In accordance with the provisions of section 212, if an expert witness for the prosecution submits an affidavit of his tendered evidence complying with the requirements set forth in this section,[1770] the submission of such affidavit shall serve as *prima facie* proof of the tendered evidence, implying that the court would have no option but to accept the document. In the absence of challenges by the defence, the court is then under duty to accept the document and its contents as definitive proof of fact.[1771] Challenges to such evidence are unlikely to be raised if the defence possesses no mentionable familiarity with scientific technique.

It is doubtful that legal representatives without any knowledge or understanding of forensic science would recognise unreliable scientific evidence or technique, highlighting the importance of legal practitioners familiarising themselves with principles of forensic science.

Legal practitioners have been accused of being incapable, both by education and by inclination, to adequately familiarise themselves with scientific evidence in order to discharge their duties towards the administration of justice.[1772] In fact, Black *et al*[1773] tersely describe the situation as follows:

1770 The requirements include that the expert must be employed by the State, that he possesses expertise in any of the sciences mentioned (for example, biochemistry, mathematics, ballistics, biology, and so forth), that the particular science is relevant to the matter before the court, and that certain facts have been established through performance of an examination or process – section 212(4) of the Criminal Procedure Act 51/1977.

1771 Zeffertt *et al* 2003:213. See *S v Veldthuizen* 1982 (3) SA 413 (A) and *S v Mkhize* 1998 (2) SACR 478 (W).

1772 Black *et al* 1994:716.

1773 1994:716.

> Judges and lawyers usually react to science with all the enthusiasm of a child about to get a tetanus shot.

6.3 FORENSIC SCIENCE AND JUDICIAL DECISION-MAKING

6.3.1 Introduction

The formulation of the *Daubert*-standard of admissibility in the United States of America illuminated presiding judges as the caretakers of the admission of reliable scientific evidence into criminal trials. Distressingly, however, judges periodically over-value the quality of forensic evidence and then allow erroneous scientific evidence into trial.[1774] Lieberman *et al*[1775] describe this phenomenon:

> …a special aura of credibility surrounds scientific evidence…jurors are especially prone to attribute a mystic infallibility to such evidence.

Even DNA evidence, the golden standard of scientific proof, can be mismanaged:

> DNA evidence is particularly complicated for judges to evaluate because they must determine the reliability of the methodology itself, as well as its applications.[1776]

Ultimately, judicial decision-makers, who are called upon to perform final evaluations of scientific evidence provided by experts in the

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1774 Lieberman *et al* 2008:57.

1775 Lieberman *et al* 2008:32.

1776 Lieberman *et al* 2008:57.

various forensic disciplines, are woefully incapable of confirming scientific reliability and validity.[1777]

Yet assessment of evidence, including technically intricate scientific evidence, is inextricably part of the criminal justice process. To investigate how judicial fact-finders cope with this task, it is necessary to examine the rules of evidence within each of the investigating countries' legal systems, as well as the different interpretations of these rules which ultimately results in presiding officers' decision-making paradigms.

6.3.2 The United States of America

6.3.2.1 Introduction

By the end of 2011, a total of 32 American states had adopted the *Daubert*-criteria[1778] for the admission of expert evidence in trials, the two most recent states having both previously unequivocally rejected the standard.[1779]

While it certainly appears as though the influence of the *Daubert*-judgment is reaching across the United States of America, it has revealed some problems of its own.

1777 Zeffertt *et al* 2003:305.

1778 From the case of *Daubert v Merrel Dow Pharmaceuticals, Inc.* (1993) 509 U.S. 579.

1779 Ambrogi 2011. http://www.ims-expertservices.com/blog/2011/two-more-states-adopt-daubert-bringing-total-to-32. Accessed on 22/12/2012.

The *Daubert*-criteria for admission of expertise in trials have set an elevated standard for admissibility to those standards previously employed to assess this type of evidence.[1780] The *Daubert*-standard requires presiding judges to act as "gate-keepers" of forensic science, yet there is significant doubt whether judges are prepared to accurately assess forensic science evidence, such as DNA evidence, especially in light of rapid developments in scientific technique.[1781]

Yet, despite the commendable effort of the *Daubert*-judgment to exclude fallacious forensic science, dubious evidence is still being admitted.[1782] Moreover, a variety of forensic identification evidence with high or unspecified error rates are admitted to courts, which leaves members of juries to their own devices to uncover the problems with the evidence.[1783]

6.3.2.2 Admissibility and assessment of expertise in the United States of America[1784]

Saks[1785] reveals that the first admissibility paradigm, the 'commercial marketplace test,' had been in use as far back as the American civil

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1780 Lieberman *et al* 2008:57. Other standards include the *Frye* general acceptance test as formulated in the case of *Frye v United States* (1923) 54 App. D.C. 46, 293 F. 1013, 34 A.L.R. 145, as well as the use of the Federal Rules of Evidence.

1781 Lieberman *et al* 2008:57.

1782 Lieberman *et al* 2008:30.

1783 Lieberman *et al* 2008:30.

1784 Para 2.3.3 above contains an examination of the historical development of expert evidence in the American criminal justice system, as well as definitions and descriptions of the major admissibility standards used in American criminal litigation. This section should be considered a continuation of the paragraph above.

1785 1998:1073.

war. According to this test, courts had to determine whether the expert's knowledge possessed commercial value in the marketplace.[1786]

The adjustment from the 'marketplace test' to the formulation of the 'general acceptance test' in the case of *Frye v United States,*[1787] was significant in that it moved from general acceptance in the marketplace by laypersons, to general acceptance in the specific discipline of science in which it belongs:

> Just when a scientific principle or discovery crosses the line between the experimental and demonstrable stages is difficult to define. Somewhere in this twilight zone the evidential force of the principle must be recognized, and while the courts will go a long way in admitting expert testimony deduced from a well recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs.[1788]

This 'general acceptance test' differed from the 'marketplace test' in other respects. Firstly, the marketplace standard inquired whether the expert's profession was accepted, while the *Frye*-standard examined whether the expert's theory and methodology was accepted.[1789] Secondly, acceptance in the former instance was required by lay consumers in the marketplace, while in the latter, acceptance was needed by other experts in the relevant sphere of science.[1790]

1786 Saks 1998:1073-1074.

1787 (1923) 54 App. D.C. 46, 293 F. 1013, 34 A.L.R. 145. In this case the admissibility of lie detector evidence was rejected.

1788 *Frye v The United States* (1923) 54 App. D.C. 46, 293 F. 1013, 34 A.L.R. 145. Naturally, traditional rules of admissibility of all kinds of evidence still apply, namely logical relevance, the extent to which the judicial fact-finder would be assisted by the evidence, and the qualifications of the witness. See also the discussion in Godden and Walton 2006:267-268.

1789 Imwinkelried 2011:9.

1790 Imwinkelried 2011:9.

While the *Frye*-standard endured slow reception, it was the governing law pertaining to expert evidence in almost all courts in the United States of America by the mid-twentieth century.[1791] While this standard enjoyed the benefit that it could be applied relatively effortlessly by non-specialists,[1792] it suffered tremendous criticism, on occasion being referred to as an entirely inadequate criterion for admissibility.[1793]

While the general acceptance test was universally applied in American courts, its harsh criticism persisted. The test was accused of being too vague, too narrow and subject to multiple interpretations.[1794] Novel scientific techniques that may very well be reliable and scientifically valid, may nonetheless be excluded simply because it is not yet generally accepted in a specific field of science.[1795] On the other side of the coin, theories and methodologies are generally accepted that have not yet been subject to serious scientific scrutiny.[1796]

The *Frye*-test was also condemned for its apparent deference to extra-judicial scientific authority.[1797] Awaiting general acceptance caused delays in proceedings, it ultimately obscured issues and was found to

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1791 Imwinkelried 2011:9; Golan 2008:930-931. See also *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 585.

1792 Godden and Walton 2006:268.

1793 See Black *et al* 1994:722.

1794 Golan 2008:931-932.

1795 Godden and Walton 2006:268.

1796 Godden and Walton 2006:268.

1797 Black *et al* 1994:726.

be difficult to apply.[1798] Yet this deference does not in the least eliminate the choices that courts have to make regarding science:

> The court applying *Frye* has to decide what must be accepted, what constitutes the relevant field of science, and what demonstrates acceptance, and making these decision requires the very understanding of science that *Frye* ostensibly avoids.[1799]

The enduring conundrum of conflicting expert opinion is also not addressed by this standard in the slightest. Where numerous experts offer opinions that are not only at odds with one another, but also emanate from generally accepted theories and techniques, the judicial decision-maker *sans* scientific knowledge will have a very difficult time identifying the most reliable opinion.[1800]

Black *et al*[1801] believe that no comprehensible guidelines have been proposed to aid the determination of scientific validity in courts of law, and, as an alternative, courts have surrendered to the various "surrogate tests" based on factors like general acceptance, error rate, and more.

The application of the *Frye*-test persevered until 1975, when the United States Congress promulgated the Federal Rules of Evidence.[1802] Rule 702 stipulates that if scientific, technical or other specialised knowledge

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1798 Black *et al* 1994:726.

1799 Black *et al* 1994:726-727.

1800 Godden and Walton 2006:268.

1801 1994:718-719.

1802 Golan 2008:932; Godden and Walton 2006:268. Rule 402 of the Federal Rules of Evidence stipulates that "all relevant evidence is admissible, except as otherwise provided by the Constitution of the United States, by Act of Congress, by these rules, or by other rules prescribed by the Supreme Court pursuant to statutory authority."

will assist the judicial fact-finder in understanding evidence or determining a fact in issue, a qualified expert[1803] may testify thereto by providing his opinion.

While Rule 702 seeks to abandon the general acceptance test, it expands on any existing imperatives in that it includes any knowledge that will be helpful to the fact-finder in a trial, which is basically an endorsement of the significance of relevance in admissibility determinations.[1804] The reliability of evidence is implied in the wording of the provisions.[1805]

Godden and Walton[1806] accordingly argue that the Federal Rules of Evidence adjusted admissibility criteria for expert evidence from general acceptance to relevance and reliability.

Although judicial interpretation of this legislation indicated that the Federal Rules in no way codified the general acceptance test and that these Rules, in effect, were meant to overturn the *Frye*-standard,[1807] this was not clear to all participants in the legal system. Litigants, judges and legal scholars remained in disagreement for a long time over

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1803 Here, expertise will be determined by knowledge, skill, experience, training or education – Rule 702 of the Federal Rules of Evidence.

1804 Godden and Walton 2006:269.

1805 Godden and Walton 2006:269.

1806 2006:269.

1807 Imwinkelried 2011:13. The Reporter for the committee which drafted the Federal Rules commented that "no common law of evidence remains under the Federal Rules." Since the *Frye*-case was a common law decision, the courts interpreted this to mean that the general acceptance test was thoroughly repealed – Imwinkelried 2011:13. See also *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 588.

whether Rule 702 embraced the *Frye*-test or established a new standard.[1808]

However, the Rules did not consider or mention the general acceptance test applied by most courts at the time, and since this created an "interpretive vacuum," courts felt it failed to properly repeal the use of the *Frye*-criteria, causing the latter to thus remain operational as standard for assessing expert forensic evidence.[1809]

In the perplexing period following the enactment of the Federal Rules and the apparent endurance of the general acceptance test, case precedent and rules stipulating scientific evidence assessment became cloaked in controversy and confusion.[1810]

The matter was finally resolved when, in 1993, the court, in *Daubert v Merrell Dow Pharmaceuticals, Inc*.,[1811] affirmed the import of relevance and reliability in admissibility determinations by stating that the Federal Rules of Evidence supplanted the *Frye*-standard, and that 'general acceptance' no longer served as prerequisite for permissibility.[1812]

In casu, the petitioners instituted a civil claim against the respondents on the grounds that two minor children were born with serious birth

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1808 National Academy of Sciences 2009:3-4. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1809 Golan 2008:933; Godden and Walton 2006:269.

1810 Godden and Walton 2006:269.

1811 (1993) 509 U.S. 579.

1812 Godden and Walton 2006:270. See *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 588. See also National Academy of Sciences 2009:3-1. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

defects that had been caused by the mothers' ingestion of anti-nausea medication marketed by the respondents.[1813] After hearing evidence the respondent submitted a motion for summary judgment. In applying the *Frye*-standard, the District Court[1814] held that the scientific technique employed by the expert witnesses for the petitioners cannot be said to enjoy general acceptance in the scientific community, and thus the evidence was inadmissible.[1815]

On appeal, the petitioners placed in dispute the enduring authority held by the general acceptance test established by the *Frye*-case, and argued that the general acceptance test was, in fact, displaced by the Federal Rules of Evidence. This presented the Supreme Court of the United States with the perfect opportunity to rule on the supremacy of the Federal Rules. After a meticulous consideration the court agreed, and affirmed that the *Frye*-test is incompatible with the Federal Rules and should thus no longer be applied in federal courts.[1816]

While the court accordingly established the Federal Rules (specifically Rule 702) as the preferred admissibility standard, it expanded on the Rules to ultimately formulate a novel standard of admissibility. The

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1813 *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 582.

1814 The respondent had removed the suits to federal court on grounds of diversity - *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 582. See also the discussion in Black *et al* 1994:720-721.

1815 *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 584. The court found in favour of the respondent.

1816 *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 587, 589. See also Black *et al* 1994:721. While the *Frye*-standard is now disqualified from application in federal courts, it still finds application in courts on state level, and many states, for example New York, Washington and Pennsylvania, still employ this test as criteria for expert evidence admissibility – Shelton 2011:19-20.

court's first order of business was to reinstate the presiding judge as the "gate-keeper" of relevant and reliable scientific evidence:

> …under the Rules the trial judge must ensure that any and all scientific testimony or evidence admitted is not only relevant but reliable.[1817]

In rationalising its decision to position the presiding judge as the gate-keeper of scientific validity, the court held the following:

> We recognize that in practice, a gatekeeping role for the judge, no matter how flexible, inevitably on occasion will prevent the jury from learning of authentic insights and innovations. That, nevertheless, is the balance that is struck by Rules of Evidence designed not for the exhaustive search for cosmic understanding but for the particularized resolution of legal disputes.[1818]

It has been argued that the recasting of the role of the presiding officer by this ruling has been one of the most significant changes induced by the *Daubert*-case in that it now obliges judges to assess scientific testimony, its underlying theory and technique, for reliability and relevance before admitting it into evidence.[1819] It has also breathed new life into the question as to how a court, without adequate scientific training, should determine scientific validity.[1820]

1817 *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 589. See also Godden and Walton 2006:270. This is significant since Rule 702 refers to "trier of fact," which in the American justice system, is the jury. However, this pertinent statement by Justice Blackmun replaces the burden of evidence assessment back onto the shoulders of the presiding judge.

1818 *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 597. See also Godden and Walton 2006:270.

1819 Berger 2005:S60.

1820 Black *et al* 1994:724.

Chief Justice Shelton[1821] confirms that the role of the American trial judge as gate-keeper of appropriate forensic evidence for contemplation by the jury is currently firmly entrenched in American law. He adds:

> Although states differ as to the implementation of that role, all have adopted the gatekeeper concept.[1822]

According to Black *et al*,[1823] both judges and juries, as non-scientists, can effectively assess scientific claims intelligently and are thus capable of accurately deciding disputes regarding forensic evidence. However, since the principle issue is how the courts can best obtain the expertise they require, they concur with the *Daubert*-ruling's preference for pre-trial judicial assessment since judges are better suited to identify and consider the data that is relevant to the dispute resolution.[1824]

The determination of scientific validity, of course, revealed itself to be at the heart of the problem of admitting reliable scientific evidence. In devising new admissibility criteria that would successfully avoid past mistakes, the court had to deliberate on the past approaches that were effective and those that were not.[1825] It was evident that the *Frye*-standard, as well as other relevance and reliability alternative tests, have failed to generate consistent and rational decisions.[1826] Black *et al*[1827] reason that this is because courts evade the crucial issue of

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1821 2011:17.

1822 Shelton 2011:17.

1823 1994:787.

1824 Black *et al* 1994:787.

1825 Black *et al* 1994:724.

1826 Black *et al* 1994:724.

1827 1994:724.

whether the expert evidence proffered to court is founded upon valid scientific knowledge.

In casu, the court's decision depended on statutory interpretation, rather than an assessment of the facts of the case or the merits of the general acceptance test. In evaluating the wording of Rule 702, Justice Blackmun held that the words "scientific knowledge" contained in this provision, determined a paradigm of evidentiary reliability,[1828] and that describing knowledge as having to be "scientific" implies that the knowledge is founded upon methods and procedures of science.[1829] The main consideration for the court in assessing expert evidence is thus validating the scientific methodology because evidentiary reliability is based upon scientific validity.[1830]

Moreover, the court considered the American legislature's use of the words "assist the trier of fact" as indicative of the condition that the expert evidence must also be relevant.[1831]

It is therefore clear that when considering expert testimony, the very first issue the court must decide is whether the evidence emanates from scientific knowledge (reliability), and whether it will assist the fact-finder,

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1828 *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 590-591.

1829 Black *et al* 1994:747.

1830 *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 590-591. See also Black *et al* 1994:747.

1831 *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 590-591. See also Black *et al* 1994:747.

that is, the jury, to understand or determine a fact in issue (relevance).[1832]

Justice Blackmun formulated criteria, widely referred to as the "*Daubert* factors," to facilitate the reliability determination by presiding judges. Firstly, the scientific hypothesis or technique employed by the expert must be testable. Secondly, the theory or method must have been subjected to peer-review, including publication. Thirdly, the court should enquire into the known or potential error rate of any scientific technique used. Fourthly, the court must ascertain whether appropriate control standards exist and are maintained for the methodology employed. Lastly, there must be an explicit identification of a relevant scientific community and a determination of a specific degree of acceptance within that community.[1833]

Even though these *Daubert*-factors have suffered some criticism,[1834] the court has been commended for finally placing courts in the right direction by cautioning presiding judges to concentrate on whether expert evidence originates from valid scientific knowledge.[1835]

Godden and Walton[1836] confirm that these *Daubert* factors were not intended by the court to be an authoritarian checklist, but rather a

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1832 *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 592. See also Berger 2005:S60. The American Law Institute's Model Code of Evidence defines relevant evidence as having any propensity in reason to prove any material fact - Zeffertt *et al* 2003:219.

1833 *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 593-594. See also Saks 1998:1077; Godden and Walton 2006:270-271; Shelton 2011:17-19.

1834 Black *et al* remain sceptical that these considerations are still inadequate in conducting a thorough validity probe – Black *et al* 1994:721.

1835 Black *et al* 1994:721.

1836 2006:271.

flexible set of guidelines to be applied where appropriate, perhaps even with other useful and relevant criteria.

Black *et al*[1837] affirm this view and criticise those who would narrowly interpret this judgment and see the *Daubert* factors as constituting a novel four factor test for evidence admissibility. The court expressed the need for flexibility in applying Rule 702, but also the need to focus on the predominant issue of scientific validity, and as a consequence, relevance and reliability of the principles that underlie a proposed submission.[1838] But Black *et al*[1839] warn:

> If lawyers and judges hope to apply the new *Daubert* test rationally, they will have to learn what distinguishes science from other forms of knowledge – what it is that makes science scientific.

Justice Blackmun, in deciding the case, also addressed underlying concerns of the respondent and *amici,* that abandonment of the *Frye*-test as principle condition for admissibility will result in an overabundance of unfounded pseudoscientific statements in court that will ultimately confuse the members of the jury.[1840] The court expressed its faith in juries and the accusatorial system of procedure by maintaining that:

> Vigorous cross examination, presentation of contrary evidence, and careful instruction on the burden of proof are the traditional and appropriate means of attacking shaky but admissible evidence.[1841]

1837 1994:751.

