INDIVIDUALISATION OF GLASS IN MOTOR VEHICLE ACCIDENTS

By

CHARLIZE VAN DER LINDEN

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SUPERVISOR: MS JS HORNE

CO-SUPERVISOR: DR NJC OLIVIER

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Student number: 3680-647-1

Address: MacKenziestreet 143, Vryburg, 8600

Telephone and cell phone numbers: Office:(053) 928 8100 Mobile:082 712 3547

Email address: inla@telkomsa.net

ABSTRACT

The intention with this research is to determine how physical matching of glass can be used as individualization technique in hit-and-run incidents by South African Police Service investigators, forensic analysts and forensic specialists. Another aim of this research is to establish the importance of physical matching as an investigative tool to identify the suspect of a hit-and-run crime scene.

An introduction, definition and explanation are given of certain key theoretical concepts such as physical matching, individualization, motor vehicle accidents, hit-and-run accidents, forensic and criminal investigations and their objectives and purposes. The importance of physical matching as investigative tool and the process of physical matching for individualization purposes are also discussed and explained as are the chain of custody of evidence. A large part of this research deals with the role of individualization in the investigation process and important principles regarding the collection, packaging and dispatching of glass.

The findings of the research are discussed and recommendations subsequently made regarding the shortcomings identified. The findings that were made related to the research questions, 'what is physical matching' and "How can physical matching of glass be used as an individualization technique in the investigation of hit-and-run incidents?

Further findings were made in respect of individualization of evidence, process of physical matching, forensic and criminal investigations, purpose of conducting evidence, identification and individualization, principles when collecting, packaging and dispatching of glass and chain of custody.

Recommendations were made regarding training and skills transfer to address the shortcomings identified.

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This work is dedicated to my late dad, Peter van der Linden, who always supported me in my studies and all my achievements.

DECLARATION

I, Charlize van der Linden, hereby declare that “Individualization of glass in motor vehicle accidents” is my own work and that all sources that I have used or quoted have been indicated and acknowledged by means of complete references.

_____ 31th January 2012

(Me EC van der Linden) Date

(3680-647-1)

CHAPTER ONE
GENERAL ORIENTATION

1.1 Introduction

Crime in South Africa is rife and affects all sectors of the community, old and young, rich and poor, black and white. When people read newspapers, the front, middle and back pages are filled with stories about crime. Criminals are opportunists and therefore see an opportunity and take it. Different emotions are experienced by people who become victims of crime. Some even say they do not trust the police because of corruption in the South African Police Service (SAPS), despite the fact that corruption exists in virtually all occupations.

Solving any crime that has been committed depends on police obtaining information from the community. Most crimes are committed by and between people who know one another, which makes the gathering of information and the tracing of suspects extremely difficult. The community is still the best source of information, as these are the police's eyes and ears on ground level. The police sometimes find it arduous to get information about a crime from communities which may not wish to disclose information and this leaves them with a weak track record in solving certain crimes.

A crime which is sometimes hard to solve is motor vehicle accidents. A general problem persists at some motor vehicle incidents that no eyes or ears are there to assist the police in the tracking of the suspect, which means no witnesses, and no direct linkage being provided to who the perpetrator is. In some motor vehicle accidents, a victim is hit by a vehicle and the perpetrator speeds away from the scene of the crime, leaving the victim either injured or dead. There are also no witnesses to speak on behalf of the seriously injured or dead. The fact remains that crime affects everybody and without the information from people in the community or who witnessed the crime, some crimes will remain unsolved.

1.2 Problem Statement

According to accidents reported to the SAPS, more than 12 003 accidents occurred in South Africa for the year 2009 and 944 of those accidents occurred in the North West Province. According to the accident report register of the SAPS, 130 serious accidents were reported for the period April 2009 to March 2010 in the areas of Vryburg, Stella, Setlagole, Madibogo, Ganyesa, Huhudi, Reivilo and Madibogo. Incidents where the vehicles flee the scene are included under these serious accidents. Vehicle windscreens, side mirrors, side indicators, vehicle headlamps, grill and glass or synthetic glass objects are often found at the site of motor vehicle accidents that occur on national routes in the above-mentioned areas.

To clarify what hit-and-run incidents are and to separate them from all motor vehicle accidents, the researcher interviewed the Local Criminal Record Centre (LCRC) Commander in Vryburg, JJ Kluge, in 2010. According to Kluge (2010), the LCRC experts attend to all motor vehicle accidents that are reported to the SAPS. Records of the scenes that LCRC experts have attended have shown that five hit-and-run incidents occurred for the year April 2008 to March 2009 and six incidents for the year April 2009 to March 2010, in the Vryburg area, which includes Vryburg and surrounding towns Stella, Ganyesa, Huhudi, Reivilo, Vorstershoop, Morokweng and Piet Plessis.

To clarify the problem further, the researcher carried out a pre-research docket analysis and found that these dockets had all been closed and filed as “undetected” because of the lack of physical evidence at the crime scene linking the crime to or identifying a possible culprit. This zero detection rate of motor vehicle accidents is of great concern because suspects flee the scene and are not linked to the accident neither through evidence found at the scene nor through eyewitness accounts.

Physical evidence from the motor vehicle accident crime scene in the form of glass, synthetic glass, mirrors, headlamps and plastic or metal pieces are called “a silent witness” and can assist the police in identifying the involved vehicle (Hildebrand, 2004:1). Hildebrand (2004:1) further writes the following on a silent witness: “Wherever he steps, whatever he touches, whatever he leaves, even unconsciously, will serve as a

silent witness against him." In a motor vehicle accident where the vehicle fled from the scene, it is expected from the police to find the vehicle and the driver and prove their involvement in the accident. According to a conversation between the researcher and forensic specialists of the LCRC, during the pre-research investigation, the first police and traffic officials to arrive at the accident crime scene are not always conversant with identifying, collecting and preserving whatever physical evidence is found at the accident scene. By the time members of the LCRC who specialise in collecting evidence at any crime scene arrive at the accident scene, most of the physical evidence, such as the glass or synthetic glass headlamps of the vehicle, side mirrors, glass light bulbs, grill, plastic indicators and plastic taillights, have already been tampered with or contaminated.

The concerns, as pointed out during internal SAPS lectures by police detectives and forensic specialists, are to establish and maintain the correct method in identifying, collecting and preserving the known physical evidence found at a crime scene and physically match the unknown evidence to use as an individualisation technique in the investigation of motor vehicle accidents.

1.3 Aims of the Research

The aim of a research study is basically the intention of the research. Without an aim, there can be no intention to research. Mouton (1996:103*)* states that the aim of research is to collect new data.

The aim of this research was to examine how physical matching could be used as an individualisation technique in the investigation of motor vehicle accidents.

1.4 Research Purpose

To have a purpose in research simply means that there is an intention or an end result to be achieved with the research being conducted. "The main driving force behind a piece of research is sometimes the desire to solve a practical problem or to improve procedures" (Denscombe, 2002:25). Particularly in the context of organisations or the work environment, the aim of research is to arrive at recommendations for good practice

that will tackle a problem or enhance the performance of the organisation and individuals through changes to the rules and procedures within which they operate (Denscombe, 2002:25).

In this context, the researcher evaluated the current situation existing with the collection of evidence by the LCRC from motor vehicle accident crime scenes to determine the strengths and shortcomings of the current practice of physical matching as an individualisation technique in the investigation of motor vehicle incidents. The purpose of this is to find the most effective that physical matching can be used as an individualisation technique in the investigation of motor vehicle accidents.

The researcher hopes to achieve this purpose through exploring national and international literature with a specific focus on physical matching as individualisation technique in the investigation of motor vehicle incidents. More exploration was done through docket analysis specifically focusing on motor vehicle accidents where vehicles flee the crime scene that occurred in the Vryburg, North West geographical area.

The researcher also developed a number of recommendations for good practice with regard to the use of physical matching as an individualisation technique in the investigation of motor vehicle incidents. It is hoped that this research will be of benefit to police detectives involved in the reactive investigation of motor vehicle incidents and all law enforcers and forensic investigation specialists in the pro-active collecting of physical evidence for physical matching in the investigation of motor vehicle incidents.

1.5 Research Questions

According to Leedy and Ormrod (2005:5), research is guided by a specific question. Denscombe (2002:31) has also pointed out that research questions specify exactly what is to be investigated. Noak and Wincup (2004:122) further state that researchers need to give advance thought at the outset of projects to the key themes that they wish to address and to design their project accordingly.

In light of the above-mentioned viewpoints, the research questions for this research are:

a) *Question 1:* What does physical matching entail?

b) *Question 2:* How could physical matching be used as an individualisation technique in the investigation of motor vehicle accidents?

1.6 Key theoretical concepts

Some key concepts are included that are used when dealing with physical matching as an individualisation technique. These concepts are defined below as an attempt to provide an introductory perspective on the topic and to provide an easy reference for the reader and for the user of this research (Mouton, 1996:173).

1.6.1 Physical matching

Physical matching is when unique fragments from recovered evidence are found at a scene of crime and are compared to a possible source (Zamir, Oz, Novoselski & Klein, 2000:352). Physical matching can also be the act of linking pieces of evidence that are in pieces or shards or shreds, but which were once part of the same item (South Africa, 2007:1).

1.6.2 Individualisation

"Individualisation" refers to the demonstration that a particular sample is unique, even among members of the same class (Marais, 1992:19). "Individualisation"' means to distinguish somebody or something from others (Concise Oxford Dictionary, 1982:722).

1.6.3 Motor vehicle accidents

According to Juta's Statutes of South Africa (2007:2-276), the Road Accident Fund Commission Act 71 of 1998 defines "road accident" as an accident or collision caused by or arising from the driving of a motor vehicle.

The National Road Traffic Act 93 of 1996 further defines "motor vehicle" as any self-propelled vehicle and includes – a) a trailer; and b) a vehicle having pedals and an engine or an electric motor as an integrated part thereof and which is designed to be

propelled by means of such pedals, engine or motor (Juta's Statutes of South Africa, 2007:2-212).

A traffic collision (motor vehicle collision, motor vehicle accident, car- accident or car crash) occurs when a road vehicle collides with another vehicle, pedestrian, animal, road debris, or other geographical or architectural obstacle (*Wikipedia*, retrieved 18 January 2011).

The term "hit-and-run" accident is defined as an accident involving another party and the driver of the injuring vehicle leaves the scene without awaiting help or providing personal information (Zamir et al., 2000:351). Wikipedia (retrieved 18 January 2011) supports the view by defining hit-and-run as the crime of colliding with a person or a fixture, and failing to stop and identify oneself afterwards.

The National Road Traffic Act 93 of 1996 states the duties of the driver of a motor vehicle in the event of an accident is to – a) immediately stop the vehicle (Juta's Statutes of South Africa, 2007:2-230). This act also states that – 2) no person shall remove any vehicle involved in an accident in which another person is killed or injured from the position in which the vehicle came to rest, until such removal has been authorised by a traffic officer (Juta's Statutes of South Africa, 2007:2-230).

According to the Concise Oxford Dictionary (1982:473), "hit- and-run" is to "damage and retreat or make off immediately. Being or involving the driver of a motor vehicle who leaves the scene of an accident, especially one in which a pedestrian or another vehicle has been struck."

1.7 Research design and approach

A research design is an exposition or plan of the way in which the researcher plans to execute the research problem that has been formulated (Mouton, 1996:175). Basically, the research design consists of a clear statement of the research problem as well as the plans for gathering, processing and interpreting the observations intended to provide some resolutions to the problem (Singleton & Straits, 1999:91).

1.7.1 Research design

A Research design is the complete “strategy of attack” on the central research problem. It provides the overall structure for the procedures that the researcher follows, the data that the researcher collects, and the data analyses that the researcher conducts. Simply stated, research design is planning (Leedy & Ormrod, 2005:91).

The researcher decided to use an empirical design in this research, because it involved the researcher going into the field and focusing on the personal experiences of the participants in the study (Mouton, 2001:149). This was necessary because of the shortage of literature on the topic. Another reason for using this design was that the emphasis in the empirical design tends to be on producing data based on real-life observations. The very notion of this research is that the research has involved an active attempt by the researcher to go out and look and search (Denscombe, 2002:27). People with the knowledge of physical matching based on experience or observation can address real-life situations. This type of research is associated with getting information “straight from the horse’s mouth”, so to speak. The research is also purposeful and constructive (Denscombe, 2002:27). Maxfield and Babbie (1995:4) write that empirical research is the production of knowledge based on experience or observation. For this reason, the researcher decided to use only investigators with investigation experience. This research is necessary, because physical matching is not a common topic and not much has been written on it.

The reason for using this design during this research is to uncover new knowledge that will be of use for all law enforcers, police detectives and forensic investigation specialists.

1.7.2 Research approach

Qualitative researchers study things in their natural settings (Creswell, 2008:15). The researcher decided on a qualitative approach, because the aim was to obtain practical answers to the problem. Pope, Lovell and Brandl (2001:369) state that “qualitative research including focus groups, in-depth interviews and extensive examination of

documents, are essential whenever previous research and theory yields information about the topic and issue".

Qualitative research emphasises the production of data based on real-world observation (Denscombe, 1998:27). Welman and Kruger (1999:186) also argue that qualitative research could be used successfully in the description of groups, small communities and organisations and can involve existing data and historical research, which is very often used in the field of law and criminology. The approach adopted in this study focused on locating existing documents such as books, newspaper reports, official statistics, law reports and internet articles. The production of new data was made possible using docket analysis, personal experience and interviews based on a structured interview schedule.

The procedures used in the study focus as mentioned above have been designed to provide outsiders with maximum insight into the situation being investigated. Qualitative research involves a series of research techniques where the researcher has direct and sustained social interaction with participants in a particular setting (Mouton, 2001:208). Qualitative research refers to the use of focus groups, in-depth interviews and extensive examination of documents. This type of research is essential whenever previous research and theories yield scanty information about the topic and issues; when there are likely to be strong contextual effects (that is, the previous research and theories may not be a useful guide in the specific situation confronting the researcher). This research is also important when researchers want to enhance the validity of their interpretations by drawing on the experiences of those most involved in the research setting itself (Pope et al., 2001:369).

Qualitative research is applicable in this study, because the researcher worked with "raw" data of which the details needed to be organised.

1.8 Population

The population of a research study includes all individuals or cases of a certain type (Welman & Kruger, 1999:122; Taylor, 1994:158). According to Bailey (1987:81), the

sum of all the units of analysis is called the population or universe. In reality the whole population of motor vehicle accident investigators in South Africa should be used in this research. However, it is impossible to conduct the research utilising all of South Africa's investigators and therefore the researcher decided on a target population.