1838 Black *et al* 1994:751.

1839 1994:751.

1840 *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 595-596.

1841 *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 596; Black *et al* 1994:749.

The petitioners in the *Daubert*-case exhibit some apprehension as well, in that they feared the recognition of judges as gate-keepers of scientific evidence will cause the mass exclusion of "invalid" evidence that will ultimately endorse an oppressive scientific orthodoxy and will not be conducive to finding the absolute truth.[1842] While the court conceded that judicial gate-keeping might occasionally prevent the jury from discovering authentic insights and innovations, it also affirmed that this was a fair balance to strike since the Rules of Evidence do not purport to seek "cosmic understanding" but rather to accomplish specified dispute resolution.[1843]

Ultimately, the subject of Rule 702 is scientific validity, which comprises relevance and reliability, of the principles and methodology that underlie a proposed submission, and not the conclusions that they generate.[1844]

Procedurally, the *Daubert* factors are applied during pre-trial "*Daubert* hearings," specifically held for expert evidence admissibility determinations in cases going to trial.[1845] According to Black *et al*,[1846] the *Daubert*-ruling can be applied by either instructing party-selected specialists to draft reports and attend pre-trial conferences to narrow the point in dispute,[1847] by conducting pre-trial hearings or even

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1842 *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 596.

1843 *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 597.

1844 *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 594-595.

1845 Godden and Walton 2006:271.

1846 1994:790.

1847 This may have the tremendous benefit of alleviating much of the difficulty in assessing conflicting expert testimony during the trial proceedings.

complete “mini-trials” in order to assess admissibility. Moreover, in their decision-making endeavours judges may also employ advisers, special masters or appoint their own experts.[1848]

While the *Daubert*-ruling was envisioned to be a guide to evidence validity assessment, rather than a strict check-off list for judges, the degree to which courts enjoyed discretion in applying the guidelines needed some direction, which was provided in the form of the case, *General Electric Co. et al v Joiner*.[1849]

The court in this matter affirmed that neither the Federal Rules of Evidence, nor the *Daubert*-ruling provided a court of appeal with any special powers to overturn a decision of admissibility rendered by a lower court.[1850] This has the effect that trial courts retain discretionary power to render admissibility decisions and abuse of this discretion is the appropriate standard of review of a federal court’s evidentiary rules.[1851]

1848 Black *et al* 1994:790.

1849 522 U.S. 136 (1997). See the discussion in Godden and Walton 2006:271. *In casu*, the respondent, *Joiner*, presented with small-cell lung cancer and instituted proceedings against the petitioner, alleging that his disease was promoted by his workplace exposure to carcinogenic chemicals, manufactured by the petitioners. The petitioners removed the matter to federal court and applied for a summary judgment. The respondent called expert witnesses, testifying to causation between the respondent’s cancer and the chemicals, but the court granted the summary judgment nonetheless, since it held, *inter alia*, that the expert evidence was inadmissible on the grounds that it amounted to mere subjective belief or unsupported speculation, and was thus inadmissible. *Joiner* disputed this, claiming that the judge had focused on the experts’ conclusions, rather than on their methodology, contrary to the clear instructions of the *Daubert*-ruling – *General Electric Co. et al v Joiner* 522 U.S. 136 (1997) at 140. See also Shelton 2011:18.

1850 Godden and Walton 2006:271. *General Electric Co. et al v Joiner* 522 U.S. 136 (1997) at 141.

1851 *General Electric Co. et al v Joiner* 522 U.S. 136 (1997) at 141. See Godden and Walton 2006:271.

Moreover, the court *in casu* addressed an instruction by the court in the *Daubert*-case that in assessing expert evidence for admissibility, the judicial decision-maker should only contemplate methodological issues, rather than the acceptability of results.[1852]

Against this, the court in the *Joiner*-case ruled that "…conclusions and methodology are not entirely distinct from one another"[1853] and broadened the extent of the court's discretion by ordering that, in fact, the court should consider both scientific methodology and the acceptability of the results or conclusions, and disallow evidence if the expert's conclusions are not properly founded upon the methodology.[1854]

The court held further that trained experts frequently draw inferences from existing data, but that no legislation of case precedent requires courts to admit expert evidence that is linked to existing data only by the *ipse dixit* of the expert.[1855] A court may infer that there is too wide an analytical chasm between the data and the opinion provided.[1856] The court upheld the trial court's decision in excluding the evidence.[1857]

1852 The court held that considerations of scientific validity, which includes relevance and reliability, of the underlying principles of the opinion is what should be the court's focus rather than the results that the methods generate - *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 594-595.

1853 *General Electric Co. et al v Joiner* 522 U.S. 136 (1997) at 140, 146. See also Shelton 2011:18.

1854 *General Electric Co. et al v Joiner* 522 U.S. 136 (1997) at 140. See also Godden and Walton 2006:272; Shelton 2011:18.

1855 *General Electric Co. et al v Joiner* 522 U.S. 136 (1997) at 140.

1856 *General Electric Co. et al v Joiner* 522 U.S. 136 (1997) at 140.

1857 *General Electric Co. et al v Joiner* 522 U.S. 136 (1997).

In *Kumho Tire Co. Ltd v Carmichael*,[1858] the Supreme Court of the United States again expanded the *Daubert*-decision pertaining to whether this case applies to non-scientists.[1859] In the trial court, *Kumho Tire Co.* successfully managed to argue that *Carmichael's* expert witness should be excluded based on unreliability according to the *Daubert*-criteria. On appeal, the matter was reversed on the basis that the *Daubert*-case should never have been the admissibility standard used, since the latter case only applies where an expert depends on the application of scientific principles, rather than skill- or experience-based observation.[1860] The petitioner then approached the Supreme Court to decide the issue.[1861]

In casu, the court was once again concerned with statutory interpretation rather than factual analysis, and held that the language of Rule 702 of the Federal Rules makes no relevant distinction between "scientific" knowledge and "technical" or "other specialised" knowledge, and that it is clear the provision intends any such knowledge to serve as expert testimony.[1862]

1858 526 U.S. 137 (1999) at 145-146. In this matter, the respondent suffered a motor vehicle accident in which a passenger died and several others were seriously injured, after his motor vehicle's right rear tire blew out. He instituted civil proceedings against the petitioner, claiming that the accident was caused by a defective tire, manufactured and distributed by the petitioner. While an expert in tire failure analysis testified for the respondent, the petitioners successfully applied for exclusion of expert evidence on the grounds that it failed the *Daubert*-test. The respondent challenged the matter to a successful appeal and the petitioner approached the Supreme Court of Appeal for clarification on the issue of admissibility of non-scientific expertise.

1859 In this matter the court dealt specifically with engineers, but the enquiry included other experts who are not strictly speaking affiliated with any of the sciences.

1860 *Kumho Tire Co. Ltd v Carmichael* 526 U.S. 137 (1999) at 151. See also Younger *et al* 2007:214-217.

1861 Younger *et al* 2007:217.

1862 *Kumho Tire Co. Ltd v Carmichael* 526 U.S. 137 (1999) at 147. Godden and Walton 2006:272; Younger *et al* 2007:217.

The court added that the use of the word "knowledge" in reference to "scientific knowledge," is what creates a standard of evidentiary reliability and that this standard applies to expert evidence, whether of scientific, technical or other specialised nature.[1863]

Moreover, the court accentuated the principle raised in the *Daubert*-case that the *Daubert* factors it formulated were never envisioned to be a definitive checklist or test for admissibility, but rather a collection of factors that should be applied where there are reasonable measures of the reliability of expert testimony.[1864] Godden and Walton[1865] concisely review the court's position on this point:

> …the court in *Kumho* found that it was the responsibility of the trial judge to ensure that expert testimony was relevant and reliable, but that the criteria to be used in making this determination should be specifically matched to the testimony under consideration. Thus reliability criteria are, to a significant degree, context-dependent and situation-specific.

While the intended effect of the *Daubert-, Joiner*- and *Kumho*-cases must have been to launch a revolution, it instead consolidated a general narrowing of admissibility standards in response to problems with civil litigation.[1866] Presiding judges were urged to act as gate-keepers and courts of appeal were prevented from interfering with admissibility rulings unless trial judges visibly abused their discretions.[1867] This

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1863 *Kumho Tire Co. Ltd v Carmichael* 526 U.S. 137 (1999) at 147-148. In the *Daubert*-case, the presiding judge held that the word "scientific" had this effect.

1864 *Kumho Tire Co. Ltd v Carmichael* 526 U.S. 137 (1999) at 152.

1865 2006:273.

1866 Edmond and Roach 2011:353.

1867 Edmond and Roach 2011:353.

accomplished a “chilling effect” as plaintiffs struggled to have their expert evidence admitted.[1868]

In 2000, the legislature, in response to the developments effected since the *Daubert*-case, formulated amendments to the Federal Rules of Evidence, Rule 702, in order to ensure clarification of the Rules and the elimination of loopholes.[1869] Rule 702 now reads as follows:

> If scientific, technical, or other specialised knowledge will assist the trier of fact to understand the evidence or to determine a fact in issue, a witness qualified as an expert by knowledge, skill, experience, training, or education, may testify thereto in the form of an opinion or otherwise, if (1) the testimony is based upon sufficient facts or data, (2) the testimony is the product of reliable principles and methods, and (3) the witness has applied the principles and methods reliably to the facts of the case.[1870]

Therefore, the amended Rule 702 illuminates the concept of reliability by offering three distinctly necessary but jointly sufficient standards that establish reliability, namely sufficiency of facts or data, reliability of principles and methods, and the reliability of the application of these principles and methods to the facts of the case.[1871]

It is interesting to note at this point that the three standards added by the amendment of Rule 702, are recognised as criteria previously formulated in a pre-*Daubert* court case, namely *Kelly v State of Texas*,[1872] decided in the Texas Court of Criminal Appeals before the *Daubert*-criteria that were eventually adopted by the state of Texas.[1873]

1868 Edmond and Roach 2011:353.

1869 Godden and Walton 2006:273; Younger *et al* 2007:204.

1870 Rule 702 of the Federal Rules of Evidence, Amendment 2000. Younger *et al* 2007:204.

1871 Godden and Walton 2006:273-274.

1872 824 SW 2d 568 (Tex.Crim.App. 1992).

In this matter, the trial court convicted the accused of murder, a verdict that was confirmed on appeal. On discretionary review the court considered the issue whether the court of appeal erred in affirming the trial court's decision to allow DNA evidence against the accused.[1874]

Five DNA expert witnesses testified for the prosecution at the evidence suppression hearing, while one expert testified for the accused, arguing that the method employed at that time during the state's DNA analysis was not generally accepted by the genetic community. Thus, while the defence argued inadmissibility under the *Frye*-standard, the prosecution argued for reliability, and thus admissibility, under Federal Rule 702, which was adopted into Texas state law as Texas Rule of Criminal Evidence 702.[1875]

The court in the *Kelly*-case ruled that the *Frye*-test no longer enjoyed application in the state of Texas, as the *Frye*-measure did not provide for novel scientific evidence and would therefore result in the exclusion of evidence that might be sufficiently reliable but had not yet achieved general acceptance in the relevant scientific community.[1876] The court then proceeded to formulate a test to ascertain the reliability of novel scientific evidence:

> As a matter of common sense, evidence derived from a scientific theory, to be considered reliable, must satisfy three criteria in any particular case: (a)

1873 The *Kelly*-case was decided in 1992, while the *Daubert*-case was decided in 1993.

1874 *Kelly v State of Texas* 824 SW 2d 568 (Tex.Crim.App. 1992) at 569.

1875 *Kelly v State of Texas* 824 SW 2d 568 (Tex.Crim.App. 1992) at 570.

1876 *Kelly v State of Texas* 824 SW 2d 568 (Tex.Crim.App. 1992) at 572.

> the underlying scientific theory must be valid; (b) the technique applying the theory must be valid; and (c) the technique must have been properly applied on the occasion in question.[1877]

The court was also clear that these criteria must be ascertained outside the presence of the jury, meaning that the presiding judge must conduct the inquiry,[1878] thereby endorsing the judge's position as gate-keeper of reliable scientific evidence.

According to Godden and Walton,[1879] while there is no comprehensive test for establishing whether evidence qualifies as expert, opinion-based evidence, it is indispensable that standards of reliability and relevance be met in each and every case. In what manner reliability is to be determined is fundamentally left up to the presiding judge.[1880]

Though trial judges have access to the *Daubert*-factors to use as guidelines of reliability determination, the notes to the Federal Rules of Evidence amendment to Rule 702 suggest additional criteria. Firstly, the court may consider whether experts' opinions emanated from research conducted independent from litigation, or whether it was formulated specifically for purposes of testifying. Secondly, it should be ascertained whether the expert has unjustifiably reached an unfounded inference from an accepted premise. Thirdly, the court must be satisfied that the expert adequately accounted for discernible alternative explanations. Fourthly, the court must conclude that the expert witness was as careful in providing the court with knowledge as he would have been in his

1877 *Kelly v State of Texas* 824 SW 2d 568 (Tex.Crim.App. 1992) at 573.

1878 *Kelly v State of Texas* 824 SW 2d 568 (Tex.Crim.App. 1992) at 573.

1879 2006:274.

1880 Godden and Walton 2006:274.

regular professional work outside litigation. And lastly, the court must determine whether the expert's sphere of expertise is acknowledged for reaching reliable results for the type of opinion the expert provides to court.[1881]

Collectively, these factors, as well as the *Daubert*-factors, facilitate judicial assessment of the reliability and relevance of expert evidence, and thus assist in admissibility determinations.

But expert evidence assessment does not end with admissibility determinations. Following the initial admissibility appraisal, the evidence is evaluated for a second time in order to establish the weight that is to be attached to the particular evidence. In other words, the evidence is assessed not for its admissibility, but for its acceptability, which represents the level of persuasion of the expert evidence pertaining to the facts at issue.[1882] This evaluation is performed by way of the normal accusatorial processes of the criminal trial system.[1883] Some of these processes were already identified and affirmed by Justice Blackmun in the *Daubert*-decision.[1884]

1881 Godden and Walton 2006:274.

1882 Godden and Walton 2006:275.

1883 Godden and Walton 2006:275.

1884 The presiding judge averred that vigorous cross-examination, presentation of contrary evidence, and meticulous instruction on the burden of proof are the typical accusatorial tools for challenging doubtful but admissible evidence - *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 596; Black *et al* 1994:749.

Despite the pioneering improvements effected by the *Daubert*-trilogy[1885] in admissibility determinations, unresolved problems remained.[1886] *Daubert*'s application has provoked some concern, for example, whether courts apply the criteria as meticulously when prosecutors introduce expertise as when defence experts are introduced.[1887]

The National Academy of Sciences' congressionally authorised research also provided a bleak view of the criminal justice system's reliance on the *Daubert*-standard.

According to the National Academy of Science (NAS) research report, courts' greatest challenge in using sometimes questionable forensic science to prove facts, is to determine whether, and to what extent, there is science in the particular forensic discipline before court.[1888] In determining the admissibility and reliability of forensic evidence, courts should inquire to what extent a specific forensic field is based on reliable scientific methodology, as well as the extent to which practitioners in a field of forensics rely on human interpretation that could be subject to error, bias, or the absence of valid operational procedures.[1889]

1885 The *Daubert*-case, together with the cases of *General Electric Co. et al v Joiner* and *Kumho Tire Co. Ltd v Carmichael*, are referred to as the *Daubert trilogy*, and pertain directly to the court's role in the admissibility of scientific evidence – Shelton 2011:17.

1886 Godden and Walton 2006:271. See also Berger 2005:S61-S62; Bernstein 2008:453; Shelton 2011:19.

1887 Shelton 2011:19.

1888 National Academy of Sciences 2009:S7; 3-1. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1889 National Academy of Sciences 2009:S7. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

Following a discussion of the *Daubert*-judgment and other cases involving the expansion of the *Daubert*-criteria, the NAS report held the view that:

> *Daubert* and its progeny have engendered confusion and controversy… Federal appellate courts have not with any consistency or clarity imposed standards ensuring the application of scientifically valid reasoning and reliable methodology in criminal cases involving *Daubert* questions.[1890]

The NAS report criticises the court in the *Daubert*-case for describing the standard as "flexible," averring that this offers appellate courts no clear substantive standard by which to review decisions by trial courts, which, in turn, confers upon judges a massive level of discretionary power in admitting evidence, resulting in a high volume of 'abuse of discretion' reviews.[1891]

Although it is difficult to get a clear, comprehensive picture of the application and interpretation of the *Daubert*-standard,[1892] it would appear that in the vast majority of reported opinions trial judges rarely exclude or limit expert evidence proffered by prosecutors, while the vast majority of reported opinions also indicate that appeals against decisions to admit expert evidence against an accused are usually denied.[1893]

1890 National Academy of Sciences 2009:S8. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1891 National Academy of Sciences 2009:S8. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1892 The difficulty arises from the fact that the majority of decisions are delivered without a published opinion, and without an appeal – National Academy of Sciences 2009:S8. Http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1893 National Academy of Sciences 2009:S8. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

In conclusion, following a comprehensive investigation into the use of forensic science in the criminal justice system, the NAS committee found:

> …that the existing legal regime – including the rules governing the admissibility of forensic evidence, the applicable standards governing appellate review of trial court decisions, the limitations of the adversary process, and judges and lawyers who often lack the scientific expertise necessary to comprehend and evaluate forensic evidence – is inadequate to the task of curing the documented ills of the forensic science disciplines.[1894]

The NAS committee speculates that one of the principle problems with the *Daubert*-tested admissibility contemplations is that the techniques of many forensic disciplines have been relied on for so long that courts might be disinclined to reconsider their role in the trial.[1895] In many of these forensic disciplines, effectively no research exists to support the practice.[1896]

Moreover, while the *Daubert*-ruling reaffirmed belief in the accusatorial system in eliminating precarious but admissible evidence,[1897] the NAS committee concluded that the accusatorial process pertaining to scientific evidence admissibility and exclusion is unequipped to the task of finding "scientific truth."[1898]

1894 National Academy of Sciences 2009:3-1. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1895 National Academy of Sciences 2009:3-20. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1896 National Academy of Sciences 2009:3-20. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1897 *Daubert v Merrell Dow Pharmaceuticals, Inc*. (1993) 509 U.S. 579 at 596; Black *et al* 1994:749.

1898 National Academy of Sciences 2009:3-20. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

The NAS committee emphasised the fact that although the *Daubert*-ruling represents the standard by which admissibility in federal cases are appraised under Federal Rules of Evidence, Rule 702, courts on state level remain free to apply other standards of admissibility.[1899] Some state courts still apply the *Frye*-test, while others apply the *Daubert*-criteria, or alternative versions of the *Daubert*-test. The problem with this practice is that it creates an irregular hodgepodge of standards, which is exacerbated by the fact that state courts in the United States of America handle 200 times more criminal prosecutions than federal courts and forensic science is typically used in violent crimes which are predominantly tried in state courts.[1900]

A review of reported judicial opinions exposes the fact that forensic evidence is not regularly examined in accordance with the *Daubert*-criteria for reliability, and, in fact, that the *Daubert*-ruling has done little to improve the use of forensic science evidence in criminal cases.[1901]

Adequate or not, the *Daubert*-measure is nevertheless the paradigm that most presiding officers in criminal proceedings must employ for admissibility determinations.[1902]

6.3.2.3 Daubert-*based assessment and the future of forensic evidence assessment in America*

1899 National Academy of Sciences 2009:3-8. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1900 National Academy of Sciences 2009:3-9. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1901 National Academy of Sciences 2009:3-17. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

1902 Shelton 2011:19.

According to Edmond and Roach,[1903] while many commentators welcomed the criteria formulated in the *Daubert*-case, many forensic scientists and prosecutors were initially distressed about the developments due to the shortage of proper quality controls, formal qualifications and research-based support. However, in practice it emerged that these criteria are only truly relevant in the exclusion of expert evidence in civil proceedings[1904] and that their bearing on the criminal justice system, specifically concerning the use of forensic science, has been significantly less substantial than originally anticipated.[1905]

While the *Daubert*-ruling is legally binding on federal courts, many courts on state level still employ the *Frye*-test.[1906] This irregular application of admissibility standards have resulted in an abundance of research and debates over which paradigm is the stricter, and which places the decision-making power in the appropriate institution.[1907] Naturally, this uncertainty has resulted in state supreme courts struggling with the decision whether to employ *Frye* or *Daubert* in admissibility assessments.[1908]

1903 2011:354.

1904 It is noteworthy that all the modern expert evidence decisions in the United States of America that effected reform in admissibility determinations transpired from disputes concerning expert evidence adduced in civil litigation - Edmond and Roach 2011:349.

1905 Edmond and Roach 2011:354.

1906 See Shelton 2011:19-20.

1907 Cheng and Yoon 2005:472. The *Frye*-test, of course, places the decision-making duty in the hands of the scientific community to assess general acceptance, and *Daubert* places this duty on the presiding officer to screen unreliable evidence – Cheng and Yoon 2005:472.

1908 Cheng and Yoon 2005:472.

Extensive statistical research conducted by Cheng and Yoon[1909] revealed that a state's choice of scientific admissibility standard does not have a statistical significant effect and that the *Daubert*-ruling did not, in fact, succeed in generating a new doctrinal test for admissibility. Instead, its sole accomplishment was to raise the general awareness of presiding judges to the dilemma of unreliable or 'junk' science.[1910]

> …whether a jurisdiction nominally follows *Frye* or *Daubert*, the practical results are essentially the same.[1911]

This would imply that discussions regarding the benefits and shortcomings of either the *Frye*- or *Daubert*-tests are fundamentally superfluous.[1912]

Research conducted by Groscup *et al*,[1913] revealed that after the formulation of the *Daubert*-criteria there had been greater scrutiny of expert evidence but that no substantial change had occurred in the proportion of evidence admitted. In fact, it was discovered that the *Daubert*-test is not being properly used to assess expert evidence in criminal proceedings at all.[1914]

> …the most important rating on sources of expertise were [*sic*] the experience and education of the proffered expert. Sources of knowledge which indicate methodological reliability were rated as less important…[1915]

1909 2005:491-502.

1910 Cheng and Yoon 2005:474.

1911 Cheng and Yoon 2005:474.

1912 Cheng and Yoon 2005:503.

1913 2002:339-353. The research was conducted on both federal and state court level.

1914 Groscup *et al* 2002:363-364.

1915 Groscup *et al* 2002:357.

Additional study performed by Edmond and Roach[1916] suggests that ideological commitments regarding anxiety about crime, time constraints and limited resources, drive the practice of admissibility considerations in criminal proceedings. Research has shown that, in criminal trials, forensic experts testifying for the defence appear to be generally doubted by courts to a greater degree and tend to be held to higher standards than experts for the prosecution.[1917]

Cheng and Yoon[1918] propose that if it is indeed true that the adoption of either *Frye* or *Daubert* is pointless, that all states should consider embracing the *Daubert*-standard in order to eliminate further conflict and confusion. However, it is also suggested that states should feel free to experiment with entirely different admissibility tests, on condition that such tests be substantially different from existing tests, and be meticulously understood if they are to achieve some success.[1919]

6.3.3 England and Wales

6.3.3.1 Introduction

The England and Wales legal system was stunned into reviewing its expert evidence admissibility guidelines when a series of court cases in the beginning of the twenty-first century revealed weaknesses in

1916 2011:358.

1917 Edmond and Roach 2011:358.

1918 2005:503-504.

1919 Cheng and Yoon 2005:504.

assessment of forensic evidence which ultimately resulted in wrongful convictions.[1920]

Following meticulous research on the subject of expertise in criminal proceedings, the Law Commission of the United Kingdom published a consultation paper on the admissibility of expert evidence in 2009, describing the problems and proposing some solutions for consideration.[1921]

In 2011, a follow up report was published to elaborate on the explanations and recommendations suggested in the consultation paper, as well as providing a draft Criminal Evidence (Experts) Bill which would give effect to the proposals contained in the Law Commission's report if ultimately enacted.[1922]

6.3.3.2 Admissibility and assessment of expertise in England and Wales[1923]

Expert opinion in the England-Wales legal system is considered, as it is in South Africa, to be an exception to the rule that opinion evidence in criminal trials is excluded from admission.[1924]

1920 See in this regard Law Commission (UK) 2011:1-3. In response to these questionable rulings on expert evidence, the English Law Commission conducted research on the legal framework in England and Wales, and published its findings in a consultation paper, number 190 in 2009 – Law Commission (UK) 2009. Available at http://www.justice.gov.uk /lawcommission/areas/expert-evidence-in-criminal-trials.htm; Law Commission 2011:1.

1921 Law Commission (UK) 2009:8-46.

1922 Law Commission (UK) 2011:1.

1923 See para 2.3.2 above for an exploration of the historical development of the employment of expert evidence in the England and Wales legal system.

1924 Meintjes-Van der Walt 2001a:228.

The common law criteria for admissibility of expert opinion evidence, as it currently applies in the England and Wales legal system, consists of four requirements, namely assistance, relevant expertise, impartiality and evidentiary reliability.[1925]

The watershed case of *R v Turner*[1926] was pioneering in formulating the 'assistance' requirement for admissibility of expert evidence. *In casu* the court held that an expert witness's opinion is admissible if that opinion is able to assist the court with knowledge and information which is probably outside the experience of the judge or jury, and is able to assist the court in reaching the necessary conclusions. Thus the evidence will be inadmissible if the judicial fact-finder can reach his own conclusions unassisted based on the proved facts.[1927]

In this approach one finds an inherent paradox of expert evidence in the legal system. Expert witnesses are expected to assist the court in matters that go beyond the knowledge and experience of the court, yet, simultaneously, the court, represented by lay judges and jurors, must ultimately adjudicate upon this expert evidence.[1928]

Typically in the English legal system[1929] it is the relevant expertise itself which determines admissibility, not the process by which the expert

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1925 Law Commission (UK) 2011:13.

1926 [1975] QB 834.

1927 *R v Turner* [1975] QB 834 at 841. See also Law Commission (UK) 2011:13. See also Meintjes-Van der Walt 2000a:773.

1928 Meintjes-Van der Walt 2000a:773.

1929 All references hereinafter to the 'English legal system' must be regarded as referring to the England and Wales legal system.

came to possess it.[1930] According to the Law Commission, an individual alleging expertise must be an expert in the relevant forensic discipline, having acquired, by study or experience, adequate knowledge of that discipline to render his opinion valuable.[1931]

Expertise provided in English courts must be done impartially and strictly within the specific forensic discipline.[1932] In criminal law proceedings specifically, this requirement has been promulgated in Rule 33.2 of the Criminal Procedure Rules 2010, which stipulates that an expert has an overriding duty to give opinion evidence which is objective and unbiased. However, the court in *R v Stubbs*[1933] held that apparent bias would not necessarily render the expert's opinion inadmissible.

As far as the matter of evidentiary reliability is concerned, the expert testimony must satisfy a threshold of acceptable reliability.[1934] It is at this point that case precedent plays an indispensable role in clarifying and particularising this requirement.[1935]

1930 Law Comission (UK) 2011:14.

1931 Law Commission (UK) 2011:13. See in this regard *R v Stubbs* [2006] EWCA Crim 2312.

1932 Law Commission (UK) 2011:14. See also *Toth v Jarman* [2006] EWCA Civ 1028, [2006] All ER 1276.

1933 [2006] EWCA Crim 2312.

1934 Law Commission (UK) 2011:15.

1935 While the Australian case of *R v Bonython* [1984] 38 SASR 45 carries persuasive force on the matter of evidentiary reliability, other English cases, especially in the early twenty-first century served to specify expert evidence reliability. For example, *R v Dallagher* [2002] EWCA Crim 1903, [2003] 1 Cr App R 12 at 29; *R v Reed* [2010] 1 Cr App R 23 at 111.

In the Australian case of *R v Bonython*[1936] the court held that in ensuring reliable expert evidence is admitted, the presiding judge must determine whether the subject matter of the opinion forms part of a body of knowledge or experience which is sufficiently organised or recognised to be accepted as a reliable body of knowledge or experience.[1937]

The UK Law Commission suggests that if this view was adopted by the English legal system, the question to be addressed by courts would be whether the expertise is accepted as reliable by the courts, rather than by the relevant scientific community.[1938] This would endanger the admissibility of reliable, but not yet widely accepted novel scientific techniques.

In *R v Clarke (Robert Lee*)[1939] the court finally affirmed that it would be mistaken to deny the law of evidence the advances to be gained from novel methods and new advances in science,[1940] thereby effectively diminishing the influence of the Australian case in reliability determinations.

1936 [1984] 38 SASR 45. In this matter the appellant lodged an appeal against his conviction on charges of forgery and uttering a request for the payment of money. The basis for the appeal was that the trial judge had erred in allowed the testimony of a handwriting expert. In consideration of the requirements for expertise, the court finally dismissed the appeal.

1937 *R v Bonython* [1984] 38 SASR 45 at 47.

1938 Law Commission (UK) 2011:15-16.

1939 [1995] 2 Cr App R 425.

1940 *R v Clarke (Robert Lee)* [1995] 2 Cr App R 425 at 430.

In 2003, in the case of *R v Dallagher,*[1941] the court averred that the accepted view in admissibility determinations was that as long as the discipline was sufficiently well-established to pass the ordinary tests of reliability and relevance, no further tests for admissibility would be applied, but the probative weight of the evidence should be established by the usual accusatorial processes.[1942]

In 2004, the courts fundamentally opened the influx of expertise in court by declaring that notwithstanding the erstwhile approach to assess admissibility of expert evidence more conservatively, the English courts are adopting a more flexible stance in admitting expert evidence.[1943] In this manner courts have the opportunity to enjoy the advantages of being exposed to novel scientific techniques and advances in science.[1944]

Then, in 2010, the Criminal Court of Appeal in *R v Reed*[1945] expounded on a proper reliability test for expert evidence in the English legal system. In this matter, the accused had been convicted on a charge of murder and sentenced to life imprisonment after stabbing the deceased multiple times. The DNA of the accused had been demonstrated to be on the murder weapon, extracted from cellular material left on the handle of the knife.[1946]

1941 [2002] EWCA Crim 1903, [2003] 1 Cr App R 12.

1942 *R v Dallagher* [2002] EWCA Crim 1903, [2003] 1 Cr App R 12 at 29.

1943 *R v Luttrell* [2004] EWCA Crim 1344; [2004] 2 Cr App R 31 at 37.

1944 *R v Luttrell* [2004] EWCA Crim 1344; [2004] 2 Cr App R 31 at 37.

1945 [2010] 1 Cr App R 23, 310.

1946 *R v Reed* [2010] 1 Cr App R 23, 310 at 311-315.

In casu, the court had to render a decision on the admissibility of the 'touch DNA' proffered by the state's expert witness. The court held that in admissibility determinations, there are three relevant principles relating to such admissibility:

> Firstly, expert evidence of a scientific nature is not admissible where the scientific basis on which it is advanced is *insufficiently reliable* for it to be put before the jury.[1947] (Own emphasis)

While there is no improved test of admissibility for expert evidence, if such evidence is challenged, the court must consider whether there is a sufficiently reliable scientific basis for that evidence to be admitted. Should the court deem the evidence founded on sufficient scientific basis, the evidence will be admitted and all opposing views must be tested in trial.[1948]

> Second, even if the scientific basis is sufficiently reliable, the evidence is not admissible unless it is within the scope of evidence an expert can properly give.[1949]

This principle demanded the court's contemplation regarding the extent to which an expert could express an opinion on the significance of what he had observed without there necessarily being a statistical foundation for comparison purposes. The court affirmed that a jury is entitled to be thoroughly informed by an acknowledged specialist in the relevant field, and that leaving jurors without such information, or not subjecting it to

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1947 *R v Reed* [2010] 1 Cr App R 23, 310 at 334.

1948 *R v Reed* [2010] 1 Cr App R 23, 310 at 334. This echoes the finding regarding weight determination in *R v Dallagher* [2002] EWCA Crim 1903, [2003] 1 Cr App R 12 at 29.

1949 *R v Reed* [2010] 1 Cr App R 23, 310 at 335.

proper cross-examination, is more likely to result in perilous conclusions.[1950]

> Third, unless the admissibility is challenged, the judge will admit that evidence.[1951]

While this case affirmed the existence of a common law reliability test for expert scientific evidence, it also fortified the already established position that there is no enhanced reliability test for expert evidence.[1952]

The UK Law Commission considers this reliability requirement in the admissibility test inadequately robust, generally reflecting a permissive approach to expert evidence admissibility in the English legal system.[1953] Moreover, trial judges are provided with little to no assistance on the manner in which reliability is to be assessed in practice.[1954]

The consequence of this permissive standard is that criminal courts in the English legal system very infrequently rule expert evidence inadmissible on the grounds of unreliability.[1955] The tendency in this jurisdiction is to admit expert testimony on the assumption that its reliability will be effectively challenged during the trial by the instruments of accusatorial trials, namely cross-examination and opposing

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1950 *R v Reed* [2010] 1 Cr App R 23, 310 at 335.

1951 *R v Reed* [2010] 1 Cr App R 23, 310 at 335.

1952 Law Commission (UK) 2011:16.

1953 Law Commission (UK) 2011:16.

1954 Law Commission (UK) 2011:18.

1955 Law Commission (UK) 2011:18.

experts.[1956] But cross-examination has been found to be sadly unable to provide protection against unreliable expert evidence.[1957]

In its published report of 2011, the United Kingdom Law Commission submitted several proposals on the strengthening of the rules pertaining to the admissibility of expert evidence. According to the Commission, expert evidence should only be admissible if the court has been satisfied that it is sufficiently reliable to be admitted.[1958]

Expert evidence can safely be regarded as sufficiently reliable if, firstly, the evidence is founded upon sound theories, methodology and assumptions. Here, the presiding judges will be under duty to evaluate the accuracy and robustness of the underlying principles and techniques used by the expert.[1959]

If the first test has been satisfied, the second requirement is complied with if the theories, methodology and assumptions have been properly applied to the facts of the particular case.[1960]

Lastly, reliability is achieved if the expert opinion is supported by those theories, methodologies and assumptions as applied to the facts of the particular case. This phase would compel the presiding judge to examine the expert's application of logical reasoning and the

1956 Law Commission (UK) 2011:18.

1957 Law Commission (UK) 2011:18; Shaw 2011:371.

1958 Law Commission (UK) 2011:19. See also Edmond and Roach 2011:345.

1959 Law Commission (UK) 2011:19.

1960 Law Commission (UK) 2011:19.

soundness of the conclusions drawn from the underlying methodology to the facts of the case.[1961]

These recommendations will arguably go a long way to improve the reliability of admitted expert evidence, since currently it appears that reliability assessment in England and Wales, just like in South Africa, is an issue to be addressed during weight determination of evidence, instead of an issue to be focused on in admissibility contemplations.[1962]

Finally, the Law Commission proposed that legislative provisions governing evidentiary reliability should be drafted to ensure legal certainty on the subject.[1963] Moreover, it was suggested that presiding judges should be afforded one set of guidelines to assist them in determining whether the test for scientific evidence was satisfied, and quite another set of guidelines to assist in the assessment of experience-based, non-scientific expertise.[1964]

This is welcome news indeed, since the English legal system has neglected to give much consideration to the gate-keeping role of presiding officers in criminal trials.[1965]

According to Shaw,[1966] judicial evaluation of scientific evidence in the English legal system should occur prior to the expert's testimony in

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1961 Law Commission (UK) 2011:19.

1962 Meintjes-Van der Walt 2001a:233.

1963 Law Commission (UK) 2011:20.

1964 Law Commission (UK) 2011:20. It was also suggested that such guidelines be included in legislation - Law Commission (UK) 2011:20.

1965 Meintjes-Van der Walt 2001a:233.

court, since judges suffer an inadequacy to effectively assess the reliability of expertise of all sciences and skills. Such evaluations must be conducted alongside an assessment of the expert's qualifications, which should also occur independently and impartially[1967]

The Law Commission report was concluded with a drafting of the Criminal Evidence (Experts) Bill, which represents these suggestions regarding possible legislative governance of admissibility deliberations.

6.3.4 The Republic of South Africa

6.3.4.1 Introduction

As previously mentioned the South African system of evidence, like the other jurisdictions under discussion, is of Anglo-American persuasion and accordingly follows an accusatorial system of proof.[1968] However, South Africa is unique from the other countries under investigation in that the employment of juries as fact-finders in criminal proceedings was officially abolished in 1969, while the evidentiary system designed for jury trials was retained.[1969]

Since then, magistrates and judges, who are legally trained individuals, have assumed fact-seeking responsibilities in criminal proceedings.[1970]

1966 2011:372.

1967 Shaw 2011:372.

1968 Schwikkard and Van der Merwe 2009:6.

1969 Schwikkard and Van der Merwe 2009:5. See also Meintjes-Van der Walt 2003:89. See para 2.3.4 above for an analysis of the historical development of expert evidence and scientific expertise in the South African justice system.

1970 Schwikkard and Van der Merwe 2009:13.

In South African criminal proceedings in Higher Courts, judges preside with mostly legally trained assessors,[1971] although Schwikkard and Van der Merwe[1972] comment that assessors are also increasingly being employed in lower court proceedings.

Judicial decision-makers, in the context of expert evidence, must determine both the admissibility, and thus relevance, of the evidence, but must also employ techniques in ascertaining the significance and probative weight of such evidence.[1973]

6.3.4.2 Admissibility and assessment of expertise in the South Africa criminal justice system

Locally, admissibility of evidence in general in criminal proceedings is regulated statutorily by way of the Criminal Procedure Act 51 of 1977, and the Civil Proceedings Evidence Act 25 of 1965.

Section 210 of the Criminal Procedure Act[1974] stipulates that no evidence pertaining to any fact shall be admissible if such evidence is

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1971 Meintjes-Van der Walt 2003:89. Assessors assist presiding officers in fact-finding but do not participate in deciding legal issues. Lay assessors are also employed in criminal trials but the presiding officer is under duty to then ensure the assessors understand the basic principles of evidence evaluation – Schwikkard and Van der Merwe 2009:13-14.

1972 2009:13.

1973 Meintjes-Van der Walt 2000:319.

1974 51/1977. Interestingly, the South African Law Reform Commission (SALRC) has suggested that these statutory regulations be substituted with novel legislation. The SALRC recommends in the *Review of the Law of Evidence (Hearsay and Relevance)* (Discussion paper 113, Project 126), that codified rules defining relevance be formulated, as is the approach in Australia and New Zeeland. While no such regulations have been generated as yet, the prudence of such codification is questionable in light of the abstract nature of relevance determination – Schwikkard and Van der Merwe 2009:57-58.

irrelevant and incapable of proving or disproving any fact at issue in criminal proceedings. Simply put, irrelevant evidence is inadmissible.[1975]

A similar stipulation is contained in section 2 of the Civil Proceedings Evidence Act,[1976] which reads that any immaterial or irrelevant evidence regarding any fact, matter or thing which cannot prove or disprove any fact in issue, shall be inadmissible.

The categorisation of evidence as relevant is by no means a concrete determination, but rather a matter of degree,[1977] subject to reason and logic.[1978] In *R v Matthews and Others*,[1979] Schreiner JA[1980] described the essence of relevancy:

> Relevancy is based upon a blend of logic and experience lying outside the law. The law starts with this practical or common sense relevancy and then adds material to it or, more commonly, excludes material from it, the results being what is legally relevant and therefore admissible.