In this study the population involved investigators of the SAPS, who conduct investigations and analysis regarding motor vehicle collisions.

1.8.1 Target population

The target population is the population about which the researcher ideally would like to generalise in the research (Welman & Kruger, 1999:122). Because the researcher is based in the North West Province, it was decided to conduct this research only in the North West Province. The problem as mentioned in the problem statement was identified in the North West Province.

The North West Province is one of nine provinces in South Africa. It is divided into three areas, which are the Molopo, Mooiriver and Marico areas, and is serviced by 96 police stations and 825 detectives. It was impossible for the researcher to conduct the research in the entire North West Province and it was decided to break down the research to study a smaller target population.

1.8.2 Study population and sampling

A study population is that aggregation of elements from which the sample is actually selected (Maxfield & Babbie, 1995:186). To determine the study population, the researcher wrote down the names of the three areas of the North West Province on a piece of paper and used simple random sampling to select one area. The names were put in a hat and one was drawn. The Molopo area was selected through this simple random sampling technique.

Simple random sampling is the least sophisticated of all sampling designs. The sample is chosen by simple random selection, whereby every member of the population has an equal chance of being selected. Simple random sampling is easy when the population is

small and all of its members are known. For very large populations (as in all police officials), simple random sampling is neither practical nor, in many cases, possible (Leedy & Ormrod, 2005:201). Welman and Kruger (1999:52) also argue that “random sampling” is where each member of the population has the same chance of being included in the sample and each sample of a particular size has the same chance of being chosen.

After this selection, a sample from this study population was selected. Denscombe (1998:11) states that a sample is a small portion of the whole population. The ideal sample is one that provides a perfect representation of a population, with all the relevant features of that population included in the sample of the same population (Blaickie, 2003:161). In a random sample each person in the universe has an equal probability of being chosen for the sample, and every collection of persons of the same size has an equal probability of becoming the actual sample, as long as they are members of the same universe. All that is required to conduct a random sample, after an adequate sampling frame is constructed, is to select persons without showing bias for any personal characteristics (Bailey, 1987:87).

The samples for this study were selected as follows:
Selection of sample A: Molopo area consists of 23 police stations with a detective unit at 15 stations, comprising a total of 225 detectives. Detectives are responsible for the investigations of motor vehicle accidents. Of the 225 detectives in the Molopo area, 15 detectives were selected. All the names of the 225 detectives in the Molopo area from the different police stations were obtained and written down in alphabetical order. To get a starting point the researcher divided 225 by 15, which equalled 15. The numbers “1” to “15” were each then written on a piece of paper and put in a holder and one was drawn to determine the starting point. The number that was drawn was “8”. The researcher then started with number 8 and thereafter every 15th name from the 225 detectives was chosen. This selection technique is called systematic random sampling.

Maxfield and Babbie (1991:197) write that with systematic sampling the total list is chosen (systematically) for inclusion in the sample. If the list contains 10 000 elements

and you require a sample of 1 000, you select every 10th element for your sample. According to Maxfield and Babbie (1991:197), this method is technically referred to as a "systematic sample with a random start". The researcher considered sample A to be representative of the population because a random selection was used.

Selection of sample B: Also part of the study population were 20 forensic analysts in the Molopo area, stationed at Vryburg, Taung and Mahikeng, who were responsible to visit the accident scenes and to gather physical evidence, such as the glass or synthetic glass headlamps of the vehicle, side mirrors, glass light bulbs, grill, plastic indicators and synthetic glass taillights at the motor vehicle accidents. The researcher selected five forensic analysts from the 20 to serve as sample B. Sample B was selected by using the simple random sampling technique. The names of the 20 forensic analysts were written on pieces of paper, put into a holder and then five names were drawn. The researcher considered sample B to be representative of the population because a simple random selection was used.

Selection of sample C through purposive sampling: The physical evidence collected at the scenes was analysed and physically matched by the Forensic Science Laboratory. The researcher decided to select four of the forensic specialists for interviewing by using purposive sampling. The selection of the forensic laboratory specialists will be discussed under interviews in the sub-section "purposive sampling".

In purposive sampling, people or other units are chosen, as the name implies, for a particular purpose. For example, people are chosen or decided upon based on a "typical" group or on those who have diverse perspectives on an issue. Purposive sampling may be very applicable for certain research problems. The researcher should keep in mind always to provide a rationale explaining why they selected the particular sample of participants (Leedy & Ormrod, 2005:206).

The researcher did not consider sample C to be representative of the population because, according to Leedy and Ormrod (2005:206), in non-probability sampling there

is no way for claiming representivity, as some members of the population had little or no chance of being sampled.

1.9 Representivity

In random sampling every individual has the same chance of being chosen as part of a sample. It is the same with the collection of people of the same occupation, race, gender that have the same chance of being part of a sample of the same population. The only requirement is that the people must be of the same universe. All that is required to conduct a random sample, after an adequate sampling frame is constructed, is to select people without being biased or allowing any personal characteristics or personal preferences to influence the selection (Bailey, 1987:87). The advantage of random sampling is the elimination of bias and that it provides a statistical way of estimating sampling errors (Bailey, 1987:87).

In probability sampling, the researcher can specify in advance each segment of the population that will be represented in the sample. Generally, the components of the sample are chosen from the larger population by a process known as “random selection” (Leedy & Ormrod, 2005:199). Doing this, the resulting sample is likely to provide a representative cross-section of the whole. Random selection means choosing a sample in such a way that each member of the population has an equal chance of being selected. When such a random sample is selected, the researcher can assume that the characteristics of the sample approximate the characteristics of the total population (Leedy & Ormrod, 2005:211).

The researcher regards samples A and B as representative of the target population and the forensic analyst target population, because it has all the relevant features of the population (Blaickie, 2003:161), while sample C is not representative of all forensic specialists as some members of the population had little or no chance of being sampled with purposive sampling.

1.10 Data collection

The researcher made use of primary and secondary data, because this sort of data can support most of the interviews with the forensic specialists and investigators. Primary data is used to answer specific research questions, such as those posed in the interviews conducted with the study participants. It is data characterised by the fact that this data is the result of direct contact between the researcher and the source (Blaickie, 2003:18). During the interviews there was direct contact between the researcher and the participants and the researcher gathered relevant information personally.

Secondary data comprises the books, literature, journal and internet articles, law books, records of motor vehicle accidents reported, and analysis of dockets cited in the list of references. Mouton (2001:69) describes secondary data as written sources (including those from the Internet), which discuss, comment, debate, and interpret primary sources of information.

In this process, the researcher decided to make use of structured interviews, literature and written information that included dockets and other records.

1.10.1 Interviews

Data was systematically collected from the participants by means of structured prepared questions based on the research questions. The structured questions of the interviews, allowed for the flexibility of the interviewer to reword the questions, to probe the interviewee further and to allow follow-up questions on issues that needed further clarification. The interviewer took notes and recorded the responses on tape. These pre-determined questions (known as an interview schedule) were based on the research questions of the study. Structured interviews have the advantage of allowing the researcher to obtain better quality data and the data can be more easily compared with less risk of bias occurring simply because different people are being asked rather different questions (Robson, 2000:90). For this study, the researcher compiled a structured interview schedule according to the research questions posed at the beginning of the study. The interview schedules were then submitted to the various

participants during the interviews. Separate interview schedules were developed for the different samples based on the aim and research questions for this research project.

The researcher conducted the interviews personally and the privacy of the participants was kept throughout the interviews. Prior permission was obtained from participants to conduct an interview and they consented to the use of their names. All answers to questions asked were written down for future reference.

Leedy and Ormrod's (2005:159) guidelines for conducting productive interviews were followed by the researcher as follows:

- The researcher sought written permission from the various participants, employers and commanders and interviews were then conducted with the participants. The researcher firstly applied in writing to the SAPS Head Office to obtain permission to conduct the research. Thereafter, the commanders of the participants were approached for permission to conduct the interviews and the topic of the research was explained to them.
- The researcher found a suitable venue and time to conduct the interviews. In this case the researcher conducted the interviews at a time conducive for the participants and in conference rooms of the detective offices and the forensic laboratory.
- The researcher took some time to establish a rapport with the participants in order to make them feel comfortable. Before the commencing of the interviews, the researcher made the participants feel at ease by explaining the topic of the study as well as the aims of the researcher with this research. Participants were relaxed during the interviews because they were conducted in an area that they were conversant and comfortable with.
- The researcher did not put words in the participants' mouths and allowed them to discuss and elaborate on any answer, as they deemed necessary. The participants were given the questions according to the interview schedule and answered each question in the manner they wished to answer. Where clarity regarding a question was requested, the researcher and participants discussed

the question until the participants made their own decision in answering the relevant question.

- The researcher recorded the participants' responses *verbatim* in a written document (interview schedule) as interview notes (field notes). As the interviews progressed, the researcher wrote down the answers of the participants according to the relevant questions. The answers were read back to the participants to confirm that the information written down was correct.
- The researcher refrained from showing reaction to answers and wrote down the exact response of participants and never showed disapproval or surprise of the answers given. The researcher respected each individual and their own opinions towards the structured interview questions.
- The researcher always remembered throughout the research that the facts were not necessarily portrayed and always treated the participants' responses as perceptions rather than facts. The researcher accepted each answer to the interview schedule as correct and as the individual opinion of the participant and did not dismiss any answer as irrelevant. Each participant had their own perception and understanding of the interview questions which the researcher also accepted as such.

1.10.1.1 Purposive or judgemental sampling

According to Maxfield and Babbie (2001:238), purposive sampling is when the need arises to select a sample based on personal knowledge of the population, the nature of the research aims and the study purpose. "Purposive sampling gives us the opportunity to choose a case based on certain features or a specific process that we are interested in" (Silvermand, 2000:104).

Based on the argument of Leedy and Ormrod (2005:206), people are selected for a specific purpose with purposive sampling. For example, people can be chosen because of their work experience or their appropriateness to answer certain research problems. It is assumed that with judgemental sampling, samples can be handpicked through good judgement and a common strategy that will be satisfactory for the needs of the research (Hoyle, Harris & Judd, 2002:187).

The following experts were purposively selected by the researcher to be interviewed:
a) Brigadier S. de Klerk, Section Head: Scientific Analysis, SAPS Forensic Laboratory. This expert had 17 years' experience in the analysis of physical matching at the SAPS Forensic Laboratory and had received training at the United States' Federal Bureau of Investigation (FBI) Trace and Evidence School.

b) Colonel J. Westraat, Chemistry Commander, SAPS Forensic Laboratory. This expert had 24 years' experience in the field of forensic analysis, of which 20 years of experience was on the physical matching and collection of glass. He also had three degrees in laboratory management and chemistry.

c) Colonel R. Dixon, Forensic Analysis, SAPS Forensic Laboratory. This expert had 15 years' experience in the field of forensic analysis and specialised in physical matching.

d) Warrant Officer J. Niewenhuys was a Forensic Ballistic Specialist in the SAPS Forensic Laboratory. This expert with 18 years forensic experience had a qualification (M+3) in Forensic Criminalistics: Ballistic Investigations. He worked daily on all kinds of physical matching with the experience of investigation and physical matching.

The participants were all asked the same questions from the same interview schedule that was used for the detectives and forensic analysts. All the interviews with participants were recorded in writing. The interviews were conducted in the offices of the participants.

1.10.2 Literature study

For Leedy and Ormrod (2005:87), a literature study is the exploration of existing knowledge on the problem or topic of study. Therefore all available literature relevant to the topic and key concepts was critically examined to provide a comprehensive summary of current knowledge about the research problem. The purpose of a literature review is to access what previous studies can tell the researcher about the topic and the methods used in previous studies, including research design, data analysis methods

and data collection. The researcher conducted a detailed literature study to explore all previous research on the topic of this research, physical matching as individualisation technique in the investigation of motor vehicle accidents, and key concepts in this field of study.

While conducting a review of the literature, the researcher could not locate any literature that dealt exactly with the same topic as present research study. The literature search involved the use of the Goldfields Library and information service database, textbooks, published and electronic journals, internet web pages, and catalogues for any other literature with a similar topic as the topic of this research. Other website search engines such as Google, Wikipedia, Questia, WorldCat, Bookfind and the Criminal Justice website were also utilised. Scattered internet articles on the physical matching of glass were located and many books, journals, and articles were found to contain only subject-related information on the key concepts employed in the study. They did not fully address the research areas; however, there were some aspects of these studies that were relevant to the current study.

The literature that was collected can be considered to be valid because it was collected from a wide range of sources and the researcher followed Mouton's (2001:90) criteria for a good literature review. The researcher reviewed different literature from reliable text books, journals and internet pages, and collected relevant data addressing the research questions.

The literature review was exhaustive in that it covered all literature collected from a subject-related field and in the selection of books, articles and journals, the researcher looked for information that covered the research questions and key concepts in order to collect relevant data for the research. The researcher took the research questions of the current study into account and obtained data covering all aspects of the different questions addressed by the study. Every word in the research question was used as search criteria to obtain data from a selection of books, internet sites, journals and articles (Mouton, 2001:90).

The literature review was fair in its treatment of authors and the researcher objectively reviewed and analysed a range of authors' papers. The researcher did not only make use of one author, but gained the data and opinion of different authors and books on the same topic and compared the authors' opinions on the subject. If the researcher made more use of one author than the other, it was not because of favouritism, but because of the relevance of the data in the author's books (Mouton, 2001:90).

The review was topical and not dated. The researcher collected data from different literature not based on the date of the book or article that was written, but based on the relevance of the data for answering the research questions of the study. The researcher made sure that the literature review was well organised. The researcher organised all data collected in writing and according to the research questions and saved copies thereof on the computer of the researcher (Mouton, 2001:90).

The formulation of the research questions helped frame and direct the researcher's reading. This helped the researcher to divide data according to the research questions and align the views of all relevant authors accordingly. A list of references was compiled to determine the most appropriate books, journals and others. The researcher made a list of the authors and topics of books and articles to determine the most relevant according to the research questions. Following this, a record of the literature on the topic was kept for easy retrieval. This record was kept in writing and also on a flash drive and on the computer of the researcher. The literature that was identified was prioritised. The researcher went through all data to determine the data most relevant to the research topics. The literature retrieved was discussed in a logical and coherent way. The researcher reviewed each and every article of an author on the topics of the research questions and formulated the data in the most logical way for others to understand.