The premise of this statement was confirmed in *S v Zuma*,[1981] in which the presiding officer added that in establishing relevancy, no court can

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1975 Schwikkard and Van der Merwe 2009:45. Reference is made here to irrelevant evidence, the negative form, since not all relevant evidence is necessarily admissible. Exclusionary rules pertaining to hearsay, unconstitutionally obtained evidence, as well as evidence obtained in breach of privilege are examples of possible highly relevant evidence being excluded from trial – Schwikkard and Van der Merwe 2009:45.

1976 25/1965.

1977 Schwikkard and Van der Merwe 2009:46. This is in contrast to admissibility itself, which is not a matter of degree, but rather a concrete determination. Evidence is either admissible or not – Schwikkard van Van der Merwe 2009:20.

1978 Zeffertt *et al* 2003:219. See para 4.2 above for an examination of proof of fact and rational adjudication in the criminal justice process.

1979 1960 (1) SA 752 (A).

1980 *R v Matthews* 1960 (1) SA 752 (A) at 758.

1981 2006 (2) SACR 191 (W).

ever separate such a determination from the facts of the particular case.[1982]

The imperative nature of facts can be better understood in light of the judgment of the Appellate Division in *R v Mpanza*,[1983] when the court held that facts are deemed relevant "…if from their existence inferences may properly be drawn as to the existence of a fact in dispute."[1984]

Ascertaining precisely when an inference can safely be made is, according to Zeffertt *et al*,[1985] "…determined by commonsense [*sic*], according to every-day standards of reason prevailing at the time of a particular case, and that much depends on the experience of the judicial officer."

While this is a relatively generic description of what exactly relevance constitutes, a more particular illustration of the term might be offered: Relevance, in the context of evidence presented in criminal proceedings, can be illustrated as being a sufficiently intimate relationship between two facts that, either taken by itself or in connection with other facts, proves or renders probable the past, present, or future existence or non-existence of the other.[1986]

1982 *S v Zuma* 2006 (2) SACR 191 (W) at 199.

1983 1915 AD 348.

1984 *R v Mpanza* 1915 AD 348 at 352. See also *R v Trupedo* 1920 AD 58 at 62.

1985 2003:219-220.

1986 Stephen 1930:3-4. See also Zeffertt *et al* 2003:220; Schwikkard and Van der Merwe 2009:46. Of course, this is applicable to both the *facta probanda* as well as the *facta probantia* in a criminal case – Schwikkard and Van der Merwe 2009:47.

Ascertainment of relevancy also demand that courts pay heed to the persuasive value of the particular evidence, in other words, its probative weight.[1987] In *S v Shabalala*,[1988] the court clarified this position:

> Naturally, the distinction between admissibility and weight must not be blurred. On the other hand, if the latter is so inconsequential and the relevance accordingly so problematical, there can be little point in receiving the evidence.[1989]

It is thus clear that in determining whether a reasonable inference could be made from the proffered evidence, the court must assess whether there is sufficient weight to later assist the court in its fact-finding duty.[1990] At this stage, namely the admissibility stage, the court is not concerned with final weight determination of the evidence, but merely weight approximation.[1991]

Once admitted, evidence does not cease to be functional and important. At the end of the trial, the presiding judge must perform a final evidence assessment to ascertain whether, collectively, the evidence carries sufficient weight to discharge the burden of proof.[1992]

1987 Schwikkard and Van der Merwe 2009:20. While the final assessment of evidential weight is made at the end of the trial, this preliminary assessment is referred to as provisional assessment of the evidence and occurs during trial while the admissibility of the evidence is determined – Schwikkard and Van der Merwe 2009:49.

1988 1986 (4) SA 734 (A).

1989 *S v Shabalala* 1986 (4) SA 734 (A) at 743. Interestingly, Nestadt AJA qualified his decision in averring that the finding to exclude the evidence on the conduct of dogs in criminal investigations, subject to judicial precedent, is not set in stone, and that if the reliability of the evidence can be substantially increased, it could become relevant and therefore admissible – *S v Shabalala* 1986 (4) SA 734 (A) at 743. In this manner, the presiding judge also underscored the fact that relevancy determination is a matter of degree and cannot occur within a vacuum – Zeffertt *et al* 2003:220.

1990 Schwikkard and Van der Merwe 2009:49.

1991 Schwikkard and Van der Merwe 2009:49.

1992 Schwikkard and Van der Merwe 2009:20, 49.

Opinion evidence is generally excluded from criminal proceedings as it is the court's function to draw inferences and form an opinion from the facts in the case.[1993] At present, however, accepted practice in South Africa is that if it appears clear from a consideration of the issues in a particular case that the opinion of a witness will undoubtedly assist the court in deciding the issues at hand, that opinion evidence is relevant to proceedings, and by this virtue admissible as evidence.[1994]

Unsurprisingly, there are cases where courts are in dire need of the opinions of expert witnesses to inform and instruct the court on issues that fall beyond the court's knowledge.[1995] The definition of who would be considered expert witnesses and under which circumstances these specialists would be required to serve court, have been demarcated in case precedent.[1996]

In *Gentiruco AG v Firestone SA (Pty) Ltd*[1997] the court focused on the admissibility of expert opinion, as opposed to the opinion of a lay witness, and held that the authentic test of the admissibility of the opinion of an expert witness is whether the court can receive "appreciable help" from that witness on the specific issue at hand.

1993 Zeffertt *et al* 2003:289. See also Meintjes-Van der Walt 2001a:229.

1994 Schwikkard and Van der Merwe 2009:83. See also Zeffertt *et al* 2003:300. Unless, of course, the evidence is disqualified from admission by some exclusionary rule like, for instance, the rule against the admission of evidence unconstitutionally obtained - Schwikkard and Van der Merwe 2009:83.
Para 2.3.4 above contains a discussion on the historical development of admissibility in South African criminal courts as well as the definition and scope of expert witnesses in the South African context.

1995 Zeffertt *et al* 2003:300-301.

1996 Zeffertt *et al* 2003:301.

1997 1972 (1) SA 589 (A).

Zeffertt *et al*[1998] explicate the matter as follows:

> The opinion of expert witnesses is admissible whenever, by reason of their special knowledge and skill, they are better qualified to draw inferences than the judicial officer.

The court in *Ruto Flour Mills Ltd v Adelson*[1999] extended the demarcation of admissible forensic expert opinion by directing that such evidence will be admitted when the expert in question possesses greater skill than the court on a given matter, and is thus able to significantly assist the judicial decision-maker. The trial court can, in fact, request the expert to provide an answer to the very issue the court must decide.[2000]

The court defined anew six requirements for expert forensic evidence in the early twenty-first century in the case of *S v Engelbrecht*.[2001] *In casu* the court held that, firstly, the matter in which the expert is summoned to court must necessitate specialised skill and knowledge. Secondly, the expert must possess sufficient experience and skill to warrant the title of 'expert.' Thirdly, the expert testimony must be adequately relevant to a matter in issue to be established by court. Fourthly, the significance of the expert evidence must not be exaggerated so that it supersedes the competencies and duties of the court. Fifthly, the

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1998 2003:299.

1999 1958 (4) All SA 198 (T).

2000 Schwikkard and Van der Merwe 2009:93. This is, of course, in conflict with the 'ultimate issue rule' which dictates that experts may not express opinions on questions which the court has to decide. This rule is problematic in that it fails to recognise the fact that in some cases an expert will struggle providing an opinion without touching upon the ultimate issue – Meintjes-Van der Walt 2001a:237.

2001 2005 (2) SACR 41 (W) at 54: paras 23-31.

opinion that the expert renders in court must be proved by admissible evidence, which can either be facts within the personal knowledge of the specialist, or founded upon facts demonstrated by others. Lastly, the specialist opinion must never usurp the function of the court.[2002]

Forensic experts will only be considered thus if they are expressly qualified or trained to render such evidence, and it is the duty of the presiding judge to determine whether the purported expert has, in fact, sufficient qualifications to provide the court with information and instructions beyond the court's own set of knowledge.[2003]

Meintjes-Van der Walt[2004] describes experts as individuals possessing adequate specialised knowledge, skill, training or experience to permit them to provide the court with information that falls beyond the knowledge pool of average persons. At present, specialist witnesses in South African courts need not have any formal qualifications or have acquired expertise in a profession. The essential requirement is that the expert has achieved adequate knowledge from experience.[2005]

While expert witnesses are duty-bound to provide the court with knowledge and assistance, they are also obliged to communicate the

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2002 *S v Engelbrecht* 2005 (2) SACR 41 (W) at 54-55: para 26. Regarding the last point it must not be forgotten that it is not the function of the expert to decide the case, but only to provide the court with tools to assist it in deciding cases – see *S v Ncube and Others* 2011 (2) SACR 471 (GSJ) at 478.

2003 Zeffertt *et al* 2003:291, 302; Schwikkard and Van der Merwe 2009:97. See also *Menday v Protea Assurance Co Ltd* 1976 (1) SA 565 (E) at 569. This requirement complies with the second requirement for admissible expertise as set out in *S v Engelbrecht* 2005 (2) SACR 41 (W).

2004 2000a:772.

2005 2000a:773.

foundational data upon which their inferences were based, and consequently allow the court to draw the inferences itself.[2006]

Tshiqi JA in the case of *Seyisi v The State*[2007] affirmed that forensic experts are theoretically required to support their opinions with valid reasons. According to Schwikkard and Van der Merwe,[2008] providing the court with adequate reasons will strengthen the probative value of such evidence.

However, history dictates that once relevance and expertise have been determined, the real dilemmas appear. Courts seem unable to critically assess and confirm the reliability of an expert's conclusions.[2009] This can result in erroneous judgments based on fallacious forensic evidence that appear, on the face of it, trustworthy. In *S v Nthati en 'n Ander*,[2010] the court conceded that it would have accepted the forensic evidence and convicted the accused in the matter before it had the defence expert not drawn attention to the errors in the proffered evidence.[2011]

2006 Zeffertt *et al* 2003:291, 304; Schwikkard and Van der Merwe 2009:97. See also *R v Herholdt and Others* 1956 (2) SA 714 (W) and *Ruto Flour Mills Ltd v Adelson* 1958 (4) SA 235 (T), and *Menday v Protea Assurance Co Ltd* 1976 (1) SA 565 (E) at 569. This requirement is analogous to the fifth requirement as set out in *S v Engelbrecht* 2005 (2) SACR 41 (W).

2007 (117/12) [2012] ZASCA 144 (28 September 2012). This case can be accessed at http://www.saflii.org/za/cases/ZASCA/2012/144.pdf. It confirms the dictum in *S v Ramgobin and Others* 1986 (4) SA 117 (N) at 146.

2008 2009:97. Historically, there has been some contrasting decision-making regarding the necessity of expert witnesses providing the court with reasons for their conclusions. See *R v Cele* 1943 AD 123 *versus S v Engelbrecht* 2005 (2) SACR 41 (W) at 55: para 26. See also the discussion on the judicial progress on the issue under para 2.3.4 above.

2009 *Menday v Protea Assurance Co Ltd* 1976 (1) SA 565 (E) at 569; and later reaffirmed in *William Grant & Sons Ltd and Another v Cape Wine & Distillers Ltd and Others* 1990 (3) SA 897 (C) at 912.

2010 1997 (1) SACR 90 (O).

2011 *S v Nthati en 'n Ander* 1997 (1) SACR 90 (O) at 94E-F.

> Ek kan nie anders as om my ergste ontsteltenis oor hierdie gebeure uit te spreek nie. Deskundige getuies behoort hul ondersoeke met die grootste mate van noukeurigheid en sorgsaamheid te verrig.[2012]

In *S v Van As*,[2013] the presiding judge defined two separate scenarios in reliability assessment of expert evidence. In the first scenario, the forensic expert testifying before a criminal court provides an opinion founded upon the view and estimations of recognised scholars in the particular sphere of forensics at hand.[2014] In the second scenario, the expert imparts an opinion based on the results of experiments and tests conducted by the expert himself.[2015]

In casu, Kirk-Cohen J declared that in cases such as the second scenario it is easier for the court to comprehend the evidence, to accept it and to rely on it in deciding the issue.[2016]

> Dit is die geval waar 'n deskundige nie alleen 'n mening vel nie, maar dit ook demonstreer deur feitlike en daadwerklike getuienis waarop dit gegrond word voor die Hof te lê.[2017]

2012 Cillié J in *S v Nthati en 'n Ander* 1997 (1) SACR 90 (O) at 94E-F.

2013 1991 (2) SACR 74 (W). *In casu*, the accused person, a member of the South Africa Police Service, was charged with murder after the deceased, a detainee at the relevant station, was found with a gunshot wound to the head in the police offices. The firearm used in the death belonged to the accused, but the version put forward by the defence was that the deceased had grabbed the firearm from his holster and shot himself - *S v Van As* 1991 (2) SACR 74 (W) at 77-82.

2014 *S v Van As* 1991 (2) SACR 74 (W) at 86. Courts take no issue with evidence provided by experts who have gained their expertise by reading and studying rather than own observation. Opinions on scientific matters usually involve reliance upon information provided by others – Zeffertt *et al* 2003:302.

2015 *S v Van As* 1991 (2) SACR 74 (W) at 86.

2016 *S v Van As* 1991 (2) SACR 74 (W) at 86.

2017 *S v Van As* 1991 (2) SACR 74 (W) at 86. The accused in this matter was finally convicted of culpable homicide.

This approach was confirmed and applied in *Seyisi v The State.*[2018] In this non-reported matter, decided in the Supreme Court of Appeal in 2012, the appellant was accused and convicted of 1025 counts of fraud, after orchestrating unsanctioned payments of social welfare grants to fictitious persons by attaching her own fingerprints to payment vouchers. All the counts were taken together for purposes of sentencing and the appellant was ultimately condemned to five years' imprisonment. She appealed her convictions only.[2019]

The most damning of the evidence against the appellant was forensic fingerprint evidence connecting her with the crime. During the trial, however, the appellant made no objection to the testimony of the state's fingerprint expert and providing the court with no rebuttal evidence.[2020]

Notably, the court seemed at ease with accepting the fingerprint evidence since the expert compared the unknown and reference prints himself and explained this with some clarity to the court.[2021]

> Where the expert has personally conducted experiments it is easier for the court to follow the evidence, accept it and rely on it in deciding the issue.[2022]

Tshiqi JA[2023] held on appeal that where the state's forensic expert provided the court with credible evidence, the trial court was obliged to

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2018 (117/12) [2012] ZASCA 144 (28 September 2012).

2019 *Seyisi v The State* (117/12) [2012] ZASCA 144 (28 September 2012) at para 1-2.

2020 *Seyisi v The State* (117/12) [2012] ZASCA 144 (28 September 2012) at para 12.

2021 *Seyisi v The State* (117/12) [2012] ZASCA 144 (28 September 2012) at para 12.

2022 Tshiqi JA in *Seyisi v The State* (117/12) [2012] ZASCA 144 (28 September 2012) at para 12.

2023 *Seyisi v The State* (117/12) [2012] ZASCA 144 (28 September 2012) at para 12. See in this regards also *S v Nzimande* 2003 (1) SACR 280 (O) at 283.

accept that evidence as being *prima facie* proven against the appellant. Moreover, an onus then descended upon the defence to challenge the facts that were now considered *prima facie* proven. *In casu*, the appellant did not dispute any of the fingerprint evidence proffered during the expert's testimony and it thus stood as undisputed evidence that, by law, had to be ultimately accepted as proven evidence.[2024]

What is worthy of note is that this decision was delivered in September of 2012, three years after the publication of the report by the National Academy of Sciences (NAS), in which the myth of the accuracy and reliability of friction ridge analysis was finally abolished.[2025] Despite the damning averments in this report, as well as international case law indicating courts' distrust of this type of evidence, the *status quo* of fingerprint evidence reliability in South Africa appears to endure.[2026]

In South Africa then, as in the England and Wales legal system, forensic evidence reliability seems to be a matter for consideration when probative weight is ascertained, rather than a factor determining admissibility.[2027]

Assessing the probative value of scientific evidence presents the presiding judge with additional difficulty,[2028] as it does in the other

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2024 *Seyisi v The State* (117/12) [2012] ZASCA 144 (28 September 2012) at para 12-13.

2025 National Academy of Sciences 2009:5-12. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011. See also in this regard the American cases of *State of Maryland v. Bryan Rose* (2007) In the Circuit Court for Baltimore County. Case No. K06-545, as well as *United States v Llera Plaza I* 179 F Supp 2d 492, 504 (ED Pa Jan 2002). See para 5.2.2.1 above for a discussion of fingerprint evidence and its limitations.

2026 This will be discussed at greater length later in this section.

2027 Meintjes-Van der Walt 2001a:233.

2028 Zeffertt *et al* 2003:305.

jurisdictions under discussion. Presiding officers, in their capacity as judicial decision-makers, are generally powerless in confirming the inferences drawn by experts' during their testimonies.[2029]

It seems at odds that expert witnesses would be required to provide information matters outside the scope of normal human understanding, while expecting lay[2030] judges (and jurors in England and Wales) to decide on this highly technical type of evidence.[2031]

Where experts for the prosecution and defence provide the court with conflicting opinions, the problem is even more pronounced.[2032] In these instances, the court must examine the rationale for the differing opinions. However, if the rationale reaches beyond the understanding of the presiding officer, assessment of such evidence will revert to tentative factors such as the witnesses' reputation and experience.[2033]

According to Meintjes-Van der Walt,[2034] the court will not gain any insight into the reliability of expert evidence from considering factors such as witness credibility or demeanour.

2029 Zeffertt *et al* 2003:305; 2003a:352.

2030 That is, judges without training in that particular area of expertise.

2031 Meintjes-Van der Walt 2000a:773.

2032 Meintjes-Van der Walt 2003:89. This "problem" of assessing scientific evidence that seems to haunt judicial decision-makers, is astutely referred to by Meintjes-Van der Walt as "decision-maker's dilemma" – Meintjes-Van der Walt 2000c:60.

2033 Zeffertt *et al* 2003:305. See in this regard also *S v Malindi* 1983 (4) SA 99 (T) at 104-105.

2034 2003a:352.

However, according to Zeffertt *et al*,[2035] the practical reality of assessing conflicting expert opinions is not as simplistic as considerations of credibility, and they refer to the civil case of *Michael and Another v Linksfield Park Clinic (Pty) Ltd and Another,*[2036] decided in the Supreme Court of Appeal, as resourceful guide in assessing opposing opinions.

In casu, the issue to be determined by court was the alleged liability of the defendant, which includes considerations of reasonableness and negligence. While both parties pressed their respective experts for comments on the very issues of reasonableness and negligence, the court maintained that those were matters for the judicial decision-maker's consideration.[2037]

> …it is perhaps as well to re-emphasise that the question of reasonableness and negligence is one for the Court itself to determine on the basis of the various, and often conflicting, expert opinions presented. As a rule that determination will not involve considerations of credibility but rather the examination of the opinions and the analysis of their essential reasoning, preparatory to the Court's reaching its own conclusion on the issues raised… That being so, what is required in the evaluation of such evidence is to determine whether and to what extent their opinions advanced are founded on logical reasoning… The court must be satisfied that such opinion has a logical basis, in other words that the expert has considered comparative risks and benefits and has reached 'a defensible conclusion.'[2038]

2035 2003:306.

2036 2001 (3) SA 1184 (SCA). In this matter, a young boy had collapsed into a persistent vegetative state after undergoing corrective nasal surgery during which he had suffered cardiac arrest under general anaesthesia. His parents instituted a delictual claim for damages based on medical negligence in the High Court at Johannesburg. The case in trial court and on appeal was dismissed – *Michael and Another v Linksfield Park Clinic (Pty) Ltd and Another* 2001 (3) SA 1184 (SCA) at 1192, 1201.