In the absence of a subject-related book, journal or article on this specific topic, the topic was divided into research questions and key concepts in order to find more relevant literature. Primary sources and recent research and literature were used where possible

and were critically evaluated in as balanced and unbiased a way as possible to support the findings of the study.

1.10.3 Case file analysis

Written records are used in a variety of ways and include records maintained by the police such as case dockets, records maintained by a criminal court, text documents containing information on certain topics, and court decisions (Maxfield & Babbie, 1995:176). According to Maxfield and Babbie (1995:176), analysing dockets and court decisions is a specialised example of content analysis and this data can be collected either through observation or by asking people questions, such as in an interview.

The researcher used the docket analysis to analyse critically the physical matching of the glass or synthetic glass headlamps of the vehicle, side mirrors, glass light bulbs, grill, plastic indicators and synthetic glass taillights at motor vehicle collisions. Reported cases of motor vehicle collisions for 2008 and 2009 were used in the research. Docket analysis of five reported cases for 2008 and six reported cases for 2009 was conducted. A list of all accident-related dockets was retrieved from the records of the LCRC whose officials attend to all accidents. Then, out of the 32 and 63 accidents reported for 2008 and 2009 respectively, only the motor vehicle collisions where vehicles flee the crime accidents scene were selected by hand to analyse.

Court decisions are another type of written record and these were used by the researcher to determine how many motor vehicles accidents cases went to trial and to analyse what actions were imposed or what best practices could have been used to better the individualisation of glass in motor vehicle collisions.

The following questions were put to the dockets as a guide for analysis:

a) Was physical matching as individualisation technique used at the specific motor vehicle accident?
b) What actions were taken to collect physical evidence at this specific motor vehicle accident?
c) Was somebody charged, sentenced or convicted in this specific case?

1.11 Data analysis

The researcher made use of the data analysis spiral as indicated by Leedy and Ormrod (2005:161) to analyse the data. Leedy and Ormrod (2005:161) and Creswell (2008:234) provide some steps to follow to analyse data. The process of data analysis entails using raw data to form the basis of one's research study by carrying out the steps outlined below:

1.11.1 The researcher organised the raw data retrieved from books, articles and the internet. Huge volumes of text were broken down into smaller controllable units and individual sentences. By organising the information, the researcher scanned through all data and divided the information according to each research question. A back up of all information was created in a data folder on the researcher's laptop. The researcher kept all data that was collected in hard copy, on two flash drives and in a folder on the researcher's laptop.

1.11.2 The researcher then perused all data several times to get a sense of what was contained in it as a whole. Through this process the researcher could clearly see what data was relevant to each research question and at what stage in the research it would be used. Some points that, according to the researcher, seemed important were written down to indicate different sections to concentrate on later on in the research process.

1.11.3 The next step was to classify or group the data according to categories or themes. Once again the researcher grouped the data according to the research questions. This was done when the researcher got an idea of the meaning of the data and could form some pattern and answer the research questions.

1.11.4 At the synthesis stage, the researcher integrated and summarised the data. The researcher could not use all of the data and had to summarise the relevant and important data and decide which data could be integrated with the rest of the information obtained. Throughout this stage the integration or relationship between categories were included.

1.11.5 Finally, the researcher could divide the report into chapters that addressed each of the research questions.

There was a description of how the data was coded and analysed and how the findings were validated. According to Leedy and Ormrod (2005:161), the researcher should remain “true” to the data and there should be no evidence of bias in the interpretation of results.

Using the interview schedule, the researcher interviewed 24 participants for this study:

- Four of the participants were forensic specialists, with the most experienced specialist having worked for 24 years in the department and having had 20 years’ experience in the collection of physical evidence at motor vehicle accidents. The highest qualifications of these specialists included BSc Chemistry, BTech Lab Management, ND Chemistry, Advance Programme in Forensic Criminalistics and BTech Chemistry. All four had received formal training in dealing with the individualisation of physical evidence. This included Forensic Science Laboratory (FSL) in-house forensic training, training at the FBI Trace Evidence School and several in-service training courses in physical matching and microscopic individualisation.
- Of the five forensic analysts, the most experienced analyst had worked for 25 years in the field as a criminalistics expert and had 18 years’ experience in the collection of physical evidence at motor vehicle accidents. The highest qualifications of these analysts included a Diploma in Forensic Criminalistics. All analysts had formal training that included advanced crime scene courses, internal forensic and chemistry training.
- Of the 15 detectives, the most experienced detective had 21 years’ experience in the investigation of crimes and, in particular, motor vehicle accidents. The highest qualifications included a BTech in Policing. None of the detectives had formal training in physical matching or individualisation.

1.12 Measures taken to ensure validity

Validity concerns the accuracy of the questions asked, the data collected and the explanations offered. Generally, it relates to the data and the analysis used in the research (Denscombe, 2002:100). Maintaining validity ensures that the research truly measures what it is intended to measure in a reliable and generalised way. The researcher regarded the structured interview questions that were asked and the literature that was used as valid, accurate and relevant, because they were based on and addressed the research questions that were relevant to the topic.

The researcher regarded the data collection techniques to be valid, based on the following factors:

1.12.1 Literature validity

The literature collection was considered to be valid because it was collected from a wide range of sources, and the researcher followed Mouton's (2001:90) criteria for a good literature review. The literature addressed the aim and the research questions of the study.

1.12.2 Interview validity

The guidelines for conducting productive interviews were followed as pointed out by Leedy and Ormrod (2005:159). The interview schedule was directly related to the original research questions, which, in turn, sought to address the main working title of this research report.

No factors influenced the actual interviews and the way they were conducted; the participants were interviewed in a normal environment and pre-arranged meeting dates were set up.

The participants approached the interviews as passive, neutral beings (Welman & Kruger, 1999:109). There were no reactivity of research; there was no placebo effect; there were no Hawthorne or John Henry effects, and no demand characteristics could be noticed during the interview process, as pointed out by Welman and Kruger

(1999:109). This means that no activity in this research was redone. The placebo effect means that the participants are used to create “blind” trials in which the participants do not know whether they are getting the active treatment or not, so that physical effects can be measured independently of the participants’ expectations. The Hawthorne effect occurs when research participants know they are being studied and alter their performance because of the attention they receive from the researcher.

The interviews were done with specialists in the field of accidents and forensic analysis and experts in the field of investigation of motor vehicle collisions. The researcher regarded the data analysis process as valid and relevant because researchers such as Leedy and Ormrod (2005:159) and Creswell (2008:234) have prescribed it.

1.12.3 Document validity

The documents that were located were valid because of the fact that the researcher read competing or rival hypotheses and reviewed all literature as objectively as was possible. Motor vehicle accidents and specifically hit-and-run incidents that were reported were of high validity, because a critical docket analysis was done on the contents of these dockets. The docket analysis process, in itself, substantiated the relevance and validity of the documents.

1.12.4 Data analysis validity

The researcher followed Leedy and Ormrod’s (2005:161) data analysis spiral process. Their approach to data collection and analysis and Mouton’s (2001:109) data-capturing guidance were adhered to and the researcher ensured that:

- No data-capturing errors occurred during the data collection process as the researcher captured the data manually and point-for-point personally and saved a master copy in a data folder in the researcher’s laptop, to ensure the original data-capturing records would stay constant;
- No post-coding errors occurred after data collection because the researcher referred back to chronologically filed documents, field notes of docket analysis and interview schedules. The researcher did all the data-capturing personally and re-checked the data capturing several times; and

- No missing values during data capturing involving statistics were identified and all statistical values were captured manually and point-by-point by the researcher; each value was also re-checked and compared to totals. This process eliminated any capturing of coding errors.

Through this process, the researcher ensured that no errors or omissions were made during the data collection process that could have had an effect on the validity of the data.

1.13 Measures taken to ensure reliability

The researcher put all measures in place to ensure internal consistency when seeking a high degree of generalisation across the items within the measurement (Welman & Kruger, 1999:144).

The fact that the researcher used pre-determined questions in the search of the data proved that the interviews were reliable, because there was stability and consistency in the questions (Singleton & Straits, 1999:114). The researcher regarded the methods of data collection as reliable because they did not vary from occasion to occasion. For example, if the researcher interviewed two participants about “what physical matching entails”, the results achieved were the same, because the method produced the same result.

Reliability relates to the methods of data collection and the concern that data collection was consistent and that it did not distort the findings. Generally reliability entails an evaluation of the methods and techniques used to collect the data (Denscombe, 2002:100).

1.14 Ethical considerations

Denscombe (2002:165) refers to “ethics” as “the duties and responsibility of individuals”, with broader systems of moral principles and rules of conduct. Ethics concerns the systems of moral principles by which individuals can judge their actions as right or

wrong, good or bad. This means that the ultimate goal of science lies in the search for truth (Mouton, 2001:239).

Most ethical research falls into one of four categories: protecting from harm, informed consent, right to privacy and honesty with professional colleagues (Leedy & Ormrod, 2005:101).

The researcher followed Mouton's (2001:243) ethical guidelines and did not force people to be interviewed and adhered to their right to refuse to be interviewed. The researcher also acknowledged people's right to refuse to answer questions. When coming to informed consent, participants were informed of the nature of the study to be conducted and were given the choice of either participating in or not participating in the study (Leedy & Ormrod, 2005:101). The participants were also given written information about the research being conducted.

The participants were notified that they had the right to withdraw at any stage even if they had previously agreed to participate in the study (Leedy & Ormrod, 2005:101). The participants were not deceived and were not submitted to any unnecessary distress or discomfort. Any participation in this study was completely voluntary (Leedy & Ormrod, 2005:101).

The researcher kept the nature and quality of the participants' performance strictly confidential (Leedy & Ormrod, 2005:102). At no stage was the research report, oral or written, presented in such a way that others became aware of how a particular participant had responded or behaved (Leedy & Ormrod, 2005:102). There should be evidence that the researcher has stored the data safely, and that it remains confidential to the researcher. It has been argued that social researchers are expected to be honest and open about who they are and what they are doing and not rely on misrepresentation or deception as a means to getting the necessary information (Denscombe, 2002:178).

Leedy and Ormrod (2005:102) recommend that with respect to protection from harm, a researcher should not expose research participants to undue physical or psychological

harm. No intrusive measures, such as physiological or psychological experiments, situations involving abnormal stressful activity, or procedures involving the dosing of participants, were used during this study, as suggested by Mouton (2001:245).

In following Mouton's (2001:244) guidelines, the researcher communicated with the institution the researcher represents and the participants in the study about the aims of the research, their rights in terms of anonymity, and how the data was to be used and disclosed as part of the research report. Following Leedy and Ormrod's (2005:102) guidance, honesty and professionalism with colleagues was taken into consideration and the researcher strove to report the findings of the study in a complete and honest fashion, without misinterpreting what was done or intentionally misleading others about the nature of the findings. As Denscombe (2002:177) has pointed out, researchers should be committed to discovering and reporting things as faithfully and as honestly as possible, without allowing their investigations to be influenced by considerations other than what is the truth of the matter.

The researcher took into consideration issues such as objectivity and integrity in research, the recording of their own data, ethical publishing practices, no fabrication or falsification of data in the research process, the appropriate ascription of authorships to a publication, the rejection of any form of plagiarism, no secret research, the right to privacy, the right to anonymity and confidentiality and the right to full disclosure of the research carried out (Mouton, 2001:239-245).

1.15 Research structure

The research report is divided into four chapters based on the research design, the research questions and research findings, and is set out as follows:

Chapter 1: General Orientation

In this chapter the focus is on giving a broad overview of the research proposal, the objectives and importance of the study.

Chapter 2: Physical Matching

In this chapter the main focus is on what physical matching is as well as a focus on the process of physical matching for individualisation purposes.

Chapter 3: Physical Matching as an Individualisation Technique

Here the researcher discusses the difference between identification and individualisation in depth and the role individualisation plays in the investigation process.

Chapter 4: Findings and Recommendations

In this chapter the findings related to the research questions are discussed and a number of recommendations are offered on the training of investigators and the transfer of skills to investigators investigating motor vehicle accidents.

CHAPTER 2
PHYSICAL MATCHING

2.1 Introduction

When a crime is committed, the role of investigation is to determine the legality of the crime committed together with the unlawfulness of the act and the intent of the act performed by the person. Police have many strategies and tactics in place when it comes to the investigation of crime. Many of the investigations into crimes entail balancing and prioritising objectives with regard to each crime reported. If proper investigation of any crime is carried out, it will lead to a good detection and conviction rate that will result in the decline and prevention of crimes.

In this chapter the researcher will discuss physical matching, and forensic and criminal investigation.

2.2 Physical matching

The first case of physical matching is documented in 1784, when John Toms was convicted of murder. A wad of newspaper was found in his pocket matching the newspaper that was used as a filling in his pistol (Pyrek, 2007:3). In the case of a vehicle accident crime scene, a physical match involves producing a match between evidence found at a scene of an accident with that of the suspected vehicle (Zamir et al., 2000:352).

To be able to conduct physical matching, there must be physical evidence on the scene of crime. This section will start with the definition of physical evidence.

2.2.1 Definition of physical evidence

Marais (1992:5) states that physical evidence includes a large variety of objects: almost any object, substance, trace or impression could constitute physical evidence. Anything that could indicate that a crime has been committed, or which could point to the identification or detection of a criminal or could be associated with a criminal, such as fingerprints, glass, hair, blood, soil or semen, may be termed as evidence. Houck (2001:69) also states that physical evidence may take the form of a variety of materials.

2.2.2 Meaning of physical matching

Physical matching involves the recovery of unique fragments from physical evidence found at a scene of crime and the comparison of these fragments to a possible source (Zamir et al., 2000:352). A physical match is achieved when any piece of any solid, which may for example be glass, synthetic glass or plastic, is broken or fragmented and the resulting fragments can be physically matched or fitted to each other. This can be at a macroscopic and/or a microscopic level (South African Police Service, 2001:5). Physical matching remains the most definite means of establishing a common origin between a known and an unknown sample. If the forensic scientist can fit two samples of glass together to form one, then they can determine that the samples have only originated from that one item and nowhere else (Tilstone, Savage & Clark, 2006:168). According to the South African Department of Safety and Security (1998:50), physical matching takes place when two or more parts of an object fit one another and together form the complete object. The parts must form pieces of the whole object above all reasonable doubts. Physical matching plays an important role in the determination of the origin of the object and can be carried out on virtually any physical evidence, such as soil, glass, plastic, wood, synthetic glass, paper, herd skin, paint or any broken or torn object (South Africa, 1998:50).