2037 *Michael and Another v Linksfield Park Clinic (Pty) Ltd and Another* 2001 (3) SA 1184 (SCA) at 1200 para 34.

2038 *Michael and Another v Linksfield Park Clinic (Pty) Ltd and Another* 2001 (3) SA 1184 (SCA) at 1200 para 34, 36, 37. See also *S v Ncube and Others* 2011 (2) SACR 471 (GSJ) at 478.

This case underlines the obligation on experts to provide the court with meticulously considered reasons for their opinions and the dedicated employment of logical reasoning in communicating findings to court.

Nevertheless, the complexity of scientific evidence, judicial fact-finders' struggle to assess evidence of a highly intricate and technical character, and the subsequent danger that presiding officers may reach conclusions on the basis of evidence not fully understood, have given rise to the speculation that judicial fact-finding based on common sense and logical reasoning is no longer appropriate.[2039]

> The dilemma of conflicting expert opinions has in South Africa resulted in courts being unable to rely on expert evidence.[2040]

In 2009, in the case of *SMD Telecommunications CC v Mutual and Federal Insurance Company Ltd,*[2041] the court again dealt with conflicting expert opinions, where two physicians provided the court with two divergent medical views. In its judgment, the court discussed

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2039 See in this regard Meintjes-Van der Walt 2003a:352-353. In fact, Damaška underscored the widening chasm between reality as observed by natural senses and reality as uncovered by specialised faculties specifically designed to clarify all that falls beyond observation by the natural senses – Damaška 1997:143. See discussion in Meintjes-Van der Walt 2000c:60.

2040 Meintjes-Van der Walt 2000:320.

2041 (5450/2005) [2009] ZAWCHC 147 (18 May 2009). For a thorough discussion of this case, see Meintjes-Van der Walt 2011:213-217. In this matter, a contract of insurance existed between the parties according to which the defendant endeavoured to compensate the plaintiff in the event of disability or death of one of its managerial staff, subject to conditions. When one of the plaintiff's managers passed away seven months after a debilitating motor vehicle accident, the defendant repudiated the claim, claiming that the death fell outside the scope of the contract of insurance. The plaintiff instituted a claim in the Western Cape High Court. The plaintiff argued that due to the serious injuries sustained during the vehicle accident the deceased suffered such deteriorations in his health that it ultimately resulted in his death. The defendant disputed this, submitting that the deceased was at high risk prior to the collision, that he already suffered from severe health problems and that it could not possibly be said that the vehicle accident resulted in his death, as would be required for the insurance claim to pay out - *SMD Telecommunications CC v Mutual and Federal Insurance Company Ltd* (5450/2005) [2009] ZAWCHC 147 (18 May 2009) at para 1-20, 21-23, 37-39.

the American *Daubert*-decision[2042] and the admissibility criteria for expert evidence that was formulated in this case, suggesting that such criteria would be of great use in cases where expertise requires assessment.[2043] The scene was set for the incorporation of some *Daubert*-criteria into the South Africa criminal justice system.

Yet, despite entering into an analysis of the *Daubert*-case, the court, in comparing the testimonies of the two experts, ultimately reverted back to considerations of credibility and demeanour, indicating that the court prefers the expert for the plaintiff since the defendant's expert was "less impressive," aggressive and less meticulous in attempting to assist the court than the plaintiff's expert.[2044]

Then, when the *SMD Telecommunications CC*-case went on appeal in 2010 in the Supreme Court of Appeal,[2045] the presiding judge, in reference to the case of *Michael and Another v Linksfield Park Clinic (Pty) Ltd and Another,*[2046] confirmed that in deciding on opposing expert opinions, the court must evaluate whether and to what extent their opinions are based on logical reasoning.

By this time, however, courts were clearly cognisant of scholars' criticisms of this 'logical reasoning' approach to conflicting evidence.

2042 *Daubert v Merrel Dow Pharmaceuticals, Inc.* (1993) 509 U.S. 579.

2043 *SMD Telecommunications CC v Mutual and Federal Insurance Company Ltd* (5450/2005) [2009] ZAWCHC 147 (18 May 2009) at para 57-61.

2044 *SMD Telecommunications CC v Mutual and Federal Insurance Company Ltd* (5450/2005) [2009] ZAWCHC 147 (18 May 2009) at para 63. The court ultimately also found in favour of the plaintiff.

2045 *Mutual and Federal Insurance Co Ltd v SMD Telecommunications CC* (486/2009) [2010] ZASCA 133 (1 October 2010) at para 17.

2046 2001 (3) SA 1184 (SCA). For a discussion on this case, see para 6.3.4.2 above.

The court *in casu* then relied on other factors to assist it in determining the more reliable of the two conflicting expert opinions. These factors include the fact that the preferred expert confirmed his opinion with reference to scholarly articles and journals, the lack of empirical proof of the conflicting opinion, and the fact that the opposing expert conceded the logical nature of the preferred expert's hypothesis.[2047]

Meintjes-Van der Walt[2048] astutely points out that the first two factors considered by court *in casu* reflect not the current directives set out in case precedent, but rather the internationally growing trend[2049] to examine expert scientific evidence according to the scientific method.[2050] It is regrettable that despite the court *a quo*'s apparent optimism regarding the *Daubert*-case's influence in South African law, the court on appeal failed to integrate any *Daubert*-criteria into South African law of evidence.[2051]

6.3.4.3 Judicial assessment of forensic evidence in South Africa

2047 *Mutual and Federal Insurance Co Ltd v SMD Telecommunications CC* (486/2009) [2010] ZASCA 133 (1 October 2010) at para 25-27.

2048 2011:216.

2049 According to Vuille, the *Daubert*-criteria have started to spread its influence across Europe Vuille 2011:41. In the England and Wales legal system, the Criminal Evidence (Experts) Bill schedule to section 4(3) contain some *Daubert*-criteria among the reliability rules for assessing expert evidence – see Meintjes-Van der Walt 2011:217.

2050 This, of course, originates from the rule articulated in the *Daubert*-case, stating that where scientific evidence is offered during trial, evidentiary reliability will be based on scientific validity.

2051 Meintjes-Van der Walt 2011:216.

While no serious challenges have been launched against the validity and reliability of fingerprinting evidence in South Africa,[2052] warnings have been sounded regarding the potential for future contestation of such evidence based on the very science upon which it is founded.[2053] Additionally, challenges to the admissibility of fingerprint evidence, as well as other disciplines of forensics, may be launched on the grounds of evidence collection, the integrity of the chain of evidence, laboratory analyses, match probability determinations, and much more.[2054]

Individuals not specifically trained in friction ridge analysis are not competent to testify as experts. Similarly, judicial decision-makers are not qualified to formulate their own opinion regarding the probability of a fingerprint match.[2055]

In 1981, the court in *S v Segai*[2056] held that the preferred procedure for proving fingerprint evidence in court was to provide the court with comparative charts containing the prints of the accused before court, as well as the fingerprints lifted from the crime scene, in order to prevent

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2052 Meintjes-Van der Walt 2006:156. See para 5.2.2.1 above for a discussion on the problems identified with fingerprint evidence in criminal proceedings.

2053 Meintjes-Van der Walt 2006:171-172. Moreover, the case of *State of Maryland v. Bryan Rose* (2007) in the Circuit Court for Baltimore County, Case No. K06-545, launched warning flags across the world when the court excluded fingerprinting evidence on the basis that the technique is unverifiable without clearly defined rates of error - *State of Maryland v. Bryan Rose* (2007) in the Circuit Court for Baltimore County, Case No. K06-545 at page 31. National Academy of Sciences 2009:1-7. http://www.nap.edu/catalog. php?record_id=12589. Accessed on 19/04/2011.

2054 Meintjes-Van der Walt 2006:172.

2055 Zeffertt *et al* 2003:308. See *R v Morela* 1947 (3) SA 147 and *R v Nzama* 1953 (2) SA 628 (W).

2056 1981 (4) SA 906 (O). The accused was charged with housebreaking with intent to steal and theft.

the court from having to blindly accept the testimony of the expert.[2057] The court also maintained that every expert lifting latent prints and comparing those prints must be called to testify.[2058] It is unacceptable that one expert testifies on behalf of all those involved in the specific case.

Some years later, in *S v Malindi*,[2059] the court was confronted with opposing expert opinions regarding fingerprint evidence. The accused person appealed against three convictions on charges of housebreaking with intent to steal and theft, after three different fingerprint experts testified to the presence of his fingerprints on the scenes of the burglaries.[2060] At trial, the defence called upon its own fingerprint specialist who proceeded to challenge the factual observations and inferences made by die state experts, including criticism of the seven point-similarity between the prints, concluding that the unknown prints from the scenes could not without reasonable doubt be connected with the accused person.[2061]

In deciding which of the two sets of experts' opinions were to be followed, the court confirmed that while it is incapable of itself judging the similarities and dissimilarities in the prints, the court must consider

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2057 *S v Segai* 1981 (4) SA 906 (O) at 908-909. Standard procedure dictates that the friction ridge analyst will frame enlarged photographs of the two compared prints, one from the crime scene and the other from the accused, side by side and mark the points of similarity. When attending the trial, the analyst must re-take in the accused's prints in court and compare it again with the prints lifted from the scene of the crime – Schwikkard and Van der Merwe 2009:399. These photographs are then presented to court during expert testimony.

2058 *S v Segai* 1981 (4) SA 906 (O) at 909.

2059 1983 (4) SA 99 (T).

2060 *S v Malindi* 1983 (4) SA 99 (T) at 99.

2061 *S v Malindi* 1983 (4) SA 99 (T) at 100.

"…doubtful factors such as the rival witnesses' reputations and experience."[2062]

In this regard the court of appeal confirmed the approach of the trial court, which was to select the opinions proffered by the state experts, as the expert for the defence possessed vastly less practical experience than the specialists for the prosecution.[2063]

This raises the questions whether, in South Africa, the court is relieved of any responsibility to understand the science presented to it, and whether it merely has to trust the expert?

In *S v Nyathe*[2064] the court had to consider the validity of the conviction against the accused where the only evidence connecting the accused to the crime of housebreaking was fingerprints found on the scene of the offence. The fingerprint expert that testified at proceedings provided no reasons for his inferences that the accused's prints and those collected from the scene were a match.[2065] Van Coller J[2066] held the following regarding the fingerprint evidence:

> Dit is nie vir die hof nodig om self 'n opinie oor die punte van ooreenstemming te gee nie. Die hof beskik nie oor die nodige opleiding,

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2062 *S v Malindi* 1983 (4) SA 99 (T) at 104-105. Confirming what was suggested by Zeffertt *et al* 2003:305.

2063 *S v Malindi* 1983 (4) SA 99 (T) at 106. Appeal was dismissed.

2064 *S v Nyathe* 1988 (2) SA 211 (O). The accused *in casu* was convicted of housebreaking with intent to steal and theft. The matter was referred to regional court for sentencing but the regional court magistrate had certain doubts regarding the conviction and submitted the case for review in terms of section 304(3) of the Criminal Procedure Act 51 of 1977 - *S v Nyathe* 1988 (2) SA 211 (O) at 213.

2065 *S v Nyathe* 1988 (2) SA 211 (O) at 214.

2066 *S v Nyathe* 1988 (2) SA 211 (O) at 214-215.

> spesiale studie en tegniese kennis wat daarvoor nodig is nie. Die hof mag egter nie die deskundige se opinie blindweg aanvaar nie. Dit is nodig dat die deskundige die aard van die punte van ooreenstemming so duidelik as moontlik verduidelik. Hierdie ondersoek is nie daarop gerig om self die punte van ooreenstemming te bepaal nie, maar om tevredenheid te verkry dat die deskundige se mening met veiligheid aanvaar kan word.[2067]

But the expert in this matter did not, in fact, provide reasons for his inferences, although the comparative charts submitted to court did indicate the points of reference. The court accepted this as sufficient proof that the prints from the scene and those obtained from the accused are identical.[2068]

Did the court then in this instance accept the fingerprinting evidence blindly into evidence, in contrast to courts' duty not to do so?
The court held the following:

> Opiniegetuienis kan egter na gelang van omstandighede beide toelaatbaar en genoegsaam wees sonder enige uiteensetting van die gronde waarop die betrokke opinie gebaseer is.[2069]

In consideration of admissibility of the evidence in the absence of reasons provided by the expert, the court went on to apply the *dictum* in *R v Smit*[2070] in support of its conclusion that the evidence, though unsupported, was in fact admissible.[2071] In this Appellate Division case, the court affirmed that the admissibility of fingerprint evidence is not subject to the production of the impressions in court:

2067 *S v Nyathe* 1988 (2) SA 211 (O) at 214-215.

2068 *S v Nyathe* 1988 (2) SA 211 (O) at 215.

2069 *S v Nyathe* 1988 (2) SA 211 (O) at 215. In this regard the court referred to *S v Claassen* 1976 (2) SA 281 (O).

2070 1952 (3) SA 447 (A). The accused in this matter was convicted of theft of a motor vehicle after it was shown that his fingerprints were on the outside of the vehicle in question.

2071 *S v Nyathe* 1988 (2) SA 211 (O) at 216.

> Die voorlegging van die folien, hoewel dit tot verduideliking of stawing van die deskundige se getuienis mag gedien het, was dus *nie 'n vereiste vir die toelaatbaarheid daarvan nie*. Ewe min kan ons sy getuienis uitwis…omdat hy nie in uitdruklike woorde gesê het dat hy die bottelafdruk met die erkende vingerafdruk vergelyk het nie, of die toetse wat hy gemaak het, beskrywe het nie; want wanneer hy as deskundige 'n mening uitspreek, moet *prima facie* verstaan word dat hy die nodige gedoen het om tot 'n gevolgtrekking te geraak. *Die waarde van sy getuienis is 'n ander saak*; maar dit is nie hier ter sprake nie…[2072] (Own emphasis)

In *S v Nyathe* the court, after accepting the evidence, deliberated upon the weight of the fingerprint evidence and listed the factors that the court relied on. These included the fact that the expert demonstrated his expertise in the sphere of friction ridge analysis, that both the control prints taken in court and the initial prints obtained from the accused were correctly taken and the probability of mistakes in comparing those two sample were less then when comparing any sample with the unknown print, that the comparative charts were available to court if the court intended to confirm the points of similarity,[2073] and finally, that the defence at no point during the trial contested the fingerprint evidence.[2074]

The court then states that because of these considerations and discussions, it cannot be said that the court blindly followed the expertise provided to court.[2075]

The court, inexplicably, also states the following:

2072 *R v Smit* 1952 (3) SA 447 (A) at 451-452.

2073 Though it is uncertain how the court intends to do this if, at the beginning of its judgment, the court conceded that it is in no position to render judgment upon the results of the expert's comparisons.

2074 *S v Nyathe* 1988 (2) SA 211 (O) at 216-217.

2075 *S v Nyathe* 1988 (2) SA 211 (O) at 217.

> Weliswaar bestaan die moontlikheid van oneerlikheid aan die kant van die deskundige wel. Voor die deskundige in die getuiebank gaan, besef hy egter dat hy ondervra gaan word en die moontlikheid dat die deskundige valslik sal getuig dat hy die vergelyking gedoen het, kom my as 'n uiters geringe moontlikheid voor.[2076]

The justification for the court's conclusion in this regard is unclear and there is no mention of potential error rates in friction ridge analysis, and no opportunity to evaluate the correctness of procedures followed in the process of print comparison.

These decisions, despite the fact that they are not always representative of cases in which conflicting opinions are offered, imply a tendency of over-reliance on expertise and the presence of any reasonable explanation by the testifying specialist.

It would appear that during the establishment of admissibility in these decisions, courts completely disregard the preliminary weight estimation phase,[2077] and move exclusively to the determination of admissibility. Final assessment of the weight of scientific evidence is then left to the end of trial. Should the final ascertainment of probative weight then reveal that the weight is insignificant, it would, by virtue of the demarcation provided by Nestadt AJA in *S v Shabalala,*[2078] render the evidence not only useless, but inadmissible from the start.

2076 *S v Nyathe* 1988 (2) SA 211 (O) at 217.

2077 Schwikkard and Van der Merwe 2009:49. See also *S v Shabalala* 1986 (4) SA 734 (A) at 743. See para 6.3.4.2 above for a discussion on admissibility and weight determination in South African courts.

2078 1986 (4) SA 734 (A) at 743. The court held that if the weight of evidence is so inconsequential that it adversely affects the relevancy of the evidence to the facts, there is little point in admitting the evidence into trial – *S v Shabalala* 1986 (4) SA 734 (A) at 743.

Yet, in some cases, fair distrust of this type of evidence has been revealed. In *S v Khanyile*[2079] the court was of the opinion that reliance on the expert alone was insufficient in convincing the court of the accuracy of the findings. The evidence should be closely examined to eradicate, as far as is feasible, all risk of error.

In this matter, Law J[2080] described the duty of the court in cases where any doubt existed regarding the accuracy of fingerprint evidence:

> It seems to me that in such a case the least that a judicial officer can do is to question the fingerprint expert, requesting him to point out the alleged points of identity and to explain his reasons for saying that they are such. Once that has been done the judicial officer should be in a position to decide whether the expert's conclusions can be said to be acceptable and reasonable, whether or not he himself can actually observe the alleged points of identity.[2081]

While the *Khanyile*-case represented reasonable hope that judicial decision-makers would immerse themselves in the science of fingerprinting, 1989 saw a decision in which old habits were confirmed. In *S v Davids; S v Dladla*,[2082] the court briefly considered the fingerprints before it and held the following:

> …I do not, in any event, agree that fingerprint cases are especially complex. Unless the purpose of the defence is to attack what is nowadays regarded as virtually axiomatic, namely that no two fingerprints are exactly alike, it remains a factual matter of comparison only… The courts in any event are told to scrutinise such evidence closely to eliminate, as far as humanly possible, the risk of error.[2083]

2079 1984 (3) SA 756 (N) at 759.

2080 *S v Khanyile* 1984 (3) SA 756 (N) at 760.

2081 *S v Khanyile* 1984 (3) SA 756 (N) at 760.

2082 1989 (4) SA 172 (N).

2083 *S v Davids; S v Dladla* 1989 (4) SA 172 (N) at 200.

Since this judgment in 1989, judicial decision-makers have not yet had the opportunity to consider either the scientific validity, or the admissibility and reliability of fingerprint evidence. Since the NAS report was published in 2009, it has become clear, both from the report and international case law,[2084] that it is poorly supported by scientific validation studies and that the notion of it enjoying a zero error rate is wholly unattainable.[2085] Errors, both in the methodology followed and in human judgment to follow, can occur within a discipline of forensic science in which judgment is applied, particularly if the methods and factors employed to reach the judgment is poorly documented,[2086] as seems to be the case in South African case law where comparative charts need not even be submitted to achieve ultimate admissibility.[2087]

The NAS suggested in its report that documentation of fingerprint evidence must be improved to the point where the entire analysis can be accurately reconstructed. This includes data on the collection of latent prints, the evaluation of the prints, the comparisons, and an elucidation of the inferences drawn.[2088] This will provide presiding judges with additional information on which to assess the reliability of friction ridge analysis.[2089]

2084 See para 5.2.2.1 above.

2085 National Academy of Sciences 2009:5-12. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

2086 National Academy of Sciences 2009:5-13. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

2087 See above discussion on the matter. See also *S v Malindi* 1983 (4) SA 99 (T).

2088 National Academy of Sciences 2009:5-13. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

2089 National Academy of Sciences 2009:5-13. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

Much research is required to confirm the unique nature of fingerprints and the factors which affect quality of lifted fingerprints.[2090] Such research in South Africa is profoundly necessary, particularly in light of the Israeli discovery that two separate individuals can have seven points of friction ridge similarity.[2091]

Regardless, in the arena of assessing scientific evidence, judicial decision-makers cannot rely blindly on expert witnesses and require a reliable scientific background to adequately and effectively deal with the difficulties inherent in this type of evidence.[2092]

The case of *S v Van der Vyver,*[2093] in which the prosecution constructed a case against the accused based mainly on traditional forensic sciences, advances an unsettling warning against the continued refusal of role-players in the criminal justice system to become immersed in knowledge of science and scientific methodology.