In response to the question “What is physical matching?” the participants provided with the following answers:

- Participant 2 (2010) said if the irregularly shaped fractured or torn edges of two pieces of any material can be joined together to form a continuous section, then it can be concluded that the two pieces at one time shared a common origin and can be referred to as a physical match.
- It is the linking or fitting together of two or more pieces of any object that was intact before separation occurred (three participants).
- It is to match physically separate items to each other to determine if they have the same point of origin (four participants).
- To match a known part of evidence with an unknown part of the same kind of evidence (two participants).

- It is when a piece of glass or plastic is broken and the fragments of the glass or plastic can be fitted or matched to each other (four participants).
- To match two or more pieces, for example glass, with each other and to compare each piece to form an object that is unique (five participants).
- To link pieces of evidence (glass) that are in scattered, to form part of the same item (five participants).

Only one participant provided a detailed explanation of physical matching, while other participants had a similar but less scientific explanation. All are in agreement that physical matching is to match two or more separate items to each other to determine if they have the same point of origin or form part of a unique object.

Based on the information gathered from the literature one can conclude that physical matching occurs when any fragments of physical evidence such as glass, synthetic glass, plastic lights, glass bulbs found at a scene are matched or fitted together and form or are part of a whole or complete object beyond all reasonable doubts. The viewpoint of the literature was compared with the viewpoints of the participants and the researcher found no significant difference. It seems as if the participants have a good workable knowledge of what physical matching entails. Both viewpoints share the fact that two or more items (like glass) fitted together to form part of one whole object is considered as physical matching. The researcher's understanding of how physical matching works is that it is based on the principle of building a puzzle, where pieces found on the scene are put together and then the disputed piece is fitted in to find a match.

2.2.3 Objective of physical matching

The objective of physical matching is to recognise, collect, interpret or compare and to reconstruct relevant physical evidence at a crime scene (Lee, Palmbach & Miller, 2001:7). Most of the clues that lead to a solution of a crime are found at the crime scene in the form of physical evidence. The main objective of the examination of physical evidence is to provide useful information to the crime investigator to solve cases (Lee et al., 2001:7). It is the interaction of these objectives and the physical evidence matching that is the basis of "scientific crime scene investigation".

In response to the question “What is the objective of physical matching?” The participants stated the following:

- The objective of physical matching is to determine whether the pieces of glass, back lights, glass bulbs, synthetic glass collected at the scene, after being fitted together form a specific shape which fits exactly with the one found later after investigation (four participants).
- The objective of physical matching is to fit together two or more pieces of broken object to form a unit in order to link a suspect with the scene of crime or the victim (three participants).
- The objective is to give information to the investigator to use as an investigative tool to solve the crime committed (two participants).
- The objective of physical matching is to use clues of physical evidence to solve a crime (two participants).
- The objective is to compare the piece of glass found at the motor vehicle accidents crime scene with the source of origin such as on a vehicle’s head light (three participants).
- The objective of physical matching is to use valuable physical evidence to place a suspect or object used by a suspect at a scene of crime (four participants).
- The objective is to prove that the colour, size, shape and material from the object collected from the scene after being put together form the unique object that fits exactly at the point where the source object is broken (six participants).

On the basis of the feedback from the participants and information from the literature it is understood that the objective of physical matching is to recognise, collect, interpret or compare and reconstruct relevant physical evidence at the crime scene that will provide useful information to the crime investigator to individualise a suspected vehicle with the evidence found at the crime scene. The participants specifically see the objective of physical matching as the fitting together of two or more pieces of broken object to form a unit in order to link a suspect with the scene of crime or the victim.

The viewpoint of the literature was compared with the viewpoints of the participants and the researcher found no significant difference. It seems as if the participants have a

good working knowledge of what the objective of physical matching is and they are all in agreement with each other.

2.2.4 Importance of physical matching

The linkage of a person to a crime scene is accomplished by the crime scene investigation and analysis of physical evidence (Lee et al., 2001:9). Lee et al. (2001:9) further state that the indirect linkage between people and crime scenes by the use of physical evidence plays an important role in physical matching. Evidence of physical objects found at the scene, such as footwear prints, tyre prints, tool marks, glass, and fibre, can be a direct link.

Another type of linkage is the linkage of an object to a particular crime. The discovery of physical evidence at a location can often link a person to a specific criminal act (Lee et al., 2001:10). For example, glass, plastic back lights, synthetic glass or paint at a motor vehicle accident scene can be linked to the vehicle of the person believed to be the driver in the motor vehicle accidents. According to Swanson, Chamelin and Territo (2003:226), the importance of physical matching in the investigative process can, firstly, establish the elements of a crime. For example, physical evidence left at an accident scene may establish the occurrence of a vehicle that fled the scene after causing an accident. Secondly, physical evidence can associate or link victims to crime scenes, offenders to crime scenes, victims to victims, instruments to crime scenes and offenders to instruments (Swanson et al., 2003:226). For example, glass, synthetic glass, plastic, or glass light bulbs (physical evidence) from a vehicle at a motor vehicle accident can link an offender (driver of the vehicle) to the crime scene. Lastly, Swanson et al. (2003:226) argue that physical evidence submitted for analysis is intended to establish proof of guilt. For example, the glass light bulb or plastic taillight or synthetic glass headlamp at a motor vehicle accident scene are used to help establish proof of guilt.

Lee et al. (2001:11) write that proper crime scene investigation and analysis of physical evidence can often assist with the determination of the credibility of victims or suspects. An example would be the investigation of a person believed to be the driver of the vehicle that fled from a scene of accident.

The researcher asked the participants to “explain the importance of physical matching as an investigative tool”; in response to which they provided the following answers:

- Physical matching links an object or person to an area or scene of crime (two participants).
- The physical matching comparison is the most positive conclusion that can be drawn in the area of evidence (six participants).
- Participant 3 (2010) said that by physically matching the different items to each other you can determine whether different items have the same point of origin. One might find a piece of evidence with a suspect and another at the scene of crime and by physically matching the different items, one can ascertain that the suspect had to be at the scene of crime when the evidence broke or passed by at the same stage.
- Participant 7 (2010) said that if pieces of a vehicle’s lights are found at a scene of crime and the vehicle is recovered, the pieces can be matched to the lights, thereby placing the vehicle at the scene of crime.
- Conclusive evidence can be obtained from physical matching that the pieces of evidence came from the same object (three participants).
- Physical matching can be used as evidence in court and to individualise the unknown from the known source of origin (two participants).
- Physical matching is important in determining the origin (the known) of a piece of evidence that will lead to the unknown by putting the pieces together (five participants).
- It is to prove whether the said vehicle was on the scene and to prove that the said vehicle is the one that caused the accident (two participants).

The view of the literature on the importance of physical matching in the investigative process is that it establishes the elements of a crime and that physical evidence can associate or link victims to crime scenes, offenders to crime scenes, victims to victims, instruments to crime scenes and offenders to instruments and that physical evidence submitted for analysis is intended to establish associations.

The views of the participants are that by physically matching the different items one can ascertain that the suspected vehicle had to be at the scene of crime when the glass, synthetic glass, plastic, glass light bulb broke or passed by at the same stage and to link an object or person to an area or scene of crime.

The researcher observed that when the viewpoints of the literature are compared with the viewpoints of the participants there is no significant difference. It also seems as if the participants are all in agreement with one another.

2.2.5 Individualisation of evidence

James and Nordby (2003:117) state that not every crime scene has individualising physical evidence such as fingerprints, but every crime scene contains physical evidence that assists the investigator. A synonym for physical matching is “associative evidence”, which means that evidence will be located and then used to associate or disassociate a suspect. Such items or evidence are considered unknown or of questioned origin until a comparison is made to a known standard (James & Nordby, 2003:168). The items or evidence are collected from a victim, suspect, or witness and the investigation of the scene of crime. It is important when comparing evidence that the significance of association is mentioned (James & Nordby, 2003:168).

With physical matching, questioned samples are distinguished from the known standards. Sometimes it may even happen that the questioned sample is indistinguishable, or that there is no match for the standard or the comparison is inconclusive (James & Nordby, 2003:169). James and Nordby (2003:170) state that the questioned sample, even when indistinguishable from the known, cannot be said to be from that particular standard to the exclusion of all others. Fractured matches are made when an unknown fractured piece of grill, for example, is matched to a known by comparison of the fractured edges of both samples. Another example is that the synthetic glass headlamp pieces may lead only to a list of possible vehicle brands or specific models (Curran, Hicks & Buckleton, 2000:89).

The researcher conducted case file analyses on five cases from 2008 and six cases from 2009. The researcher tried to establish whether individualisation of physical evidence had been carried out at the specific motor vehicle accident, and the researcher found that in none of the cases had individualisation of physical evidence been done. According to the researcher, the reason for this might be that the first people to arrive at and attend to the accident scene the vehicle fled from are unaware of the importance of the individualisation of physical evidence, as they have not received formal training. Also, the people with experience such as the analysts and specialists do not attend or in some instances attend to the scenes later.

The researcher asked the participants to “explain the individualisation of evidence”, and they gave the following answers:

- Participant 17 (2010) said the individualisation of evidence can be linked to another piece of evidence that was found at the crime scene.
- Individualisation of evidence is the linking or identifying of the unknowns for courts (eight participants).
- Participant 8 (2010) said that it is to compare the known with the unknown and to individualise the physical evidence as an original object.
- Forensic investigation is used to individualise certain evidence to a person or crime (seven participants).
- Participant 9 (2010) said that if a physical match or fit can be made between two or more objects, it is conclusive evidence that they come from the same origin.
- Individualisation is the process of linking physical evidence to a common source (five participants).
- Participant 4 (2010) gave the following explanation. A puzzle or fracture match results when two pieces of rigid material (wood, glass, plastic) from separate locations are reconstructed to form a continuous section of that material. According to this participant, this type of match is only possible if the pieces originally were part of the same object.

The researcher found that according to the literature, individualisation of evidence is the physical matching of questioned samples which are individualised or distinguished from the known standards. It may happen, though, that questioned samples cannot be individualised or are indistinguishable from the known. For example, physical evidence found at a scene of crime may lead only to a list of possible vehicle brands or models and not to the culprit in question.

The viewpoint of the participants on this matter is inadequate compared with the information obtained from the literature. Only seven participants indicated that individualisation is the process of linking physical evidence to a common source, or rather comparing the known with the unknown and individualising evidence as an original object. This may be because only nine participants had more than 10 years of specific experience and specialised training in the collection of physical evidence at motor vehicle accidents.

2.2.6 Process of physical matching

It is important to collect, package, mark, seal and preserve physical evidence in a consistent manner, so that no item of evidence will be missed, lost, contaminated or destroyed before matching has taken place (James & Nordby, 2003:123). Houck (2001:3) states that the initial stages of a crime scene investigation are crucial, because valuable physical evidence can be lost, destroyed or altered, by individuals not directly responsible for documentation, recording and recovering of evidence. For the researcher this means that even traffic and police officials, who are inquisitive at crime scenes, can destroy evidence.

According to Houck (2001:3), the physical contact between two individuals, objects, or individuals and objects is dependent on the nature of the contact, duration of the contact and the nature of the contacting surface. According to Marais (1992:9), the process of physical matching involves the following:

- Identifying or recognising of physical evidence at the scene of crime ;
- Protection of the crime scene and all evidence at the scene;

- Recording of all evidence at the crime scene by means of photographs, sketches and notes;
- Correct collecting and packaging of physical evidence according to prescriptions;
- Marking and labelling of physical evidence collected at the scene of crime;
- Maintaining the chain of custody of evidence for use in a court of law;
- Continuous safe keeping of physical evidence; and
- Presentation of evidence before a court of law.

In response to the request to "explain the process of physical matching for individualisation purposes," the researcher found the following:

- Participant 1 (2010) said that the process starts with visiting the scene, documenting all physical evidence on its exact spot on the scene, collecting and preserving all evidence, properly packing and sealing evidence for analysing, and sending objects to the scientific analysis unit, where objects are compared microscopically or chemically.
- The process involves finding objects you wish to match, properly packaging and sealing them and forwarding them to specialists to compare chemically and microscopically (seven participants).
- It is the act of linking pieces of evidence that exist in pieces but once were part of the same item (six participants).
- Participant 3 (2010) said that one physically matches different pieces to each other and eliminates pieces not fitting the object. The process will include looking at the size of the object, the colour of the object, what the object is made of (the texture) and comparing straight lines with straight lines and not square blocks.
- The process involves physically matching broken items that were one object and reaching a conclusion that they have the same origin (eight participants).
- Participant 19 (2010) stated that physical matching is a process of gathering and comparing of pieces of solid material that were separated by tearing, breaking or cutting.

The researcher noted that the literature gave a clear explanation of the process of physical matching for individualisation purposes. This process starts with the identifying of evidence such as glass at the scene, and comprises protecting, documenting, collecting, packaging, marking and labelling of the physical evidence, through the chain of custody and the safekeeping of physical evidence to the presenting of this evidence before a court.

The participants, on the other hand, only talked about the visiting of the scene, and then the documenting, collecting, preserving, proper packaging and sealing of physical evidence. None of them indicated the chain of custody and preserving of evidence to present before a court of law, as part of the process. Only three participants spoke about the process in their response.

There is a difference in the views presented by the literature and the participants. The researcher is of the opinion that the reason for this was that a minimum number of participants had formal training and/or experience in the collecting of physical evidence, which forms a large part of the process of physical matching.

2.3 Forensic investigation

Forensic investigation is an art requiring knowledge of self, society and people (Genge, 2002:19). Forensic investigation involves the lawful tracing of people and exhibits, which may, directly or indirectly, contribute to the reconstruction of a crime situation and supply information about the modus operandi and the people involved in the crime for the purpose of bringing a criminal to justice (Dowling, 1997:1). In essence it involves observation and inquiry in order to obtain factual information about allegations, circumstances and associations (Marais & Van Rooyen, 1994:13). Miller and Brewer (2003:116) state that the integration of the crime scene investigation with the examination of the scene's physical evidence forms the basis of forensic investigation. The term "forensic" is an adjective applied to a number of fields to indicate their specific application to the criminal justice realm (Axelrod & Antinozzi, 2003:41). According to Lambrechts (2010:75), forensic investigation is investigation aimed at instituting court proceedings and where some or other scientific knowledge is applied to a legal problem.