In casu, the accused was charged with murdering a young woman by assaulting her with an ornamental hammer-bottle-opener, and then stabbing her several times with a sharp object. The accused raised an alibi defence, maintaining that at the time of the incident, he was at his place of work in a neighbouring town.[2094]

2090 National Academy of Sciences 2009:5-13. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

2091 See Epstein 2002:610-611.

2092 Meintjes-Van der Walt 2003a:355.

2093 [2008] JOL 21332 (C). See also Visser and Oosthuizen 2010:567-577 for a discussion of this case.

2094 *S v Van der Vyver* [2008] JOL 21332 (C) at para 1.

The prosecution's case consisted of circumstantial evidence only, with bloodstain and footwear impression analysis, fingerprint evidence and wound reconstruction being the most significant disciplines of forensic science involved in the case against the accused.[2095]

The bloodstain pattern analysis involved the examination of a singular transferred blood smear on the floor of the victim's guest bathroom, alleged by the prosecution's expert to have been deposited by a bloody shoe belonging to the accused.[2096] In support of this allegation the expert witness submitted an affidavit in terms of section 212(4)(*a*) and section 8(a) of the Criminal Procedure Act 51 of 1977, averring, *inter alia*, that the blood smear and the under-surface of the accused person's right shoe shared certain class and unique characteristics.[2097]

Attached to the expert witness's affidavit was a statement by the same witness in which he reported a consultation with the world's most renowned specialist in the field of footwear impression evidence.[2098] The State's expert claimed that the latter verbally confirmed his

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2095 *S v Van der Vyver* [2008] JOL 21332 (C) at para 4.

2096 *S v Van der Vyver* [2008] JOL 21332 (C) at para 59.

2097 Class characteristics refer to those features that are produced by a controlled process and they are employed to classify similar objects into groups. In other words, it is identifying features. Unique or individualising characteristics are traits generated by a random, uncontrolled process and are used to individualise objects to a common origin – Inman and Rudin 2001:118, 129.

2098 *S v Van der Vyver* [2008] JOL 21332 (C) at para 69. The American expert, Mr. William John Bodziak, holds a Master's of Science degree in forensic science and practiced as forensic consultant for the Federal Bureau of Investigation for 29 years, during which time he both consulted and taught in the arena of footwear impression evidence – Bodziak 2000:xiii. His treatise on shoe impressions, *Footwear impression evidence: Detection, recovery, and examination*, published in 2000, is widely accepted as the most authoritative work on the subject - *S v Van der Vyver* [2008] JOL 21332 (C) at para 73.

findings, and in so doing strengthened the inference that the accused had been in the victim's apartment around the time of the murder.[2099]

Following examination-in-chief of the prosecution's expert it would appear that the court considered the evidence reasonable.[2100] This opinion, however, was soon reconsidered under the weight of the allegations and revelations during cross-examination, and completely modified in light of expert witnesses for the defence.

During cross-examination it was revealed that not only could the State's expert not convince his own colleagues of his findings,[2101] but he never obtained the world renowned expert's concurrence with regard to his evidence.[2102] When this expert, as well as two additional footwear impression experts from the United Kingdom and United States of America respectively, testified for the defence and each independently provided the court with their expertise on the matter, the State expert's evidence was exposed as being both significantly unscientific as well as deceptive.[2103]

In the final assessment of the evidence presented during trial, the court held that the testimony of the prosecution's shoe print witness was to be

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2099 *S v Van der Vyver* [2008] JOL 21332 (C) at para 71.

2100 *S v Van der Vyver* [2008] JOL 21332 (C) at para 84.

2101 *S v Van der Vyver* [2008] JOL 21332 (C) at para 69.

2102 *S v Van der Vyver* [2008] JOL 21332 (C) at para 72-78. While the State's expert did in fact visit Mr. Bodziak and requested his input, it was Bodziak's later testimony that the evidence material submitted to him was inadequate for a proper examination, that he never confirmed any of the State expert's findings, and that the findings were, in fact, substantially flawed - *S v Van der Vyver* [2008] JOL 21332 (C) at para 72-78.

2103 *S v Van der Vyver* [2008] JOL 21332 (C) at para 72-85.

wholly rejected on the basis of its unreliability and misleading nature. The court accepted the defence's expert evidence since it was, in all respects, based on paradigms of logic and scientific validity.[2104]

It may be argued that if there had been a blind acceptance of the contents of the affidavit submitted in terms of section 212(4)(a) of the Criminal Procedure Act,[2105] it is unlikely that the full extent of the unreliable nature of the prosecution's expert would have been exposed. This echoes Cillié J's concern in *S v Nthati en 'n Ander*,[2106] where the court agonised over the probability of convicting the accused before court had it not been for the illuminating evidence provided by the defence expert.[2107]

Following the bloodstain evidence, the prosecution *in casu* presented the court with a ballistics expert[2108] from the South African Police Service's forensic laboratory, who provided evidence concerning the wound creation, and, more specifically, that an ornamental hammer belonging to the accused, was employed as murder weapon in the deadly assault on the victim.[2109]

2104 *S v Van der Vyver* [2008] JOL 21332 (C) at para 83-84.

2105 51/1977.

2106 1997 (1) SACR 90 (O).

2107 *S v Nthati en 'n Ander* 1997 (1) SACR 90 (O) at 94E-F.

2108 It is unclear why a recognised expert in ballistics would experiment and subsequently testify in matters concerning wound creation, and thus effectively, forensic pathology. Following the testimony provided by the defence expert, a celebrated forensic pathologist, the State made it clear that it would also call a forensic pathologist in rebuttal of the defence expert's evidence, but this was never done - *S v Van der Vyver* [2008] JOL 21332 (C) at para 110.

2109 *S v Van der Vyver* [2008] JOL 21332 (C) at para 86, 94.

Once again the court conceded that the expert for the prosecution provided compelling evidence during examination-in-chief.[2110] However, defence counsel proceeded with immensely knowledgeable cross-examination and revealed the perturbingly unscientific foundations upon which the State expert based his conclusions. These perturbing revelations were exacerbated by the defence expert's evidence that the court found to be clearly founded on scientific technique.[2111]

Here, in final analysis, the court found that the expert for the prosecution did not provide the court with any appreciable assistance in deciding the issues at hand.[2112] Considering the requirements of expert evidence admissibility,[2113] it stands to reason that this evidence would have been rendered inadmissible from the start, had it been evaluated by scientists or individuals familiar with scientific technique.

2110 *S v Van der Vyver* [2008] JOL 21332 (C) at para 109. The expert for the prosecution testified that the ornamental hammer that was seized from the accused person's possession was employed as murder weapon. In order to prove this, the expert proceeded to examine the nature and extent of the deceased's wounds and compare this with the dimensions of the hammer's surfaces. To demonstrate the similarities, the expert set out to induce similar wounds in animal carcasses with the specific hammer in question, and then, by using transparencies of the induced wounds, compare it to those wounds suffered by the deceased - *S v Van der Vyver* [2008] JOL 21332 (C) at para 94, 96.

2111 *S v Van der Vyver* [2008] JOL 21332 (C) at para 98-110. During cross-examination, for example, it was revealed that the photographs taken of the wounds in the animal carcasses were not taken in compliance with rules of forensic photography, which resulted in the distortion of apparent wound sizes compared to reality. However, a more perturbing problem revealed during cross-examination, was that the accused person's ornamental hammer bent severely backwards after the first or second blow to the animal's carcass. The bend was of such a serious extent that another hammer, much larger than the actual ornamental hammer, was obtained to further the experiments. However, this was never mentioned by the expert in his affidavit, or in *viva voce* testimony in court. In addition, the transparencies employed to demonstrate the similarities of the wounds, suffered tremendous criticism for the unscientific manner with which it was performed - *S v Van der Vyver* [2008] JOL 21332 (C) at para 98-99, 107.

2112 *S v Van der Vyver* [2008] JOL 21332 (C) at para 108.

2113 See para 6.3.4.2 above.

Finally, the prosecution offered expert evidence on friction ridge analysis, claiming that the accused person's fingerprints were lifted from a DVD cover that the victim rented on the afternoon of her murder.[2114] So overwhelming was the expert evidence for the defence,[2115] that the prosecution approached another friction ridge expert at the SAPS's forensic laboratory. When this expert confirmed the findings of the defence specialists, the State conceded to court that it would no longer rely upon the fingerprint evidence, although it had already been presented.[2116]

In acquitting the accused on the allegations against him, the court articulated its disappointment in the pre-trial investigations conducted in the case, and voiced its suspicion that there were never any sufficient grounds or evidence upon which the accused was charged.[2117]

In 2008, the accused in the *Van der Vyver*-case[2118] launched a civil claim for damages from the South African Minister of Safety and Security on grounds of malicious prosecution.[2119] In the particulars of

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2114 *S v Van der Vyver* [2008] JOL 21332 (C) at para 113.

2115 Two internationally distinguished fingerprint experts testified for the defence that the accused person's latent fingerprint, while present in the victim's home (which is wholly reasonable and expected since they were in a romantic relationship) could not have been found on the DVD cover. Both experts proceeded to express their opinions that the faulty expert evidence proffered by the prosecution was intentionally fabricated evidence - *S v Van der Vyver* [2008] JOL 21332 (C) at para 126.

2116 *S v Van der Vyver* [2008] JOL 21332 (C) at para 124. While the court did assess the evidence presented, it rejected the prosecution's evidence and accepted the defence's as the truth - *S v Van der Vyver* [2008] JOL 21332 (C) at para 140-143.

2117 *S v Van der Vyver* [2008] JOL 21332 (C) at para 184.

2118 [2008] JOL 21332 (C).

2119 *Van der Vyver v Minister van Veiligheid en Sekuriteit van die Republiek van Suid-Afrika* (7875/2008) [2008] ZAWCHC 431 (15 Augustus 2011). In this matter the allegation of malicious prosecution was not directed at the National Prosecuting Authority, but rather at the instigator of the criminal charges against the plaintiff, that was, in the estimation of the

claim the plaintiff cited the three pieces of misleading forensic evidence employed by the State in attempting to prove the plaintiff's guilt in the criminal trial, as the modes of instigation to ultimately move the National Prosecuting Authority (NPA) to institute charges against the plaintiff.[2120]

From the court's judgment in this matter it appears evident that the pre-trial forensic investigations were, in fact, pierced with actions of negligence and even at times recklessness.[2121] The court ultimately found that the defendant was indeed maliciously responsible for the unwarranted prosecution of the plaintiff.[2122]

But, distressingly, from both the criminal trial and the subsequent civil action, it is not only errors from the forensic investigators that elicit concern. It appears clear from perusal of both cases that the office of the National Director of Public Prosecutions was well aware of the dubious forensic evidence it was about to present as evidence of an individual's guilt that would, if accepted by court, ensure conviction and long-term incarceration of the accused. Realising that the ornamental hammer could not truly be connected with the murder, that the friction ridge analysis evidence was inept, and that the blood smear evidence

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plaintiff, the office of the Minister of Safety and Security in its capacity as employer of the South African Police Service officials who conducted the criminal investigation, including the forensic analyses, against him.

2120 *Van der Vyver v Minister van Veiligheid en Sekuriteit van die Republiek van Suid-Afrika* (7875/2008) [2008] ZAWCHC 431 (15 Augustus 2011) at para 8.

2121 *Van der Vyver v Minister van Veiligheid en Sekuriteit van die Republiek van Suid-Afrika* (7875/2008) [2008] ZAWCHC 431 (15 Augustus 2011) at para 20, 25-26, 28.

2122 *Van der Vyver v Minister van Veiligheid en Sekuriteit van die Republiek van Suid-Afrika* (7875/2008) [2008] ZAWCHC 431 (15 Augustus 2011) at para 36. The matter of *quantum* in this instance was deferred to a later date for determination.

was fallacious, the prosecution nevertheless continued.[2123] In fact, during the civil proceedings, the primary prosecutor in the criminal trial conceded that he had misgivings regarding the blood smear evidence but that the expert maintained his point of view:

> …hy is seer sekerlik geregtig op sy opinie en dat die opinie getoets word deur die Hof, en kom ons sit dit dan maar in die skaal.[2124]

Allowing the presentation of recognised fallacious evidence into court is an infringement of prosecutors' duty.[2125] It has already been established that the primary function of prosecutors is to institute criminal justice proceedings on behalf of the state, as well as to assist the court in reaching a just verdict in court.[2126] It cannot be reasonably said that presenting court with misleading evidence will assist it in reaching just decisions.

To prevent this failure of prosecutors' decision-making task, it is necessary for prosecutors to acquire an understanding of science and scientific technique in order to confidently recognise and exclude erroneous and misleading evidence from obscuring the truth from the court.

2123 *Van der Vyver v Minister van Veiligheid en Sekuriteit van die Republiek van Suid-Afrika* (7875/2008) [2008] ZAWCHC 431 (15 Augustus 2011) at para 31. In fact, the American footwear impression expert who was falsely said to agree with the South African expert, contacted the NPA telephonically to express his ardent disagreement with the findings of the prosecution's witness - *Van der Vyver v Minister van Veiligheid en Sekuriteit van die Republiek van Suid-Afrika* (7875/2008) [2008] ZAWCHC 431 (15 Augustus 2011) at para 27.

2124 *Van der Vyver v Minister van Veiligheid en Sekuriteit van die Republiek van Suid-Afrika* (7875/2008) [2008] ZAWCHC 431 (15 Augustus 2011) at para 29.

2125 Saks 2001:425. See also para 6.2.3 above.

2126 Meintjes-Van der Walt 2006a:278

It is clear that while it is rational, and sometimes justified, to impugn the problems pertaining to scientific pre-trial investigations and investigators, the dismal problem extends much wider than merely pre-trial role-players.

While current practice in the English and South African criminal justice systems dictates that evidence reliability assessment is a problem only to be addressed once the weight is determined instead of when admissibility is considered,[2127] it is submitted here that this is not ideal. If judicial decision-makers were well versed in understanding forensic science, inadmissibility would be determined earlier in criminal proceedings, which would unavoidably have an impact on the length, and thus the costs of a trial. It may arguably also facilitate decisions regarding immediate discharges in terms of section 174 of the Criminal Procedure Act,[2128] if presiding officers were in a position to recognise fallacious or otherwise inadmissible evidence presented during the case for the prosecution.

> Lack of special tutoring in different fields of expert evidence may lead to judges placing undue reliance on the mere *ipse dixit* of the expert, or to judges relying unrealistically on the qualifications or experience of the expert…[2129]

2127 Meintjes-Van der Walt 2001a:233.

2128 51/1977. Section 174 of this Act stipulates that if, at the close of the case for the prosecution at any criminal trial, the court is of the opinion that there is no evidence that the accused committed the offence referred to in the charge or any offence of which he may be convicted on the charge, it may return a verdict of not guilty.

2129 Meintjes-Van der Walt 2006b:177. While the court in *Associated Institutions Pension Fund v Van Zyl* 2005 (2) SA 302 (SCA) instructed that in certain areas, such as actuarial science, the training, skill, experience and intricacies involved will justify judicial deference to the expert witnesses, it is recommended that even in these circumstances the concession is made with care.

While faulty, unscientific and misleading application of forensic science will always be abhorred in the strongest possible terms, especially by the very practitioners of science, it is unreasonable and contrary to the provisions of the law of evidence to exclusively rely on the honesty and competence of testifying experts to ensure that the science employed to prove facts, is trustworthy.

The responsibility to ensure fair and just findings in criminal proceedings rests upon all role-players in the criminal justice system. Investigating officers, prosecutors, legal representatives, as well as judicial fact-finders must exercise concerted effort in achieving the truth, which includes assessment and critical consideration of scientifically intricate and technologically advanced evidential material.

6.4 CONCLUSION

The once symbiotic relationship between science and law seems to have been tainted with time and the apparent inability of law to remain on par with science.

Nevertheless, science, and specifically forensic science, remains the lifeblood of proof of fact in criminal proceedings. In an attempt to exercise authority over the dominion of science in law of evidence, common law countries have cultivated tests to ascertain which scientific testimony should be submitted to the judicial decision-maker to help ascertain the truth.[2130]

[2130] Imwinkelried 2011:8.

Courts are generally more comfortable with these admissibility tests and proxies, since it has been undeniably proven that courts are ill-equipped to assess the merits of scientific theory and methodology,[2131] and presiding officers generally lack the scientific education and training to undertake and decide legal contests.[2132]

While lack of scientific knowledge is rampant amongst judicial decision-makers, it is also distressingly lacking in the vast majority of investigating officers and legal practitioners.

The disconcerting research performed by Horvath and Meesig,[2133] in which it was revealed that of all the crimes investigated by detectives, including cases that result in convictions, the vast majority do not involve physical evidence,[2134] is telling of the unrealised potential of forensic science in solving crime. Moreover, it appears that this state of affairs does not represent any failings on the side of forensic science, but rather the manner of practice and limitations of police investigations.[2135]

Since the real value of physical evidence relies upon detectives' ability to interpret it, to realise its potential application and possible

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2131 Imwinkelried 2011:9.

2132 Imwinkelried 2011:10.

2133 1996:963.

2134 Most investigators were found to prefer relying on traditional modes of case resolution, such as admissions and confessions – Horvath and Meesig 1996:964.

2135 Horvath and Meesig 1996:968.

meaning,[2136] it is vital that investigating officers are made familiar with the intricacies of forensic science.

Without such familiarisation, forensic science could cease entirely to be useful in criminal investigations.[2137]

Saks[2138] reports that immense changes in laws of evidence regulating the admissibility of expert evidence, as well as mounting public concern regarding the disconcerting incidence of wrongful convictions, have inescapably altered the duties of both prosecutors and legal representatives pertaining to expert evidence.

Prosecutors' responsibility in guiding criminal investigation, as well as their duty to ensure only *prima facie* cases are put before court, necessitates an understanding of the sciences that participate in criminal litigation. Moreover, prosecutors are considered to have a duty to screen cases for invalid or even falsified evidence.[2139]

There is no reason why lawyers intending to offer expert evidence during trial cannot take the time to research the science involved and themselves ascertain the strength of the scientific foundation and the logic from which the expert drew his conclusions.[2140]

2136 Horvath and Meesig 1996:964.

2137 Horvath and Meesig 1996:964.

2138 Saks 2001:436-437.

2139 Saks 2001:425.

2140 Saks 2001:426.

With the high burden of proof the prosecution has to satisfy, it is essential that prosecutors have sufficient proficiency in matters of science to effectively present, cross-examine and argue on issues pertaining to expert evidence.[2141]

> …potential problems inherent in the use of expert evidence for the prosecution of crime can be far-reaching and of paramount importance to the primary function of the prosecuting authority to institute criminal justice proceedings on behalf of the State.[2142]

Cross-examination is considered to be one of the accusatorial system's most effective instruments in testing the reliability of scientific evidence, and great faith is thus invested in the competence of the cross-examiner.[2143] Effective cross-examination of specialist witnesses, however, may require a careful understanding of the nature of expertise and the specific science.[2144]

Presiding officers are critical of defence counsel's inability to properly test forensic evidence during cross-examination.[2145] The poor quality of some scientific evidence in criminal trials and especially the incapability of legal practitioners to challenge such evidence when they have no experts of their own to guide them, have been condemned by judicial decision-makers.[2146]

2141 Meintjes-Van der Walt 2006a:277.

2142 Meintjes-Van der Walt 2006a:278.

2143 Meintjes-Van der Walt 2003:100.

2144 Meintjes-Van der Walt 2003c:61-62.

2145 See in this regard also Shaw 2011:371.

2146 Law Commission (UK) 2011:5.

Research conducted by Lieberman *et al*,[2147] revealed that jurors, in executing the virtually impossible task of assessing complicated DNA evidence, can, in fact, be educated on the limitations and dangers of DNA, "…depending on the expertise and effectiveness of the defense attorney."

> Without adequate cross-examination, most jurors were not cognizant of the potential for observer effects or the importance of proficiency testing and therefore were unable to accurately assess the reliability of the lab… Thus, the way in which the defense attorney questioned the quality of the lab in the cross-examination is what ultimately affected verdicts.[2148]

Lay jurors can therefore be informed of issues of science by proper and intelligent cross-examination by legal practitioners for the defence,[2149] but this necessitates a comprehensive understanding of scientific principles and methodology by legal practitioners.

In addition to the importance of legal representatives filtering 'junk science' by way of cross-examination, it is also vital that evidence submitted in South Africa under section 212 of the Criminal Procedure Act 51 of 1977 be tested for unreliability and, more importantly, that unreliable evidence proffered in this manner is recognised by the opposing counsel. Challenges to such evidence are unlikely to be raised if the defence possesses no mentionable familiarity with scientific technique.

In review of the different jurisdictions' rules of expert evidence admissibility it appears clear that the legislature and judicial precedent

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2147 2008:50.

2148 Lieberman *et al* 2008:50-51.

2149 Lieberman *et al* 2008:52.

in the United States of America take very seriously the objective of formulating effective rules of evidence.

While much hope was placed in the *Daubert*-trilogy and the resultant legislative developments pertaining to expert evidence admissibility in the United States of America, it appears from research that, since the formulation of the *Frye*-test in 1923, not much has changed regarding the greater volume of admissibility of expertise.[2150] Instead, it appears that the accomplishment was to raise the general awareness of presiding judges to the dilemma of unreliable or 'junk' science.[2151]

> …whether a jurisdiction nominally follows *Frye* or *Daubert*, the practical results are essentially the same.[2152]

The *Daubert*-paradigm, which focuses on scientific validity, relevance and reliability, employs testability, peer-review, error rate determinations, control standards and general acceptance as parameters of validity and reliability. Moreover, the standard relies heavily on the perusal of the underlying scientific foundation of the technique used to establish validity. At every opportunity American courts attempt to refine and expand the *Daubert*-test to ultimately establish a flexible standard which can be adjusted to the case at hand.

Despite every effort by the American judiciary, problems with the *Daubert*-standard endure and 'junk science' does not appear to be vetoed by their efforts.

2150 Cheng and Yoon 2005:491-502.

2151 Cheng and Yoon 2005:474.

2152 Cheng and Yoon 2005:474.

The England and Wales legal systems are in the process of great development pertaining to their admissibility rules for expert evidence. Common law requirements still govern the admissibility determinations in English courts. They include four requirements, namely the extent to which the expert can provide assistance to the court (indicates relevance), relevant expertise, impartiality and, most importantly, evidence should be sufficiently reliable before being admitted.[2153]

In this approach one finds an inherent paradox of expert evidence in the legal system. Expert witnesses are expected to assist the court in matters that go beyond the knowledge and experience of the court, yet, simultaneously, the court, represented by lay judges and jurors, must ultimately adjudicate upon this expert evidence.[2154]

The current common law approach to evidence admissibility in England and Wales is considered inadequately robust, generally reflecting a permissive approach to expert evidence admissibility in the English legal system.[2155] Moreover, trial judges are provided with no to little assistance on the manner in which reliability is to be assessed in practice.[2156]

The consequence of this permissive standard is that criminal courts in the English legal system very infrequently rule expert evidence

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2153 Law Commission (UK) 2011:13, 15. See *R v Turner* [1975] QB 834, *R v Dallagher* [2002] EWCA Crim 1903, [2003] 1 Cr App R 12 at 29; *R v Reed* [2010] 1 Cr App R 23 at 111.

2154 Meintjes-Van der Walt 2000a:773.

2155 Law Commission (UK) 2011:16.

2156 Law Commission (UK) 2011:18.

inadmissible on the grounds of unreliability.[2157] The tendency in this jurisdiction is to admit expert testimony on the assumption that its reliability will be effectively challenged during the trial by the instruments of accusatorial trials, namely cross-examination and opposing experts.[2158] But cross-examination here too, has been found to be sadly unable to provide protection against unreliable expert evidence.[2159]

In both these systems, courts have attempted to provide guidelines in assessing evidence reliability. Yet in both systems, it has failed.

In South Africa too, very little protective measures exist to truly and effectively prevent fallacious expert evidence from entering the courtroom. As appeared from the *Van der Vyver*-case,[2160] immense dangers exist in this jurisdiction that faulty and fabricated forensic evidence can still penetrate our courts. This, accompanied with the fact that South Africa seems hesitant to truly engage in the formulation of *Daubert*-like criteria for reliability determinations, is cause for concern.

It appears that in South Africa, judicial decision-makers prefer to render decisions on admissibility, typically allowing admission of any evidence presented by scientists, but retreating from the challenge of assessing the weight of scientific evidence. According to Meintjes-Van der Walt,[2161] this phenomenon could be explained by the fact that common

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2157 Law Commission (UK) 2011:18.

2158 Law Commission (UK) 2011:18.

2159 Law Commission (UK) 2011:18; Shaw 2011:371.

2160 *S v Van der Vyver* [2008] JOL 21332 (C).

2161 Meintjes-Van der Walt 2003:89.

law systems of evidence have not provided presiding officers with ample tools to evaluate expert testimony, thus shying away from such evidence and electing to decide cases on other available evidence.

To exacerbate this problem, immense advances in the spheres of forensic science available to the criminal justice system has greatly augmented the extent and the complexity of evidence that judicial decision-makers must confer probative value upon.[2162] Deliberating and drawing inferences from evidence not fully understood could result in dire consequences for entities ostensibly protected by the South African Constitution.

Despite the uncertainties and scepticisms surrounding the application of the *Daubert*-standard in American courts, there is a perceived optimism outside the United States regarding the capabilities of more stringent admissibility standards to improve the forensic science and the safety of criminal convictions.[2163]

Edmond and Roach[2164] are supportive of even more demanding standards for admissibility of expert evidence, proposing the introduction of "demonstrable reliability" whenever the state adduces expert evidence to support a criminal conviction.

2162 Meintjes-Van der Walt 2003:89.

2163 Edmond and Roach 2011:345.

2164 2011:345.

Simultaneously, Edmond and Roach[2165] also concede that the American experience with the *Daubert*-criteria issue vital warnings that are all too often unheeded by other jurisdictions at their own expense. The first of these warnings is the need for greater focus on the political economy of the administration of admissibility tests and the restrictions of accusatorial trials and appeals.[2166] Particularly, there is a distinct need for legal representatives to procure the necessary resources and skills to successfully dispute expert scientific evidence, and for presiding officers to have doctrinal and intellectual support to effectively render decisions regarding expert evidence.[2167]

Another warning issued by the ruling in the *Daubert*-case is that the flexible nature of the case can generate idealised models of experience-based expertise, or the so-called "non-sciences," which results in the less strict application of *Daubert* in assessing its admissibility.[2168]

> Accepting the need to apply admissibility standards flexibly, there is a danger that experience-based (and other) exceptions to *Daubert*-style criteria will be used to legitimate the *status quo* and circumvent the need for actually assessing reliability.[2169]

In the end, the question to address is whether a global system of law of evidence that is essentially failing to prevent the admission of questionable science, will support the use of DNA evidence, the golden

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2165 2011:346.

2166 Edmond and Roach 2011:346.

2167 Edmond and Roach 2011:346.

2168 Edmond and Roach 2011:346.

2169 Edmond and Roach 2011:346.

standard of forensic science, and if DNA will ultimately become the only science to be trusted in litigation.

Murphy[2170] warns:

> It stands to reason that a system that failed to stem the abuse of untested or faulty forensic evidence might also be ill-equipped to safeguard the use of more robust, complicated forms of such evidence, both in terms of assuring its integrity and fostering healthy scientific development. In fact…the very traits that make this new generation of forensic evidence so promising serve to raise concerns about the use of such evidence in the future. The series of scandals that have already besieged DNA typing, arguably the most sophisticated technique of the second generation, underscore the urgency of this claim.

[2170] Murphy 2007:724-725.

CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

7.1 CONCLUSIONS

7.1.1 Introduction

The current research embarked upon an investigation into the problems relating to evidence production in crime resolution, from the time of information detection on crime scenes, to presentation and acceptance of scientific evidence in criminal litigation.

The current uneasy relationship between law and science stands in contrast to intimate historical association between these two spheres of civilisation.[2171]

Interactions between science and law can be dated back as far as 9000 B.C. to 3000 B.C., to a time known as the Neolithic age.[2172] By the seventeenth century, great scientific contributions by, amongst others, Copernicus, Galileo, Newton, and Boyle affected the way the world was viewed and what methods were most appropriate for finding the truth[2173] and, specifically, altered the thought processes of the entire literate English society, including English jurists.[2174]

2171 See para 2.1 above.

2172 Wecht and Rago 2006:5.

2173 Shapiro 1969:728-729.

2174 Shapiro 1969:728-729.

During the seventeenth century in England, law and science instantaneously arrived at the same two great scholarly paradigms, namely the need for systematic arrangement and presentation of existing data into scientifically organised groups, and more pertinently, the increased awareness by both the spheres of science and law, for probability of truth, not the certainty of it.[2175] The search for absolute truth was thus replaced by probabilistic hypotheses and assessment of evidence to achieve truth beyond a reasonable doubt.[2176]

The interconnectedness of science and law has diminished over time as contemporary thinking demanded not only greater specialisation in the profession and its subdivisions, but also a greater autonomy of legal thought and reasoning. Practitioners, scholars and authors held the view that legal reasoning is, and should remain, separate from scientific reasoning.[2177]

7.1.2 Revisiting the collaboration between science and law

From a study of the modes of reasoning employed in criminal investigation and judicial decision-making it would appear that, subject to some differences and adjustments, logical inferences and probability determinations are communal in both science and law.[2178]

2175 Shapiro 1969:730.

2176 Shapiro 1969:729-730. See para 2.1 above for a discussion of the historical development of the relationship between science and law, and para 4.2 for an examination of logical reasoning in judicial adjudication.

2177 Shapiro 1969:727. See para 2.1.

2178 See paras 3.2. and 3.4 above.

Additionally, investigating officers frequently employ forensic science and scientific evidence to assist and direct them in criminal investigations.[2179] In the same manner, prosecutors apply forensic evidence in order to assist the court in finding the truth, and to ultimately prove its version of criminal events.[2180]

In South Africa, police investigators and state prosecutors typically rely on eyewitness testimony in both the detection of crime and to achieve successful conviction of guilty offenders. In addition, DNA evidence has emerged as the golden standard of forensic evidence and much reliance is placed on the results of DNA profiling.[2181]

It appears, both from research and the perturbing volume of wrongful convictions resulting from fallacious eyewitness identity descriptions, that an absolute reliance on eyewitness testimony is perilous to just judicial decision-making.[2182] Moreover, while DNA evidence has raised the bar regarding the validity of scientific evidence used in court, it is not often available and also subject to errors and misinterpretation.[2183] Even where it is accurate, DNA evidence may, depending on the circumstances of the case, not even possess any significant evidentiary value.[2184]

2179 See paras 3.2 and 3.3.

2180 Read Chapters 4 to 6, especially para 6.2.

2181 Butler 2010:2. See paras 4.3.1 and 4.4.

2182 See para 4.3.3 above.

2183 See para 4.4.4 above.

2184 See para 4.4.4.3.

DNA evidence is not nearly as infallible as once suggested. It has slowly started to permeate the minds of the scientific and legal communities that even this Achillean forensic tool has its limitations and vulnerabilities.[2185] Since it has also been suggested that a justice system that failed to curb admission of erroneous traditional forensic evidence will also fail to safeguard the use of DNA evidence,[2186] it may be reasonably expected that faulty DNA evidence will occasionally also be admitted.

What remains, and what must be submitted in the spirit of providing the judicial decision-maker with all relevant and admissible evidence, are the traditional forensic sciences.[2187] While these types of forensics, also referred to as first generation forensic sciences,[2188] are enormously valuable in investigating officers' endeavours to answer the '5WH formula'[2189] questions, it is not without its own challenges.[2190]

The report[2191] published by the American National Academy of Sciences (NAS) committee in 2009, recognised fundamental limitations in the capabilities of traditional forensic science disciplines to distinguish

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2185 See para 4.4.4.

2186 Murphy 2007:724-725. See para 6.4.

2187 See para 5.1 above.

2188 See para 3.3.3.3 above.

2189 See para 3.2.2 above.

2190 See para 5.2 above.

2191 National Academy of Sciences 2009:1-2. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011. See para 5.2.

valid information from evidence obtained on the crime scene.[2192] Most noteworthy of all identified problems was the absence of pervasive scientific research, the tremendous disaggregation in forensic practice, varying levels of education and training, conflicting standards for performance and in-house training, as well as insufficient professional opportunities like publishing or presenting research.[2193]

The NAS report warns that the practices of the traditional forensic sciences must be improved and standardised, so that an expanded and meticulous knowledge base, as well as a sophisticated research culture may ultimately be achieved.[2194]

It is one thing, however, that the disciplines of forensic science struggle with initiating and maintaining a research culture and developing sound scientific foundations. It is yet another that the criminal justice system fails to prevent doubtful forensic evidence from being presented as proof of fact.

From the 'marketplace' test in the United States of America, through the development and application of the *Frye*-, then the *Daubert*-standards, great expectation dictated the accurate determination of scientific reliability of evidence. Even the stakeholders in the England and Wales

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2192 National Academy of Sciences 2009:S11. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011. See para 5.2.

2193 National Academy of Sciences 2009:S11. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

2194 National Academy of Sciences 2009:1-3. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011.

legal system proposed the adoption of similar rules in the United Kingdom.[2195]

Yet significant dilemmas persist. The irregular application of the *Daubert*-test in some state level courts, and the *Frye*-standard in others, have resulted in an abundance of research to ultimately determine which of the standards is most conducive to achieving admission of reliable and accurate expert evidence.[2196]

The daunting revelations by Cheng and Yoon[2197] that the practical results of using either the *Frye*- or the *Daubert*-tests for admissibility are ultimately the same, would suggest that despite Europe's enthusiasm to adopt admissibility criteria similar to those contained in the *Daubert*-case, it may not provide the desired security against the admission of unreliable forensic evidence. It would appear that the *Daubert*-ruling's only accomplishment was to raise the general awareness of presiding judges to the dilemma of unreliable or 'junk' science.[2198]

It seems as though the manner in which courts manage expert evidence in fact-finding has not quite persevered along with the immense advances in scientific knowledge and specialisation,[2199] yet the diversity and complexity of forensic science, including DNA evidence, increases undeterred.

2195 House of Commons 2005:76. See para 6.3 above for an examination of the admissibility rules of the three jurisdictions under investigation.

2196 Cheng and Yoon 2005:472.

2197 2005:491-502. See para 6.3.2.3 above.

2198 Cheng and Yoon 2005:474. See para 6.3.2.3.

2199 Meintjes-Van der Walt 2006b:183.

Since the American, English and South African legal systems place the burden of judicial gate-keeping in the presiding officer, it stands to reason that judges must be thoroughly familiar with scientific principles and techniques to enable them to effectively evaluate the evidence. This, however, is not the case. Detectives and judicial personnel who are not familiar with the value of scientific evidence are less likely to use it effectively in their work.[2200] Additionally, forensic experts unfamiliar with the criminal justice process are less likely to conduct and report their analyses in the most effective manner.[2201]

The suggestion offered by Lieberman *et al,*[2202] that judges require some degree of training and continued education regarding DNA analysis, but especially traditional forensic sciences, is supported unequivocally. It is proposed that in South Africa especially, where judicial decision-makers enjoy few legal instruments with which to test scientific validity and reliability of forensic evidence and thus depend heavily on the opinion of the testifying specialist, presiding officers can no longer exercise judicial decision-making without scientific knowledge.

Recognising the paradox of non-scientist judges deciding issues regarding the use of science in court, the legal profession mostly agrees on the need for special measures to ensure the reliability of scientific evidence.[2203] Sadly, agreement ceases over how rigorously courts

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2200 Horvath and Meesig 1996:968.

2201 Horvath and Meesig 1996:968.

2202 Lieberman 2008:57.

2203 Black *et al* 1994:717.

should screen forensic evidence and what the applicable test of admissibility should look like.[2204]

Black *et al*[2205] are of the opinion that courts can and must improve, and that the only way to achieve this is for judges and legal practitioners to learn how scientists themselves evaluate scientific claims. They further suggest that notwithstanding the debates regarding the different admissibility tests, the determinative issue is the willingness of the court to undertake a meticulous and active review of the evidence.[2206]

Murphy,[2207] perhaps in view of the failure of the *Daubert*-system to effect any real change in reliability determinations in traditional forensic evidence, warns that the measures responsible for the admissibility of untested and fallacious evidence will also be inadequate to safeguard more complicated and robust scientific evidence, such as DNA.

Thus, if no tangible differences exist between defining measures such as the *Frye*- and *Daubert*-criteria, and legal systems generally fail to differentiate between reliable first and second generation forensic sciences, it is clear that dire need for reform is needed, and that such reform cannot be successfully effected without interdisciplinary exchange.

2204 Black *et al* 1994:717.

2205 Black *et al* 1994:719-720.

2206 Black *et al* 1994:743.

2207 2007:724-725. See para 6.4.

7.2 RECOMMENDATIONS

7.2.1 Introduction

It is perhaps safe to argue that both the disciplines of forensic science and law find themselves in imperfect circumstance. But perusal of the literature available on these subjects and encounters with practitioners in both spheres, would suggest that there is a great abundance of legal and scientific scholars, forensic analysts, physicians, police officers, detectives, legal practitioners, prosecutors, and presiding officers that are ready and able to improve on the current systems.

7.2.2 Recommendations pertaining to forensic science

The explosion of discoveries and advances in the arena of forensic science in the last few decades has launched immense progress, but there is much to improve upon still. This is evident from the report produced by the National Academy of Sciences in the United States of America following its tremendous investigative effort.[2208]

Perhaps the most significant advancement that may be achieved in forensic science is a fundamental and unimpeded expansion of research on traditional forensic sciences in order to establish valid scientific foundations for these sciences.[2209] While research in

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2208 National Academy of Sciences 2009. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011. See para 5.2 above for an examination of the problems in forensic evidence as presented by the NAS report. While all recommendations regarding the sciences, laboratory practice, quality standards, accreditation, and much more, are crucial to a healthy criminal justice system, detailed discussions of every aspect fall beyond the scope of this study and remarks will be limited to those relevant to the present research.

2209 See para 5.2.3 above.

bloodstain pattern analysis, for example, has provided the discipline with improved mathematical foundation,[2210] much more research is required to stabilise this discipline into a valid scientific technique, instead of remaining a purely interpretive exercise.

Moreover, it would be irreconcilable to expect legal practitioners and judicial decision-makers to encumber themselves with the acquisition of scientific knowledge, without expecting more from the forensic practitioners themselves. Forensic scientists practising for the South Africa Police Service should be required to obtain tertiary qualifications in the natural sciences and be encouraged to further their study, thus creating a much needed culture of research in forensic science.[2211]

The establishment of a regulating body for forensic science practitioners will be beneficial to the formulation of adequate standard operating procedures for aspects such a crime scene analysis and the different forensic analyses, as well as the enforcement of these protocols and other ethical guidelines in forensic investigations.