Forensic investigation represents the medium in which facts for positive investigation are detected, identified, collected, preserved and prepared for the judicial process (Marais & Van Rooyen, 1994:17). According to Lambrechts (2010:73), forensic investigation involves the combination of scientific and investigative methods and techniques to ensure a proper investigation and to present the evidence in a court of law.

Forensics is science and forensic science is the application of scientific principles and technology to the characterisation of evidence items in a legal context (Genge, 2002:12). Forensic science is thus used to produce evidence and there are many ways to classify that evidence. These ways may include associative linking of people, places or objects. The well-known Locard Exchange Principle is about associative evidence. However, much of the evidence that comes from the typical crime laboratory is not associative, but inceptive. The inceptive approach addresses the issue of whether an offence has occurred (Genge, 2002:23). Lee and Harris (2000:16) argue that the systematic crime scene investigation is based on the principles of the transfer theory (the Locard Exchange Principle); basic, logical analysis; and the utilisation of scientific knowledge with the forensic technology of physical evidence analysis to generate investigation leads that will ultimately solve the crime.

According to James and Nordby (2003:116), forensic investigation means to observe intensely, to question systematically and to gather information. Horswell (2004:4) writes that it is a searching inquiry in order to ascertain facts. This, on its own, will reveal the truth and ultimately lead to the reconstruction of the crime.

In response to the question “How would you define forensic investigation?” the participants stated the following:

- It is specialised aid to assist criminal investigation, based on scientific facts (three participants).

- It is the application of techniques of science to legal matters, both criminal and civil (three participants).
- It is the investigation of crime and evidence through science (two participants).
- It is a study of nature and behaviour of natural things with regard to the law (three participants).
- It is an investigation of a criminal nature, which is presented in a court of law (five participants).
- It is an investigation where a crime was committed (six participants).
- Participant 18 (2010) said “forensic” also means to “work” for the court and where the court is your “main client,” meaning the court is the final place where it will be decided whether or not an accused is guilty.
- Participant 16 (2010) considered forensic investigation to mean having sufficient evidence to prove a case in court.

The researcher observed that the literature defined forensic investigation as investigation involving scientific methods aimed at instituting court proceedings. On the other hand, the researcher found that the view of the participants indicated that it is the investigation of crime and evidence through science, which will be presented in a court of law. The majority of the participants’ responses differed from the view presented in the literature and the reason for this may be ascribed to the fact that only five participants had received formal training in forensic investigation or forensic criminalistics. The other participants’ views regarding the definition of forensic investigation are very narrow.

2.4 Criminal investigation

Criminal investigation is a systematic search for the truth with the primary purpose of finding a positive solution to a crime with the help of objective and subjective clues (Adams, Caddell & Krutsinger, 2004:4). According to Du Preez (1996:2), criminal investigation is a systematic, planned process consisting in fact of the following components: information, recognition, gathering and preservation of information, and evaluation. Marais (1992:1) reveals that criminal investigation is a process of identification of people and physical objects from the time the crime is committed until

the guilt of the perpetrator is either proven or the perpetrator is acquitted in court. Axelrod and Antinozzi (2003:13-14) comment that a piece of evidence or one clue can immediately reveal the identity of the criminal. They further mention that real investigations are typically much harder work and much less instantly revealing and that many crimes cannot be solved, even by highly skilled investigators. They also argue that some crime scenes present insufficient evidence and offer no witnesses.

When the researcher asked the participants to define criminal investigation, the responses were as follows:

- Criminal investigation is the process of gathering evidence (seven participants).
- Criminal investigation is about tracing and arresting suspects (five participants).
- Criminal investigation is when the suspect is arrested and a trial has to be conducted to establish the guilt or innocence of such a suspect (four participants).
- Criminal investigation is used to determine the legality of an act (five participants).
- Participant 3 (2010) said that forensic investigation is the investigation of crime and evidence through science. Criminal investigation, on the other hand, is the specialised system of knowledge on which criminalistics, as a developing science, is based, comprising in effect the collection, studying, evaluation and utilisation of information and managed according to all possible technology and tactics available in order to ensure the realisation of the objective of individualisation.
- Participant 9 (2010) said that with forensic investigation there is a search for and gathering of physical evidence and in a criminal investigation a suspect must be linked with the physical evidence found at the scene of crime and, if guilty, brought to book.
- Participant 20 (2010) stated that forensic investigation is a more scientific process but that forensic and criminal investigators work hand in glove.

The literature defines criminal investigation as a systematic planned process of identifying people and objects by means of obtaining information, recognition, gathering,

preserving and evaluation of evidence. According to the participants, criminal investigation is defined as the process of gathering evidence in order to prosecute a suspect in criminal court. Only five participants' views are in agreement with that of the literature. The reason for this general lack of agreement may be the lack of formal training of some of the participants in forensic and criminal investigation.

2.5 Difference between forensic investigation and criminal investigation

Sir Arthur Conan Doyle, narrator of Sherlock Holmes once said, "Once you eliminate the impossible, whatever remains, no matter how improbable, must be true." While forensic investigation means court-aimed investigations, some detectives argue that criminal investigation cannot be taught, but must be learned through years of practice (Axelrod & Antinozzi, 2003:30).

Following her analysis of the literature on forensic and criminal investigation and the interviews with the participants where the researcher asked the participants to give their opinion on the "difference between forensic investigation and criminal investigation," the researcher compiled a table to differentiate between forensic and criminal investigation.

Table 1: Difference between forensic and criminal investigation

Forensic Investigation	***Criminal Investigation***
Lee et al. (2001:16) explain that scientific crime scene investigation or the forensic investigation process is a process which not only includes documentation of the crime scene and collection and preservation of physical evidence but also demands more dynamic approaches like scene survey, analysis of scene definition, and the development of a link between physical evidence and a person or object (known as physical matching).	Criminal investigation is a systematic, planned process consisting of the following components: information, recognition, gathering and preservation of information and evaluation (Du Preez, 1996:2). Criminal investigation is the specialised system of knowledge on which criminalistics is based (four participants)
Forensic investigation is therefore based	Du Preez (1996:2) regards criminal

on a scientific method that means that the investigation of a crime scene is approached in a systematic and methodical way (Lee et al., 2001:16). Forensic investigation is the investigation of crime and evidence through science. Forensic investigation focuses on the physical evidence (two participants)	investigation as the systematic process of identification, gathering, preservation and evaluation of information with a view to bringing the transgressor to trial. Criminal investigation has more to do with people/suspects/witnesses. It links forensically with crime (two participants)
According to Lee et al. (2001:17), crime scene investigation is the most crucial step of any forensic investigation of a criminal act and that the systematic process of forensic investigation consists of: ▪ Response or recognition of the crime scene ▪ Crime scene survey ▪ Documentation of the crime scene ▪ Recognition of physical evidence ▪ Development, collection, and preservation of physical evidence ▪ Identification/analysis/comparison of physical evidence ▪ Individualisation of the physical matching ▪ Evaluation and interpretation ▪ Reconstruction of the crime scene ▪ Reporting and presentation	As in forensic investigation, Du Preez (1996:4) states that a criminal investigation can also be divided into five tests. ▪ The first test is to collect information from people or objects in a systematic, planned process. ▪ The second test focuses on the gathering of objective or subjective information that will reveal the truth about the crime. ▪ The third test is the recognition of relevant information that has a possible value in solving the crime. ▪ The fourth test is the test of gathering and preserving of the information so that the legal and physical integrity is maintained. ▪ The fifth and final test of every criminal investigation is to evaluate the information properly and determine if it is relevant to the case.
James and Nordby (2003:17) also state that the steps in the scientific examination of a crime scene include scene survey,	Criminal investigation is the process of investigation of a criminal act and is a sub-division of forensic investigation (five

documentation and collection and preservation under the recognition of physical evidence section as well as evaluation and interpretation under the individualisation of physical evidence section. Forensic comprises scientific and criminal focuses on the investigation of crime (six participants)	participants)
According to Lambrechts (2010:75), forensic investigation is an investigation aimed at instituting court proceedings, and if the investigation concerned does not conform with the preceding in court, then it is not a forensic investigation.	Forensic and criminal investigation go hand in hand with one another (four participants) Forensic and criminal investigation comprises investigations conducted in ballistics, chemistry, and biology. Forensic just means “for court” (three participants)

Sources: Du Preez (1996:2-4); James and Nordby (2003:17); Lambrechts (2010:75); Lee, Palmbach and Miller (2001:16-17)

The researcher noted that in the literature, forensic investigation is defined as investigation aimed at instituting criminal, civil and disciplinary proceedings and where scientific knowledge is applied while criminal investigation is considered to be a process identifying people and obtaining physical objects and evidence from a crime scene, to be used in criminal proceedings.

The researcher compared the literature and views of the participants and this comparison indicated that there is no distinctive difference between the two view points. Even though forensic investigation also includes civil proceedings, it has a similar meaning to criminal investigation. The interviews with the participants showed that apart from terminological differences, the meaning of forensic investigation and criminal investigation is the same. Consequently from this point onwards the researcher will use the term “investigation” to refer to both types of investigation.

2.6 Objectives of investigation

The objectives of any investigation are to establish that a crime has actually been committed, to obtain information and evidence legally to identify the responsible person, and to identify and apprehend the suspect(s), recover stolen property and assist in the prosecution of the person or people charged with the crime (Swanson et al., 2003:28). Du Preez (1996:4-7) further adds that investigation also has the objective of individualisation of crime.

When asked by the researcher what the objectives of investigation are, the participants responded as follows:

- Participant 1 (2010) said that the objective is to obtain reliable court-acceptable results.
- Participant 7 (2010) said that it is to obtain a conviction of the suspect above all reasonable doubts. In order to ensure successful prosecution and conviction, it is important that the forensic investigator has gained and documented enough evidence to link the accused to the crime.
- Participant 2 (2010) said that the objective is to interpret all clues scientifically and/or physical evidence optimally in order to deliver an impartial expert finding in criminal cases.
- The objective of investigation is to gather reliable court-acceptable evidence (six participants).
- The objective is to ascertain who the suspect is above all reasonable doubts and arrest the suspect (eight participants).
- The investigation's objective is to locate, document and recover stolen property (four participants).
- The objective of investigation is to prepare a solid case for prosecution purposes (three participants).

According to the researcher, the viewpoints expressed in the literature are that the objectives of investigation are to establish that a crime has been committed, legally obtain information and evidence to identify the culprit, and assist in prosecution of people suspected of being involved in the crime. The researcher further observed that

the viewpoints of the participants differed in this regard. Only three participants had a summarised explanation agreeing with the literature, while the other participants all only indicated one objective of investigation, which is also not a very clear answer to the question. The researcher is of the opinion that the participants' views differed from that of the literature because the majority of participants had not received formal training in forensic investigation and had minimal experience in this field of expertise.

Dowling (1997:1) added that the objectives of investigation comprise a systematic planned process and the gathering and safekeeping of evidence and evaluation. These objectives will now be discussed in more detail.

2.6.1 Systematic planned process

Without a systematic and planned process, very important and relevant evidence may be overlooked or ineffectively collected, with the result that incorrect deductions are made and the investigation sent in the wrong direction (Marais & Van Rooyen, 1994:18). A systematic plan arranges and directs the investigation procedures and can therefore assist the investigator in determining whether a crime has in fact been committed, who the perpetrator is and, in the process, proving conclusively their guilt or innocence (Du Preez, 1996:2).

2.6.2 Identification of crime

According to Marais and Van Rooyen (1994:19), the crime must be identified or recognised not only in terms of the initial observations that are made at the crime scene. The investigator should also be able to recognise and identify all relevant information that may shed light on the crime committed before the information has been gathered (Byrd, 2000:1). The correct identification of the crime situation is of fundamental importance, because mistaken identification can cause the investigation to be conducted in the wrong direction, which will lead to valuable evidence being lost and the investigator's hypothesis remaining unconfirmed (Marais, 1992:2-3).

2.6.3 Collection of evidence

“Physical evidence” refers to any material items that are present at the crime scene (Byrd, 2000:1). Byrd (2000:1) states that the gathering of evidence begins at the crime scene, because the crime scene contains visible and hidden information. Physical evidence is what we generally perceive as the evidence from a crime scene (Lee et al., 2001:25). Lee et al. (2001:25) further state that any particular object may prove to be the crucial piece of physical evidence necessary to solve the case and also describe physical evidence as any evidence that can provide useful information for investigators in solving cases.

According to Lee et al. (2001:27), there are different types of evidence:

- Transient evidence (of a temporary nature such as odours at a scene);
- Conditional evidence (produced by an event of action such as smoke or fire);
- Transfer evidence (produced by physical contact of people or surfaces);
- Pattern evidence (patterns in the form of prints, markings, blood, or glass fracture patterns found at a crime scene); and
- Associative evidence (specific evidence found at a crime scene to associate a victim or suspect with a particular scene).

2.6.4 Individualisation of the suspect

According to Dowling (1997:2), it is the primary task of the investigator to identify the person who has committed the crime. Once all relevant evidence has been collected and the suspect positively individualised, the investigator can proceed with the arrest of the criminal (Van Niekerk, 2000:4).

It is also the responsibility of the investigator to ensure that the criminal will be present at their trial and to submit the evidence required to reveal their unlawful action to the court (Du Preez, 1996:1). The investigator needs to be sure that the right person is arrested for the crime (Swanson et al., 2003:28).

2.6.5 Arrest of the perpetrator

The purpose of arrest is to ensure the presence of the accused at the trial (Marais & Van Rooyen, 1994:20). The primary task of the investigator is to identify who committed the crime (Lee & Harris, 2000:14).

2.6.6 Evaluation

All information gathered during the investigation should be properly evaluated (Horswell, 2004:90). This is essential not only to determine whether the information is relevant and conclusive but also to establish whether it has potential to shed light on the crime committed (Ogle, 2004:30). The presentation of evidence forms the nucleus of proof and is indeed the final test of every investigation (Du Preez, 1996:1).

2.6.7 Prosecution

The successful prosecution of criminals depends to a great extent upon the skill and efficiency of the investigator who has conducted the forensic/criminal investigation (Du Preez, 1996:7). The objective is to assist the public prosecutor in the prosecution process to present the evidence and to reconstruct the crime in court (Palm, 2000:35). All physical evidence at the scene of crime should be collected carefully and kept in such a way that its identity and legal integrity are protected (Genge, 2002:8).

2.7 Summary

Investigation and physical matching require a systematic search for the truth, in accordance with scientific principles. They also require a very positive attitude towards the investigation of clues at a scene of crime (Horswell, 2004:7). It is also very true, as emphasised by the participants, that experience plays a very big role in forensic investigation and the matching of physical evidence found at every crime scene.