7.2.3 The law, expertise and decision-makers

Meintjes-Van der Walt[2212] suggests that dilemmas associated with scientific evidence can only be adequately addressed if due regard is given to the motivation for employing expert evidence, which is to assist

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2210 See para 5.3.2 and 5.3.3.

2211 See National Academy of Sciences 2009. http://www.nap.edu/catalog.php?record_id=12589. Accessed on 19/04/2011. In this regard, collaboration between tertiary educational institutions and forensic laboratories may enhance the exchange and development of forensic knowledge and complement the development of such a research culture.

2212 2003:92.

the judicial decision-maker both on issues beyond the scope of common knowledge, and in deciding the matters at hand. In this respect, it appears that notwithstanding the accusatorial nature of the South African system of procedure, forensic experts owe allegiance to the court, and not to either side of the legal dispute.[2213]

7.2.3.1 Experts' allegiance to the court

The successful admission and weight attachment of forensic evidence during criminal proceedings are directly impacted by the level of efficacy of evidence collection during the pre-trial stage.[2214] Following research for the National Prosecuting Authority (NPA), Meintjes-Van der Walt[2215] revealed that:

> …the optimal use of expert evidence by the prosecution depends on successful communication and co-operation between the South African Police Service investigators, South African Police Service forensic science laboratories and the prosecution… New developments in science and technology increase the potential assistance that prosecutors can gain from this knowledge and can reduce the likelihood of decision error.

While forensic analysts of the South African Police Service (SAPS) are currently employed under the South African Police Services Act 68 of 1995, it is recommended that these officials are withdrawn from employment under the SAPS and placed on independent footing alongside the NPA. All processes that will increase the level of impartiality in criminal and forensic investigation must be followed.

2213 Meintjes-Van der Walt 2003:92.

2214 Meintjes-Van der Walt 2006a:290.

2215 2006a:290.

7.2.3.2 Pre-trial disclosure

Disclosure of scientific evidence is entrenched in systems of criminal procedure in most accusatorial jurisdictions, yet the idea of defence disclosure remains shrouded in disagreement.[2216] Meintjes-Van der Walt[2217] advocates reciprocal disclosure of, particularly, expert evidence, which should include compelling defence counsel to provide the prosecution with the names of any expert witnesses it intends calling, as well as a summary of each witness's evidence.

This opinion is wholly supported. Instances where the purpose or duties of expert witnesses are described, both in scholarly research and case precedent,[2218] no distinction is ever made between experts for the state and those for the defence. Then, if it is accepted that the principle purpose of all experts testifying in court is to assist the court in matters beyond common knowledge and in deciding matters at hand, it is clear that the want of reciprocal disclosure would obscure forensic science in criminal trials even more than it already is, rather than educate and assist the judicial decision-maker.[2219]

2216 Meintjes-Van der Walt 2003:93.

2217 2003:93. See also Meintjes-Van der Walt 2006a:285-286.

2218 See in this regard Zeffertt *et al* 2003:299, *Gentiruco AG v Firestone SA (Pty) Ltd* 1972 (1) SA 589 (A), *Ruto Flour Mills Ltd v Adelson* 1958 (4) All SA 198 (T).

2219 See in this regard Meintjes-Van der Walt 2003:93. Such disclosure is unlikely to conflict with the accused's right against self-incrimination as contained in section 35(3)(*j*) of the Constitution of the Republic of South Africa of 1996, as the expertise for the defence would most probably be to the benefit of the accused. The only disadvantage the accused may suffer, according to Meintjes-Van der Walt, is the loss of the surprise element associated with trials by ambush – Meintjes-Van der Walt 2003:93.

Pre-trial disclosure is also consistent with accepted practice in Anglo-America legal traditions, in that it recognises the onus upon accused parties to disclose their defence, as well as the obligation to provide the opposition with notice of their intention to call expert witnesses.[2220] In the United States of America, for instance, the duty of reciprocal disclosure has been absorbed into legislation.[2221] Federal Rules of Criminal Procedure, under Rule 16(b)(1)(B), stipulate that if defence counsel submits a disclosure request to the prosecution, the defence obligates itself to share corresponding data with the prosecution.

The conundrum of conflicting expert opinions might also find appeasement within pre-trial disclosure and agreement. Meintjes-Van der Walt[2222] avers that some answers to the tremendous problem of conflicting expert opinions might be obtained in the inquisitorial tradition of procedure, where experts are expected to resolve their disputes amongst themselves, culminating in a joint report presented to court.

Pre-trial conferences should catalyse disclosure, but would also have the added benefit of accomplishing agreement on matters that would be conducive to an efficient and expeditious conclusion of trials.[2223] While pre-trial conferences do occur in South Africa, they rely on the willingness of both parties to participate since it is not currently statutorily regulated.[2224]

2220 Meintjes-Van der Walt 2006a:285.

2221 Saks 2001:432.

2222 2000:320-321.

2223 Meintjes-Van der Walt 2006a:287.

2224 Meintjes-Van der Walt 2006a:287.

Formulating legislation that would compel parties to a dispute to contribute to pre-trial conferences would ensure that all criminal disputes, regardless of the inclination of the legal representatives, enjoy the plethora of advantages of pre-trial agreement. Apart from resolving issues requiring expertise before trial and relieving the judicial decision-maker of the burden to assess matters of science, these conferences would shorten court time, and thus costs associated with lengthy trials, by identifying and narrowing issues in dispute.

Another possibility set forth by Meintjes-Van der Walt[2225] is, in true inquisitorial style, the appointment of court-appointed experts or assessors that would, at least theoretically, be impartial and unbiased in providing assistance to court. While it is unlikely that current South African presiding officers will employ the provisions in section 186 of the Criminal Procedure Act,[2226] section 145 of the Act provides for the appointment of assessors with the necessary and relevant skills.

7.2.3.3 Training and research

Training and research are arguably the most valuable considerations concerning the issues at hand. In both English and South African law, expert witnesses are not formally required to be professionally trained or qualified in the specific sphere in which they provide testimony.[2227] It

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2225 1996:364.

2226 51/1977. This section provides that the court may, at any time during the trial, subpoena any person as a witness at that trial if it is clear to the court that the evidence of such a witness is vital to the just decision of the case. The reason it is unlikely that courts will employ this statutory opportunity, stems from the accusatorial nature of proceedings in South Africa and judicial officers' respect for each party's strategies – Meintjes-Van der Walt 1996:365.

2227 Meintjes-Van der Walt 2003:94.

is sufficient to merely convince courts that they have been trained in their specific discipline or have obtained experience in that arena.[2228] With the advancement of science and technology employed in crime resolution it will become perilous for forensic scientists to rely on in-house training and experience. To sustain the increasing need for scientific validity and reliability, scientists must first be trained as scientists before exposure to forensic scenarios.

Investigating officers represent the most fundamental stage of evidence recovery.[2229] Currently, detective training provides minimal exposure to aspects of forensic science, and it is recommended that training bodies incorporate basic science education in these training courses. This is vital if any improvements are to be made in the evidence production capability of criminal investigations in South Africa.

Since the importance of an understanding of scientific methodology for both prosecutors and legal representatives has been demonstrated,[2230] it stands to reason that adequate training and education in scientific methodology are indispensable for all officers of the court.[2231]

> Investigating how expert evidence is usually developed in the pre-trial stage can focus legal decision-makers' attention on the fact that errors occurring in the pre-trial stage can cause weak links in the chain of expert evidence.[2232]

2228 Meintjes-Van der Walt 2003:94. See also *Menday v Protea Assurance Co (Pty) Ltd* 1976 (1) SA 565 (E).

2229 See para 6.2.2 above.

2230 See para 6.2 above.

2231 See Meintjes-Van der Walt 2006a:282.

2232 Meintjes-Van der Walt 2003:92.

While the immense workload of legal practitioners is likely to prohibit intensive study of forensic science, it is recommended that prosecutors be exposed to new developments and scientific methodology by frequently revising prosecutor practice manuals and offering regular workshop training on the subject of forensic science.[2233] Similar training opportunities can be offered to presiding officers. Regular upgrading of Magistrates' and Judges' Bench Books, as well as training by the Justice Colleges could provide judicial decision-makers with more confidence to decide upon matters of science.

The criteria for admissible scientific evidence in the United States of America formulated in *Daubert v Merrel Dow Pharmaceuticals, Inc.,*[2234] has set unprecedented guidelines for the admission of relevant, as well as reliable expert evidence. Another consequence resulting from this case is that presiding judges, now more than ever, have to exhibit scientific knowledge that includes familiarity with scientific technique.

Meintjes-Van der Walt[2235] has expressed the opinion that while the criteria articulated in the *Daubert*-case should not significantly influence South African courts on the matter of expert evidence admissibility, it should be considered in evidence evaluation.

Legal representatives acting on behalf of accused persons must realise the tremendous responsibility to avail themselves with forensic knowledge. Training and educational opportunities are not as readily

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2233 Meintjes-Van der Walt 2006a:293.

2234 (1993) 509 U.S. 579.

2235 2000:326-327.

available for lawyers as for prosecutors, and tertiary educational institutions must stand ready to fill this void in its arsenal of teaching.

The crucial role that institutions of higher education can fulfil in improving upon the criminal justice system is interminable.

According to Pfefferli,[2236] several science seminars and courses discussing scientific research and its application in the courtroom are available to presiding officers worldwide. However, these courses hardly ever focus on raising professional standards in a manner that reflects the interdisciplinary nature of forensic science.[2237]

Educational programs directed at informing presiding officers of scientific principles and techniques applied in criminal investigations must pay special attention to aspects such as individualisation *versus* identification, critical issues, quality assurance, as well as a meticulous interactive understanding of a variety of forensic science disciplines.[2238]

Meintjes-Van der Walt[2239] appropriately suggests that universities and other institutions,[2240] funded by the National Research Foundation, should assume the massive task of researching forensic science evidence, which, by its very nature, will be interdisciplinary research. Institutions that would necessarily participate in such research undertaking include the National Prosecuting Authority, the South

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2236 2003:1.

2237 Pfefferli 2003:1.

2238 Pfefferli 2003:2.

2239 2006a:294.

2240 For instance, the forensic science laboratories in South Africa.

African Departments of Justice and Constitutional Development, Safety and Security, and the Department of Science and Technology.[2241]

Traditional forensic science and its methodologies are in perhaps the most urgent need of intensive research and study.[2242] Since these types of forensic disciplines have yet to achieve true scientific validity, further research in these arenas is crucial.[2243]

Research in the employment of forensic science in the criminal justice system has been neglected for a long time and remains to be unheeded. Unfortunately, massive governmental intervention will likely be required if any difference is to be seen in the way science achieves truth and solves the dire crime problem that does not seem to diminish with time.

7.2.3.4 Continuing professional development

It is also suggested that a system of continuing professional development (CPD) be instituted within all aspects of training in the criminal justice system. Detectives, legal practitioners in criminal justice, as well as presiding officers should be required to engage in CPD in order to keep abreast with the staggering developments in the milieu of science and technology.

2241 Meintjes-Van der Walt 2006a:294.

2242 As is clear from the results of the report published by the National Academy of Science (NAS) in 2009. See para 5.2 above for an examination of the findings and recommendations by the NAS committee.

2243 Meintjes-Van der Walt 2006a:296.

CPD is the training needed to ensure that professionals maintain competence, and can be effected by way of regular attendance of seminars, lectures, workshops and further study.[2244]

In the United Kingdom, solicitors are expected to complete CPD training of at least sixteen hours per year.[2245]

Such a programme implemented in South Africa would compel police officers, lawyers and judicial decision-makers to engage in an everlasting training regime that would ultimately empower these stakeholders to employ and assess forensic evidence with comfort and accuracy.

However, such an endeavour would again require immense commitments regarding resources and funding. Collaboration between governmental and higher education structures will be a necessity and significant funding would be required to make such a programme viable.

7.2.3.5 Specialist courts

Specialist courts should be designed and put into operation to give proper effect to the enterprise of enhanced speciality amongst police, legal practitioners and presiding officers. Great variation exists between the immense volume of possible forensic disciplines and it would be both unrealistic and ineffective to expect the legal fraternity to be versed

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2244 Law Society (UK) 2011. http://www.lawsociety.org.uk/advice/practice-notes/continuing-professional-development/. Accessed on 28/01/2013.

2245 Law Society (UK) 2011. http://www.lawsociety.org.uk/advice/practice-notes/continuing-professional-development/. Accessed on 28/01/2013.

in all aspects of forensic science. Therefore, it stands to reason that diversification in courts is required to establish proper expertise.

Due to the complexity and dangers intrinsic in DNA evidence, it is suggested that cases where such evidence play a vital role be directed to courts where legal practitioners and presiding officers enjoy particular training in the field and where assessors are readily available to assist court.

Moreover, specialist courts regularly exposed to intricate natural scientific evidence may be subjected to particular guidelines in terms of pre-trial disclosure and issue determination. Much time and resources could be saved if issues pertaining to conflicting scientific evidence could be settled expeditiously and effectively in the normal course of criminal procedure.

7.3 CONCLUDING REMARKS

While the improvement of the validity and accuracy of science in legal processes will by no means be an easy or swift accomplishment, it is absolutely vital if the criminal justice system hopes to give effect to its purpose in any manner. In a country struggling under the weight of crime, improving the knowledge base, practice and collaboration between science and law should be a considerable priority with leaders in government, education and law enforcement.

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SUMMARY

Interactions between science and law can be dated back as far as 9000 B.C. to 3000 B.C., to a time known as the Neolithic age. By the seventeenth century, great scientific contributions by, amongst others, Copernicus, Galileo, Newton, and Boyle affected the way the world was viewed and what methods were most appropriate for finding the truth and, specifically, altered the thought processes of the entire literate English society, including English jurists.

During the seventeenth century in England, the fields of law and science enjoyed increased awareness of the probability of truth, not the certainty of it. The search for absolute truth was thus replaced by probabilistic hypotheses and assessment of evidence to achieve truth beyond a reasonable doubt.

The interconnectedness of science and law has diminished over time as contemporary thinking demanded not only greater specialisation in the profession and its subdivisions, but also a greater autonomy of legal thought and reasoning. Practitioners, scholars and authors held the view that legal reasoning is, and should remain, separate from scientific reasoning.

Modes of reasoning employed in criminal investigation and judicial decision-making are communal in both science and law. Additionally, investigating officers frequently employ forensic science and scientific evidence to assist and direct them in criminal investigations. In the same manner, prosecutors apply forensic evidence in order to assist

the court in finding the truth, and to ultimately prove its version of criminal events.

In South Africa, police investigators and state prosecutors typically rely on eyewitness testimony in both the detection of crime and to achieve successful conviction of guilty offenders. In addition, DNA evidence has emerged as the golden standard of forensic evidence and much reliance is placed on the results of DNA profiling.

However, eyewitness testimony is notoriously unreliable and DNA evidence is not the infallible assurance of certainty it was once thought to be.

It is trite that presiding officers must be provided with all relevant and admissible evidence in criminal trials. This includes traditional forensic sciences like bloodstain pattern analysis, trace evidence, fingerprint evidence and many more.

Recent research has revealed the questionable scientific foundations of these traditional forensic sciences. While the scientific community is working towards stabilising these knowledge bases, provisions of the law of evidence must provide adequate instruments to prevent the admission of ‘junk’ science into evidence. Yet an examination of a variety of rules of admissibility reveals a deficiency in the law to competently exclude fallible and unreliable forensic evidence.

In the South African criminal justice system presiding officers invest great reliance on the opinion and explanation of expert witnesses

without critically assessing the scientific validity of the testimony. This has resulted in the admission of faulty evidence.

To mend this problem presiding officers, as well as investigating police and legal practitioners must obtain a solid scientific knowledge base to enable these role-players to accurately assess forensic evidence.

OPSOMMING

Interaksies tussen wetenskap en die reg dateer terug so ver as 9000 tot 3000 V.C. na ‘n tyd bekend as die Neolitiese periode. Teen die sewentiede eeu, het wetenskaplike bydraes deur onder andere Copernicus, Galileo, Newton, en Boyle die manier wat ons die wêreld beskou verander en nuwe dimensie gegee aan die metodes wat mees effektief sal wees in die soeke na waarheid. Dit het ook veranderinge meegebring in die denkprosesse van die deursnee geletterde Engelse gemeenskap, insluitend Engelse juriste.

Tydens die sewentiende eeu in Engeland, het wetenskap en die reg meer bewus geword van die waarskynlikheid van die waarheid in kontras met die sekerheid daarvan. Die soeke na die absolute waarheid is mettertyd vervang deur waarskynlikheidsteorieë en evaluering van bewysmateriaal om waarheid bo redelike twyfel vas te stel.

Die intieme verhouding tussen die wetenskap en die reg het met tyd verslap soos moderne denkpatrone noodwendig groter spesialisasie in die professies en hul onderafdelings, asook die noodsaaklikheid van groter onafhanklikheid van beide wetenskaplike en regsfilosofieë, geëis het.

Wyses van beredenering wat toepassing vind in misdaadondersoek en geregtelike besluitneming stem ooreen in beide wetenskap en die reg. Daarenbowe gebruik ondersoekbeamptes gereeld forensiese wetenskap en wetenskaplike bewyse om hul by te staan in misdaadondersoek. Staatsaanklaers gebruik op hul beurt forensiese

bewyse om die hof by te staan in feitebevindings, asook om die vervolging se weergawe van ‘n misdaadinsident te staaf.

In Suid Afrika steun ondersoekende polisiebeamptes en staatsaanklaers swaar op ooggetuie verklarings en getuienis in beide misdaadondersoeke asook die verkryging van skuldigbevindings. Die resultate van DNA analise is ook wesenlik belangrik in strafregtelike vervolging en verteenwoordig die goue standaard van forensiese getuienis.

Ooggetuie verklarings en getuienis is egter berug as onbetroubare bron van inligting en DNA bewyse is nie so ‘n absoluut onfeilbare bron van sekerheid as wat eens geglo is nie.

Dit is gemene saak dat voorsittende beamptes van alle relevante en toelaatbare getuienis voorsien moet word in strafregtelike verhore. Dit sluit die tradisionele forensiese wetenskappe soos bloedspatsel-analise, spoorelement analise, vingerafdrukgetuienis en vele meer in.

Onlangse navorsing het die twyfelagtige wetenskaplike grondslag van hierdie tradisionele forensiese dissiplines ontbloot. Terwyl die wetenskaplike gemeenskap tans werk om hierdie grondslag te stabiliseer, is dit die plig van die bepalings van die bewysreg om geskikte instrumente daar te stel om die toelating van onbetroubare wetenskap te voorkom. ‘n Ondersoek van die verskeie toelaatbaarheidsreëls toon egter dat leemtes bestaan in die reg om howe genoegsaam teen onbetroubare en foutiewe getuienis te beskerm.

In die Suid Afrikaanse regsisteem plaas voorsittende beamptes groot vertroue in die opinie en verduideliking van deskundige getuies, sonder om die geldigheid van die wetenskap krities te bevraagteken. Dit veroorsaak die periodiese toelating van foutiewe getuienis.

Om hierdie probleem aan te spreek moet voorsittende beamptes, ondersoekende polisiebeamptes, asook regslui ‘n behoorlike grondslag in wetenskaplike kennis opdoen om hulle in staat te stel om forensiese getuienis met akkuraatheid te evalueer.

KEY WORDS

Forensic evidence

Scientific evidence

Traditional forensic science

Fingerprints

Proof of fact

Admissibility

Reliability

Expert witnesses

Adjudication

Daubert