CHAPTER 3
PHYSICAL MATCHING AS AN INDIVIDUALISATION TECHNIQUE

3.1 Introduction

The basis of all investigations is the ability of a crime scene investigator to recognise the potential and importance of all physical evidence, big and small, at a crime scene (Brown, 2001:383). The subsequent identification of the physical evidence and the determination of the possible source of origin of the evidence, that is, its individualisation, are the next steps in the investigation (Lee & Harris, 2000:12). A series of identifications leads to the encompassing aim in respect of investigation, namely individualisation (Lee & Harris, 2000:12).

According to Du Preez (1996:6), the overall aim of identification and individualisation is to individualise a crime as the unlawful act of a person or people. Individualisation and identification are crucial aspects of investigations, as without these aspects there can be no certainty about whether a crime was committed or not (Du Preez, 1996:6). In this chapter the researcher will explain physical matching of glass, synthetic glass, plastic lights or glass bulbs as an individualisation technique.

3.2 Identification

“Identification” means to put something with other objects that have the same characteristics (Lee et al., 2001:183). The term “characteristics” means the intentional or design features that would be common to a particular group of items (Horswell, 2004:6). For example, one could ask whether certain fragments of glass, synthetic glass, plastic lights or glass bulbs in a collection can be grouped together, because the glass is from a specific glass source, the synthetic glass is from a specific synthetic glass source, plastic lights are from a specific plastic lights source. Identification involves sorting items based on similar general characteristics. The more characteristics two or more items have in common, the more complex or discriminating the identification (Lee et al., 2001:183).

Identification is based on the theory that everything in the universe is unique in that it has distinctive individual and class characteristics (Marais, 1992:18). Marais (1992:18)

further explains that positive identification occurs when for example the glass, synthetic glass, plastic light or glass bulbs impression in question and the original source share confirmed random characteristics that. These characteristics are highlighted by the good features and position of the impression, the opinion of an experienced investigator and the fact that the impression cannot be repeated on another impression sharing the same description. Identification means the placing of objects in a specific group with similar characteristics and is therefore known as a “classification scheme”, presenting a good chance of determining the generic type origin and source of the physical evidence found at the scene of crime (Lee et al., 2001:184).

Items are identified by comparing selected class characteristics of an unknown object with similar characteristics of a known criterion. For example, if the selected class characteristics are basically similar between the known and unknown samples, then the unknown source can be classified with the known (Lee et al., 2001:184).

According to Bodziak (1996:689), the answers to the questions concerning the number of characteristics necessary for identification of an object and the quality of those characteristics depend on the distinctiveness and individuality of the characteristics themselves and the number thought necessary in the examiner’s judgement. Identifications with just one characteristic are not common and should be made only when the characteristic has more than one unique feature or is convincingly the result of the corresponding random characteristics of the evidence (Marais, 1992:20). Each case must therefore rest on its own merit.

The correct identification of the crime situation is of fundamental importance because mistaken identification can give rise to the investigation being sent in the wrong direction, valuable evidence being lost and the investigator’s hypothesis remaining unconfirmed (Lee et al., 2001:184). Identification only attains criminalistic significance when its individuality is determined, which means the object is positively compared with the surface of origin (Lee et al., 2001:184).

Identification forms the basis of investigation (Adams et al., 2004:5-6). A series of identifications leads to the surrounding aim in respect of crime investigation, namely individualisation (Lee & Harris, 2000:12). Identification for investigative purposes is merely a preface to the true function of investigation, which is that of individualisation (Lee & Harris, 2000:12). Du Preez (1996:6) states that the overall aim of identification and individualisation is to individualise a crime as the act of a person or people.

3.2.1 Categories of identification

One of the purposes of visiting the crime scene is to fulfil the action of identification. According to Van Heerden (1986:195), there are different categories of identification that can be used in investigation. These are:

- Situation identification
- Witness identification
- Victim identification
- Imprint identification
- Origin identification
- Action identification
- Culprit identification
- Cumulative identification

Because of the specific focus of this research (physical matching as individualisation technique in the investigation of motor vehicle accidents), only the following categories will be discussed: situation identification, witness identification, imprint identification, origin identification, action identification and cumulative identification.

3.2.1.1 Situation identification

Situation identification begins with the gathering of information (Du Preez, 1996:17). This type of identification is used to establish whether a crime had been committed and, if so, what type of crime (Van Heerden, 1985:14; Lee et al., 2001:27; Adams et al., 2004:10). When an investigator arrives at an alleged crime scene, it is not always obvious which type of crime has been committed or whether a crime has in fact been committed. This means that the investigator should assume nothing (Gardner, 2005:71;

Lee et al., 2001:24). Horswell (2004:8) points out that prior to attending the crime scene it is important for the investigator to obtain the best possible assessment of the circumstances relating to the incident.

Van Heerden (1985:14) and Gardner (2005:19) believe that the investigator should keep an open mind to ensure they do not make a mistake by being subjective. For example, uncertainty can sometimes arise about whether a building has burned down as a result of arson or whether it was set alight accidentally (Marais, 1992:2). Proper situation identification during crime scene processing will in most case scenarios enable the investigator to establish what crime was committed, and how (Van Heerden, 1985:14).

Adams et al. (2004:12) state that investigators should know the elements of each crime that they are going to investigate. Situation identification relates to the crime situation and individualises the unlawful nature of the situation (Du Preez, 1996:6, Gardner, 2005:75). In terms of the current study, if this identification category is applied during the analysis of physical evidence as an individualisation technique, the forensic investigator will be able to identify how and whether a crime, such as culpable homicide or reckless and negligent driving, has been committed.

3.2.1.2 Witness identification

Witness identification plays a role in assisting the investigator to obtain factual evidence regarding the suspect and the role they played in the commission of the crime (Van Heerden, 1986:195). Witness identification can also be used to establish the nature of events and elements of the crime, through eye witness statements. Witness identification is challenged by human error, such as inadequate observation and faulty association, and it is therefore not always the most reliable type of identification. Physical evidence from the motor vehicle accident crime scene in the form of glass, synthetic glass, mirrors, headlamps, glass bulbs and plastic lights or metal pieces is called “a silent witness” and can assist the police in identifying the vehicle that fled from the scene and that was involved in the accident (Hildebrand, 2004:1).

3.2.1.3 Imprint identification

Lee and Harris (2000:14) write that the imprint identification technique is based on the Locard Principle. Imprint identification is based on the assumption that all objects possess unique, individual characteristics which are transferred when they come into contact with suitable surfaces (Marais, 1992:145). The fundamental principle of imprint identification is that the distinctive characteristics of objects are transferred to any surface with which they come into contact (James & Nordby, 2003:172). For example, each piece of physical evidence, such as synthetic glass headlamps, glass light bulbs or plastic taillights left at a motor vehicle accident scene, has different characteristics that can be physically matched using the individualisation technique in the investigation of the accident. Imprint identification strives to identify and individualise a suspect by comparing a questioned imprint to a control imprint or an object of known source of origin (Du Preez, 1996:6). Should there be sufficient corresponding marks, the allegation can be substantiated that the specific imprint on the scene was made by a specific person or instrument (Chisum & Turvey, 2000:4; Gardner, 2005:49).

In some cases the connection of a person to a crime by means of an imprint is sufficient evidence that they are responsible for the identified crime (Lee & Harris, 2000:14). In other cases, this connection is merely contributory. Whatever the case may be, the value of imprint identification should never be underestimated (James & Nordby, 2003:173), as it attempts to achieve individualisation by comparing a disputed imprint with a control imprint of the alleged object (Gardner, 2005:53).

3.2.1.4 Action identification

The term “Action identification” refers to the modus operandi of the suspect, in other words the method used by the suspect to commit the crime (Van Heerden, 1986:198). For example, in some motor vehicle accidents, the modus operandi is the fleeing of the scene by a motor vehicle or motor cycle after colliding with a pedestrian, another motor cycle or motor vehicle. The physical matching of evidence left behind by the vehicle that has fled the scene could be used as an individualisation technique in the investigation of motor vehicle accidents. Many involuntary habits creep into human actions and eventually develop into personal characteristics unique to each individual (Palm, 2000:3; Lee et al., 2001:29). Consequently characteristics are developed, such as invariability

and uniqueness, making action identification a useful identification medium (Palm, 2000:4).

3.2.1.5 Origin identification

One of the purposes of visiting the crime scene is to locate physical evidence that can be individualised to trace the suspect (Van Heerden, 1986:198). Origin identification is the process of individualising the unknown by matching it to the known source or origin (Van Heerden, 1986:198). The physical matching of the unknown evidence found at the scene of a motor vehicle accident with the known source of origin found later during investigation can be used as an individualisation technique in the investigation of these motor vehicle accidents.

3.2.1.6 Cumulative identification

The individual value of each identification category can become apparent if the investigator utilises the relevant categories of identification properly during the investigation (Van Heerden, 1986:198). As discussed in each of the identification categories above, the categories indicates how physical evidence can be matched and can be used as an individualisation technique in the investigation of motor vehicle accidents. If this cumulative identification has been conducted, the investigator can come to the conclusion that on a preponderance of probabilities it is justified to summon a particular person to court (Callanan, 1994:7).

In short, the understanding of different identification categories can be used to indicate what type of crime was committed and what kind of information and clues can possibly be collected and that identification categories should be utilised during the investigation of glass, synthetic glass, plastic lights or glass bulbs found at a motor vehicle accident scene. The information, clues and facts gathered must confirm that an unlawful act was committed.

3.3 Individualisation

“Individualisation”’ means to distinguish somebody or something from others (Concise Oxford Dictionary, 1982:722). The *American Heritage Dictionary* (2006:322) defines “individualisation” as discriminating the individual from the generic group or species while Lee et al. (2001:184) state that individualisation means that an item of evidence comes from a unique source. “Individualisation” refers to the demonstration that a particular sample is unique even among members of the same class (Marais, 1992:19). Marais (1992:19) further mentions that individualisation indicates that a disputed object found at the crime scene and the standard of comparison is of the same origin. A standard of comparison is a specific object which can be linked to the object retrieved from a crime scene (Marais, 1992:19).

Lee and Harris (2000:12) further mention that individualisation takes place when a conclusion is reached by the expert that all characteristics/unique features agree and that sufficient correlation between individual characteristics is found. Individualisation therefore involves similarity, usually of the disputed object found at the scene of crime, for example the glass pieces or synthetic glass pieces or glass light bulbs, with the one of known origin obtained, for example the light on the vehicle that caused the accident and fled the scene (Du Preez, 1996:6). With individualisation, forensic scientists can with analysis determine if a particular sample is unique, even among the same class (Lee et al., 2001:184). Genge (2002:80) further states that the concept “individualisation” adds significant value to the concept of identification, since one can individualise a person or object and can therefore identify the origin or donor of the physical evidence found. Horswell (2004:6) states that individuality or uniqueness comprises those attributes that make one thing different from all others that are similar to it. Individualisation can be thought of as the uniqueness of an object to the exclusion of all other objects like itself (Fisher, Fisher & Kolowski, 2006:6-8).

Individualisation has two aims: firstly, to individualise the different disputed objects positively and, secondly, to indicate the involvement of the object or person that provides the standard of comparison (Marais, 1992:19). Marais (1992:22) explains that the process of individualisation starts at the crime scene and ends in the court, when evidence regarding the identity of a person or object is heard.

3.3.1 Difference between identification and individualisation

Marais (1992:20) argues that there is a clear distinction between individualisation and identification. Marais (1992:20) states that the concept of identification is of lesser value than the concept of individualisation, since with identification an object is identified as belonging to a specific class or group. The term “individualisation” is reserved for the process that attempts to determine whether two items share a unique common source, while identification should be used to describe the categorisation of items (Pyrek, 2007:227). The process of identification is therefore used to describe the physical nature of the evidence and individualisation, on the other hand, is used to describe the process of determining the origin of the evidence (Pyrek, 2007:227).

Another important theory regarding identification and individualisation is the distinction between macroscopic characters and microscopic traits (Fisher et al., 2006:6). Fisher et al. (2006:6) argue that identification is easily undertaken at a macroscopic level and individualisation is carried out at a microscopic level or even smaller.

The participants were asked “What is the difference between identification and individualisation?” They answered as follows:

On identification:

- People are identified (three participants).
- Identification is to identify the crime (one participant).
- Participant 2 (2010) stated that identification is the analysis of physical evidence, determination of the chemical substance, or the identification of material.
- Identification is where a certain product or person is identified to a certain group (six participants).
- No difference exists between identification and individualisation as they go hand in hand (five participants).
- Identification is used to identify a certain group, people or product to a certain group (six participants).
- Identification is the analysis of physical evidence (three participants).

The viewpoint obtained from the literature is that identification takes place when the object in question, such as glass, mirrors, synthetic glass headlamps, plastic tail lights or glass light bulbs of a vehicle, and the original source share the same confirmed characteristic and that by the good features of the fragments of the object, in the opinion of an experienced investigator, the confirmed characteristic could not be repeated on another object sharing the same description.

The viewpoints of the participants on identification are superficial. The participants only indicated that people and objects are identified to a certain group. Other participants indicated that people are identified and objects are individualised. It is clear that their understanding of identification is narrow, which may be because of the lack of training of the participants in forensic investigation and also because some of the officials are inexperienced.

According to the researcher, there is a significant difference between the views expressed in the literature and the views of the participants. This can possibly be attributed to the fact that as the participants indicated they do not have experience in collecting physical evidence at motor vehicle accidents and investigators have had no formal training dealing with individualisation of glass and other objects typically found at the scene of a motor vehicle accident where the vehicle fled the scene.

On individualisation:

- Objects are individualised (two participants).
- Participant 2 (2010) stated that individualisation concerns, for example, determining the difference between twins who look similar; only their DNA will determine the difference between them.
- The process is to individualise certain characteristics to that product or person (five participants).
- Individualisation is the process of linking physical evidence to a common source (five participants).

- Individualisation refers to the fact that each person is unique from another (six participants).
- It is proved that the evidence came from one individual (eight participants).
- It indicates that individualisation means that things are different (five participants).

The researcher observed that the viewpoint obtained from the literature on individualisation is that there is a similarity between the disputed object found at the scene, such as the glass, mirror, synthetic glass, glass light bulbs or plastic light pieces, with one from a known origin obtained, such as the glass, mirror, synthetic glass headlamp, glass light bulbs or plastic lights on the vehicle causing the accident and fleeing the scene. With individualisation a particular sample is unique, even among the same class. So for example the synthetic glass pieces found at the scene can be found to be unique, even among other synthetic glass pieces. The researcher further observed that the participants had superficial knowledge of individualisation. The participants only mentioned that individualisation refers to each person being unique from another and did not provide the definition of individualisation. The researcher observed that there is a difference between the literature and the view of the participants which can be attributed to the fact that the majority of participants have had no formal training dealing with the individualisation of glass, synthetic glass headlamps, mirrors, glass light bulbs or plastic lights.

When comparing the concept “individualisation” with “identification,” the researcher found that individualisation goes beyond identification, since individualisation implies that physical evidence found at a crime scene comes from one source only. Physical evidence can thus be individualised to one unique source after a series of identifications (Fisher, 2004:5).

3.4 Role of individualisation in the investigation process

Lee et al. (2001:183) describe a logical and systematic approach that is essential at any crime scene and whose steps are important in the investigation process to individualise physical evidence.

According to Lee et al. (2001:183), the steps in this approach are as follows:

- The recognition of a pattern or an item as potential evidence. This means the successful recognition is dependent on the ability to know what to look for and where to look for the relevant evidence.
- Identification of various shapes and appearances of evidence. This involves sorting items or evidence based on similar general uniqueness and comparing the selected class characteristics of an unknown object with comparable features of a known standard.
- Individualisation, which follows identification. This is the analysis of a particular sample to determine its uniqueness. It must be kept in mind that not all evidence has sufficient measurable characteristics to obtain individualisation.
- Reconstruction as the final phase. This is entirely reliant on proper recognition, identification and individualisation of a relevant source.

Fisher et al. (2006:7) are of the opinion that it is the forensic scientist's responsibility to test the unknown, which is known as the source or evidence from a crime scene, and further to determine what the evidence is (the identification) and what sets this evidence apart from other evidence (the individualisation). Marais and Van Rooyen (1994:18) claim that the investigator should be aware of the possible value of each potential source of evidence or information and should also possess a wide knowledge of the evidential requirements of the various crimes.

In response to the question "What is the role of individualisation in the investigation process?" the participants answered that the role of individualisation is to:

- Link or identify the unknown to courts (five participants);
- Link a suspect to the scene of crime or to the victim (nine participants);
- Match a piece of glass or plastic found at a crime scene with a specific vehicle (three participants);
- Link someone or something to a crime scene (four participants); and
- Determine the origin of the object or evidence (two participants).

In addition Participant 3 (2010) was of the opinion that the role of forensic investigation was to collect the evidence at a scene of crime to ascertain that an individual was taking part in criminal activities and that this evidence would determine the role the individual played in committing the crime.

The researcher observed that according to the literature, the role of individualisation in the investigation process is to test the unknown and to determine what the evidence is (identification) and what sets the evidence apart from other evidence (individualisation).

The views of the participants are in agreement with the views expressed in the literature. The researcher compared the literature with the viewpoints of the participants and despite the narrow view of some participants, it seems that most have a good idea what the role of individualisation in the investigation process is. The researcher is therefore of the opinion that the role of individualisation is relevant to the research question: “How could physical matching be used as an individualisation technique in the investigation of motor vehicle accidents?”

3.5 Collecting glass, synthetic glass or plastic lights for physical matching purposes

Glass is important as physical evidence because of the frequency with which it is encountered (Swanson et al., 2003:77). Swanson et al. (2003:77) further state that glass has high evidentiary value because of its variations in compactness, refractive index and light-dispersion characteristics. Kiely (2001:161) believes that analysis of glass present at a crime scene can offer a variety of class characteristics, as well as individual association evidence, to place a suspect at the crime scene. The class characteristics data that may result from the glass analysis includes the determination of the type of glass involved, the source of the glass and any glass comparison that can be made (Kiely, 2001:161).

The class characteristics information that can be obtained from glass includes the kind of glass like synthetic glass, the direction of impact, the nature of the impacting projectile and the comparison for potential matching (Kiely, 2001:162). Kiely (2001:162)

argues that this comparison will be made between whatever there is to compare from the crime scene material and related material associated with a possible suspect, to obtain a match. Genge (2002:81) adds that glass experts can, from tiny fragments, determine from which direction impact came or whether two pieces of glass might have come from the same place.

Lee et al. (2001:153) mention that glass, synthetic glass or plastic glass found at a crime scene is persistent and frequently unknowingly transferred from one surface to another surface. Pyrek (2007:228) is of the opinion that every attempt should be made to collect data to support quantitative estimates of the occurrence of sets of character, keeping in mind that the possibility exists that the data may not be sensible or rational, in some cases it could possibly be more misleading than providing no valuation.

Whether the suspected vehicle was identified by an eye witness or through physical evidence, it is still necessary to prove scientifically that the vehicle in question was involved in the accident and was the vehicle that fled from the scene and this is achieved by physically matching unique fragments found at the scene with the evidence found in the car (Zamir et al., 2000:352).

Pieces of glass, synthetic glass or plastic glass from a vehicle that fled a motor vehicle accident scene that are well documented can, in some cases, narrow the possible suspected vehicle to one or two makes (Genge, 2002:81). Physical evidence with fractured edges provides opportunities for edge matching, making it imperative to collect as many pieces from the scene as possible (Genge, 2002:81). This evidence can prove to be an invaluable means of placing a suspect at the scene by matching the fragments collected with the remaining headlamps, plastic taillights, glass light bulbs and reflector lenses on the vehicle.

Forensic scientists can fit two samples of glass together to form one item to determine that the samples have originated from one item and nowhere else (South African Police Service, 2001:10). Physical matching remain the most definite means of establishing a common origin between known and unknown samples (Zamir et al., 2000:355). All

pieces of physical evidence in cases of a motor vehicle accident where the vehicle fled the scene must be collected and the search for evidence should be extended beyond the point of collision, as pieces of the glass light bulb, synthetic glass headlamp, plastic taillights or windshield may drop from the car as the car leaves the scene (South African Police Service, 2001:9).

The researcher conducted a case file analysis and in attempting to answer the question "What actions were taken to collect physical evidence at this specific motor vehicle accident?" The researcher found that in none of the cases was physical evidence such as glass light bulbs, synthetic glass headlamps or plastic taillights of the vehicle collected. This suggests that no actions were taken to collect physical evidence at these incidents. The reason for this can be found from the interviews with the participants, who are investigators as well, that mentioned that they had not received any formal training in the collection of physical evidence at motor vehicle accidents and in dealing with the individualisation of glass and similar objects commonly found at motor vehicle accidents.

The participants were asked how glass, synthetic glass, glass light bulbs or plastic taillights should be collected for physical matching purposes and how many pieces of evidence is needed to make a match which can be admissible as evidence in court. The participants provided the following answers:

- Participant 8 (2010) said different types of glass can be identified at a motor vehicle accident crime scene, such as automobile window safety glass, automobile headlamp glass, tinted glass and glass of headlamp globes, synthetic glass headlamps, plastic taillights, and plastic indicators. A record sheet must be kept for each sample of evidence collected at the scene.
- Collection of glass, synthetic glass, plastic taillights or glass lights bulbs must be performed as per forensic science laboratory instructions (nine participants).
- Participant 6 (2010) noted that headlights are frequently broken at motor vehicle accidents and deposited on victims and suspects.
- Participant 4 (2010) suggests that two or more glass samples must be collected for individualisation and that all glass at a motor vehicle accident scene must be

collected, which includes all broken parts of the headlight and reflector lenses. Large pieces are picked up by hand and put in a container, while small pieces are picked up by tweezers and put in an envelope.

- All broken pieces of evidence commonly found at motor vehicle accidents must be collected and preserved for later comparison with a similar source of origin (six participants).
- Glass must be collected by wearing gloves to avoid contamination. Large pieces must be collected by hand and small pieces with tweezers (two participants).
- Participants 7 and16 (2010) are also of the opinion that the collecting of glass at a motor vehicle accident is important as it can lead to the tracing of the suspects and can include a certain vehicle in or exclude it from the scene of crime.
- Participant 9 (2010) said that a drawing of the scene must be made and all evidence at the scene marked and numbered and the scene photographed.
- Participant (2) 2010 added that it is important to keep in consideration that each case differs from the other and each case also depends on what needs to be proven.

The views obtained from the literature on the above questions include Horswell's (2004:27) belief that to collect fragile evidence first will avoid possible contamination and damage and that this type of evidence should preferably be collected by one person to prevent damage or contamination of evidence. Small and large glass fragments should be collected, packed and sealed in different containers to prevent breakage. Furthermore the literature suggests that scientists need at least two samples or pieces of glass to form one item to determine that samples have come from one item and to make a match that will be admissible in court. This means that one piece or sample of unknown glass or synthetic glass headlamp collected at the scene can be physically matched with one piece or sample of the same glass or synthetic glass from the known source of origin.

The researcher noted that the participants are of the opinion that all glass or evidence commonly found at motor vehicle accidents scenes must be collected and preserved for comparison. Participants also indicated that two or more samples of glass or synthetic glass must be collected from the scene for matching purposes with another sample of glass or synthetic glass from the known source of origin.

The researcher is of the opinion that the viewpoint of the participants is in agreement with the viewpoint expressed in the literature.

3.6 Process of matching for individualisation purposes

According to Lee and Harris (2000:6-7), there are different types of physical evidence found at crime scenes. There is transient evidence, which includes odour, temperature and imprints, and then pattern evidence, which includes blood spatter, glass fracture, powder residue and fire burn. Conditional evidence also exists and this evidence includes smoke, fire and light. Lastly transfer evidence is produced by physical contact between objects or between people or between objects and people (Lee & Harris, 2000:7). Glass, synthetic glass or plastic lights are included in the specific nature of each type of physical evidence (Lee & Harris, 2000:6). Glass, synthetic glass or plastic lights evidence is examined and could be physically matched by using a variety of scientific methods, and scientists can make a conclusive physical match between the known and the unknown of two glass fragments or a multitude of different glass fragments transferred (Levinson, 2002:1444).

The analysis of physical evidence may concern the recognition, identification, classification, individualisation, interpretation and reconstruction of various types of conditional, pattern, transient and transfer evidence (Lee & Harris, 2000:12). The process of analysis of physical evidence, according to Lee and Harris (2000:12-13), have different stages, which are as follows:

- *Recognition* is the ability to separate important and potentially informative material from unrelated materials that involves pattern recognition and the recognition of physical properties. If evidence is not recognised as such, then proper collection and preservation will not take place.

- *Identification* is the process of using characteristics to identify a particular object and is the beginning of more extensive forensic analysis which includes careful comparisons.
- *Classification* is undertaken by comparing the class characteristics of the evidence with those of a known standard. If the measurable class characteristics are the same for both the evidence and the known sample, then the two could have come from the same source. When a significant difference is noted, one may conclude that the sample did not originate from the same source as the known. For example, comparing windshield glass and glass from the lights provides a significant difference, because these glass pieces are not from the same source.
- *Individualisation* is the demonstration that the origin of the item of physical evidence is unequivocally determined to be uniquely related to some other object or particular source and this involves the comparison of class and individual characteristics.
- *Reconstruction*s are based on the results of a crime scene examination, laboratory analysis, pattern analysis and other types of information. The physical evidence can be used to help reconstruct a crime or determine the sequence of events.

Physical matching is the art of linking pieces of evidence that have broken into pieces but were once part of the same item (Bell, 2004:194). According to Goddard (as quoted by Bell, 2004:172), glass or glass like product breaks randomly and each breakage is unique and therefore currently the only way to link two glass fragments to a common source, is by the process of physical matching. For example, if glass fragments such as a piece of headlight of a vehicle can be fitted back into the original like a piece of puzzle, that fit individualises the glass and proves that it could come only from the same source. After microscopic evaluation of the substance of the glass is performed, the simple physical properties and description and measurements, such as colour, thickness, shape, type and texture of the glass, can be obtained (Goddard, as quoted by Bell, 2004:173). This will assist with even further individualisation of the source.

The process of identification and individualisation analysis of physical evidence and conclusions drawn are important ingredients of final reconstruction (Lee & Harris, 2000:29). In a forensic laboratory, scientists examine glass both microscopically and chemically, with the purpose of the chemical test being to identify and compare the type of glass fragments and the original source, which can result in a positive association in that the known and the questioned glass fragments could have originated from a common source (Levinson, 2002:1444).

The participants were asked to "explain the process of matching for individualisation purposes." They answered the following in response:

- Participant 1 (2010) indicated that the process of matching starts with the finding of the objects on the scene you wish to match, properly packing and sealing the evidence, and sending it to the SAPS forensic science laboratory for microscopic or chemical comparison to evaluate the substance of glass and physical description. This process will assist individualisation of the source.
- Matching means evaluating evidence, such as glass found at the scene that will be linked to the source (two participants).
- Participant 3 (2010) explained the process as physically matching different pieces to start eliminating pieces that do not fit the criteria. The focus is on the size of the evidence, what the object is made of, and the colour to be matched so that glass is compared with glass and not glass with plastic lying around on the scene.
- Two pieces of an object are compared under the microscope to determine if they form a unit to link to the common source (five participants).
- The process of matching can be at a macroscopic or microscopic level at the laboratory, where the evidence that is collected fits together to link to a common source and is documented for court (four participants).
- Physical matching is a process of gathering and comparing pieces of evidence, such as glass that was separated by tearing, breaking or cutting, and then individualising the original source (six participants).
- The process of individualisation is the analysis of physical evidence in drawing conclusions for final reconstruction (four participants).

- Participant 4 (2010) said the process of matching includes the analysis, comparison and evaluation of individual characteristics.

The researcher observed that, according to the literature the process of matching for individualisation purposes involves the recognition, identification, classification, interpretation, and reconstruction of the unique breakage of physical evidence to link the pieces to a common source. The participants' views are in line with the literature, as they indicated that it is a process used to match pieces of physical evidence according to the object, colour, and size of the evidence and eventually to compare and evaluate the individual characteristics to link the evidence to a common source.

3.7 Principles of collecting, packaging and dispatching of glass, synthetic glass or plastic lights

When vehicle glass items, such as headlamps, glass light bulbs, plastic taillights or reflector lenses are broken during an accident, hundreds of fragments are thrown in the air in the immediate vicinity of the crime scene, and clothes of the victims or suspects can be checked for fragments (Tilstone et al., 2006:2). Levinson (2002:1446) writes: "When collecting filaments or glass at accident scenes, it is vital to collect and pack the evidence so that it will not be distorted during evidence handling." For example, in many motor vehicle accidents, the question of major implication is whether the driver's headlights were on or off at the time of the accident, and the answer may be in the microscopic examination of filaments inside the glass light bulbs of the headlights of the vehicle in question (Levinson, 2002:1446).

According to Clarke (2010:3), the principles of evidence collection can be highlighted by the following points:

- Evidence is collected legally at a crime scene.
- Evidence is not contaminated when it is collected at a crime scene.
- Crimes scenes are searched thoroughly for fragile and other evidence.
- Evidence is packaged properly according to specific requirements to prevent further contamination or damage.

- The chain of custody of the physical evidence that is collected at the scene, until the case is presented before a court of law, is maintained.
- Evidence is delivered in court by means of testimony, documentary proof or technology.

3.7.1 Glass collection guidelines

Collecting evidence at a crime scene is an essential part of investigation. This is particularly challenging with glass, synthetic glass, mirrors, glass light bulbs, plastic taillights, broken headlight or windscreen that may have shattered into many pieces over a wide area at the crime scene. The collection process follows the assessment, documentation and search stages (Van Rooyen, 2001:56). The purpose of the collection process is to collect physical evidence for analysis at the crime laboratory to produce scientific information with evidential value (Gardner, 2005:347).

3.7.1.1 How glass should be collected

The collection process usually starts with the collection of the most fragile or potentially most easily lost evidence (Horswell, 2004:27), such as glass, synthetic glass, glass light bulbs or plastic taillight fragments at an accident scene. Horswell (2004:27) believes that to collect fragile evidence first will avoid possible contamination and damage to the crime scene. Once an item is removed from a crime scene, the context of the scene is forever changed (Gardner, 2005:77). So, to prevent any item from being damaged or lost at a crime scene, Lee et al. (2001:132) suggest that one person should be assigned to collect all physical evidence. When collecting fragile evidence first, one should do it in such a manner as not to damage or disturb other physical evidence. Rivers and Badger (2010:321) write that motor vehicle headlamps, windshield and side window glass fragments and glass fragments found in or on the clothing of an accident scene victim can yield valuable information pertaining to the vehicle that fled an accident scene when submitted to laboratory examination. This glass, synthetic glass, glass light bulbs or plastic taillights should be collected with tweezers and packaged in an envelope or container indicating the exact location of the evidence found. All glass or other evidence commonly found at a motor vehicle accident scene should be recovered. The search should not be limited to the point of impact, as headlight glass, plastic taillights, glass

light bulbs or mirrors may be dropped off at some distance away, as the car leaves the crime scene (South African Police Service, 2001:10). Glass, synthetic glass, glass light bulbs, mirrors or plastic taillights from different locations must be kept in different containers and so all glass be collected at the scene because more than one type of glass may be present (South African Police Service, 2001:11).

Thompson (2008:13) lists the following steps in collecting glass from a crime scene. He writes:

- Draw a detailed schematic of where the glass is located in relation to the crime scene, mark each piece of glass with a numbered evidence cone and photograph the scene with markers in place. Wear gloves throughout the evidence collection process to avoid contamination. Collect large pieces of glass by hand and place each piece into a separate carefully marked evidence bag or envelope.
- Use adhesive tape or tweezers to pick up small glass shards or pieces. Place each piece into carefully labelled evidence bags or envelopes.
- Record or log each piece of glass collected onto the evidence record sheets or book so that each piece is readily identifiable during later analysis.
- Package each piece of glass collected so that it does not break or rattle around in the container in order to avoid damage to the edges, as this might hinder the effort to piece a broken glass object back together.
- Ensure that an official chain of custody is maintained during collection, packaging, and transport between the crime scene and the forensic laboratory.

3.7.1.2 How glass, synthetic glass or plastic lights should be packaged and dispatched

Small pieces of glass, synthetic glass or plastic taillight fragments must be placed in paper binds, then in coin envelopes, pill boxes or film cases which can be sealed (South African Police Service, 2001:11). Large glass, synthetic glass, mirrors or plastic light fragments must be placed in boxes and individual pieces separated with cotton or tissue to prevent breakage and damage of edges during shipment. The box containing the glass, synthetic glass or plastic taillights must be sealed and marked (South African

Police Service, 2001:11). Lee et al. (2001:154) believe that if glass, synthetic glass or plastic taillights is found dispersed over a wide distance, particles from similar areas can be packed together. Lee et al. (2001:154) further state that large pieces of glass, synthetic glass or plastic taillights should be numbered, sealed and marked appropriately and containers should be marked if they contain sharp edges and if careful handling is necessary.

Steps in packaging and dispatching of glass, synthetic glass or plastic taillights evidence, according to Thompson (2008:15), are:

- Collect and submit all glass, synthetic glass or plastic taillights pieces (as mentioned in the steps for collecting glass) and request the laboratory to attempt a physical match.
- Package glass, synthetic glass or plastic taillights pieces from different locations into different containers, clearly marking the outside packaging as to the location and description of the evidence.
- Label large glass, synthetic glass or plastic taillights items with orienting markings, if necessary.
- Package large pieces of glass, synthetic glass or plastic taillights in a rigid container such as a cardboard box. Protect the broken or fractured edges of glass from any further breakage or damage.
- Depending on the size, small glass pieces can be packaged into envelopes, bags, or film containers. They can then be secured in padded envelopes to protect them from further breakage.

The participants were asked “What are the important principles that should be adhered to when collecting, packaging and dispatching glass, synthetic glass or plastic taillights for individualisation in motor vehicle accidents?” They provided the following answers:

- All pieces of glass, synthetic glass or plastic taillights found at the accident scene should be collected and carefully preserved (eight participants).
- According to Participants 2 (2010) and 4 (2010), glass, synthetic glass or plastic taillights should be packed in a leak proof container such as a film canister or

plastic bottle and not a paper or glass container. A glass canister could damage the glass fragments even more.

- Participants 1 (2010) and 8 (2010) added that samples of glass, synthetic glass or plastic taillights gathered from different sides of the windshield or different headlamps or different areas should be packaged separately and marked as such.
- If the laboratory should make a physical match, the glass should be packed and marked appropriately (12 participants).

Participants 2 and 3 (2010) stated the following on how glass, synthetic glass or plastic taillights should be collected and packed:

- When the direction of impact is desired, then the intact pieces of glass, synthetic glass or plastic taillights remaining in the frame can be used.
- If the frame is too big to send in with the glass, the frame must be photographed.
- All pieces of broken items on the scene must be collected and preserved for later comparison with similar evidence from the suspect, victim, vehicle or other scenes. It is impossible to know in advance which pieces of glass will be matched to each other.
- The inside and the outside of the glass, synthetic glass or plastic taillights should be clearly marked and indicate the origin of the evidence, for example collected at the crime scene or at the victim's house. The presence of soil, paint, grease or putty can give an indication as to the exterior surface of the glass.
- All cracks in the glass, synthetic glass or plastic taillights should be clearly marked to identify the initial and radial cracks and should be packed according to items from each location separately.
- Glass, synthetic glass or plastic taillights should preferably be covered in a self-adhesive laminated plastic that is soft and easy and safe to use.
- Each item's origin must also be clearly documented in order to establish confidentially a link between items left on the scene and a similar item recovered elsewhere.

- The glass, synthetic glass or plastic taillights should then be placed between two pieces of cardboard and then packed in a solid or rigid container to avoid further breakage.

According to the literature, the important principles that should be adhered to when collecting glass, synthetic glass or plastic taillights are that all glass, synthetic glass or plastic taillights at a motor vehicle accident scene should be collected, and glass, synthetic glass or plastic taillights from different locations must be collected and kept in different containers. Small glass, synthetic glass or plastic taillights pieces must be placed in paper binds or film containers and large glass, synthetic glass or plastic taillights pieces placed in boxes, with cotton in between to prevent further breakage.

Participants are in agreement with each other on the principles regarding the collecting, packaging and dispatching of glass, synthetic glass or plastic taillights. Glass, synthetic glass or plastic taillights from different types and different areas should be packed separately. All pieces of broken glass, synthetic glass or plastic taillights at the accident scene must be collected. Glass, synthetic glass or plastic taillights should be packed in film canisters to prevent further breakage. Glass, synthetic glass or plastic taillights must be clearly marked and documented.

The views of the participants are clearly in agreement with that of the literature, as their responses show that the participants understood the important principles regarding collecting, packaging and dispatching of glass, synthetic glass or plastic taillights collected for individualisation at motor vehicle accidents. The researcher compared the literature with the views of the participants and found that the participants clearly understood how items for physical matching must be packed correctly to maintain the chain of evidence.

3.8 Chain of custody

The responsibility for evidence in a case does not end when it has been booked into the log sheet or evidence register at the police station. When securing the evidence, maintaining the chain of custody is essential. When evidence such as glass, synthetic

glass or plastic taillights are seized, the chain of custody process starts immediately as evidence should be marked, identified, inventoried and preserved to maintain it in its original condition and to establish a clear chain of custody until it is introduced at trial. The individual who finds the glass, synthetic glass or plastic taillights evidence marks it for identification and bags the evidence in the relevant container. The container is labelled with the pertinent information. The container is sealed and the collector's signature is written across the sealed edges. The container is given to the next responsible person for its care. That person takes the container to the laboratory, which signs it over to a forensic scientist, who opens the container for examination. On completion of the examination, the scientist repackages the evidence with its original packaging, reseals the evidence in a new package and signs the chain of custody log attached to the packaging. The court will want to know exactly what happened to the evidence and in whose custody it has been from the time it was found until it was presented in court. This means that the process of the chain of custody of evidence is essential at crime scenes, because the evidence must be positively identified later in court, perhaps months or years later.

If gaps in possession or custody occur, the evidence may be challenged at trial on the theory that the evidence introduced may not be original or is not in its original condition and, therefore, of doubtful authenticity (Bologna & Shaw, 1997:110). Therefore, a continuous chain of custody must be maintained in order for evidence to be accepted in court.

For a seized exhibit such as glass, synthetic glass or plastic taillights to be admissible as evidence, it is necessary to prove that it is the same evidence that was seized at the crime scene and is in the same condition as it was when seized. One must be able to identify each piece of evidence positively, discuss the circumstances surrounding how it was found and accurately describe what happened to the evidence from the time it was first found. To maintain the chain of custody, standards require that every person who found, marked, packaged, booked and handled evidence must share record keeping to keep track of what happened to the evidence from the time the evidence was found until it left each person's custody. A log is created for every piece of evidence from the

beginning of the crime scene investigation until the evidence is released to the crime laboratory. The log must account for who found the item, where was the item found, the date and time it was found, who recovered and marked it, who transported it, and when and where it was booked in. The number of people who handle the evidence should be kept to a minimum, as every person who has handled the evidence may be required to testify in court. Once the evidence is in the laboratory, the forensic examiner's signature, the incoming and examination dates, and the times received are logged in. In order to avoid confusion or questionable handling, the evidence should be handled as minimally as possible. Because several people may handle it in the interval between seizure and the trial of the case, evidence should be adequately marked at the time of seizure for later identification, and its custody must be shown from that time until it is introduced in court (Bologna & Shaw, 1997:110).

3.9 Mistakes in collecting glass, synthetic glass or plastic taillights

One of the largest and potentially detrimental mistakes of poor collecting and analysing of physical evidence procedures is the lack of "quality control" (Tilstone et al., 2006:180). The researcher is of the opinion that reasons for the mistakes may be simple human error and that if people are not properly trained and if no advanced training is required regarding collecting and analysing physical evidence in future, wrongful or no convictions will occur (Tilstone et al., 2006:180).

Another error of poor collecting and analysing of physical evidence is the mishandling of such evidence. When physical evidence is collected, it must be carefully stored and each person who has access to the evidence must be documented as part of the chain of custody (Tilstone et al., 2006:181). Improper documentation and mishandling of evidence can keep a guilty person on the streets. When police or the prosecution use wrongfully obtained or identified physical evidence to secure convictions, this is a sign of poor collecting and analysing methods (Tilstone et al., 2006:181).

In response to the question "What are the common mistakes that are made in collecting glass, synthetic glass or plastic taillights?" the participants answered as follows:

- The first member on the scene or, for that matter, the investigating officer does not collect, mark and package glass, synthetic glass or plastic taillights on the scene (five participants).
- The investigating officer puts all glass, synthetic glass or plastic taillights fragment evidence together in one package that can cause the fragments to further break and then individualisation of the glass, synthetic glass or plastic taillights is made nearly impossible (six participants).
- Glass, synthetic glass or plastic taillights is packed in such a manner that its evidential value decreases or is lost or the glass evidence is not marked properly (five participants).
- Investigators do not avoid contamination of the glass, synthetic glass or plastic taillight fragments (three participants).
- The location of the evidence is not recorded as exactly where it was collected (one participant).
- The evidential value is not indicated (two participants).
- No covering letter or documents are provided to indicate the exact tests required (two participants).

The researcher noted that the literature views the mistakes in collecting glass, synthetic glass or plastic taillights as comprising the lack of quality control, poor collecting and analysing of evidence, poor documentation, and mishandling of evidence. The participants noted that mistakes in collecting evidence also included a lack of proper documentation; no proper collecting, marking and packaging of evidence; and the mishandling of evidence which results in its contamination.

The researcher is of the opinion that the views of the participants are in accordance with those of the literature on the mistakes made in collecting glass, synthetic glass or plastic taillights.

3.10 Summary

Some types of evidence can be truly individualised, but some other types can only be partially individualised (Marais, 1992:19). It is important to understand that the collecting of all glass, synthetic glass or plastic taillights pieces at an accident scene, and the

packaging and physical matching of glass, synthetic glass or plastic taillights fragments play an important role in identification and individualisation of evidence, which, in turn, play an important role in forensic investigation. As Lee and Harris (2000:12) state, the benefit of individualising something is that it makes its identification much more valuable.

CHAPTER FOUR
FINDINGS AND RECOMMENDATIONS

4.1 Introduction

The aim of this study was to research how physical matching could be used as an individualisation technique in the investigation of motor vehicle accidents. To address this aim, two research questions were asked:

Question 1: What does physical matching entail?

Question 2: How could physical matching be used as an individualisation technique in the investigation of motor vehicle accidents?

The researcher used a qualitative research approach with an empirical design, and in an attempt to address these research questions gathered information from literature by authors of national and international origin and interviewed forensic scientists, forensic analysts and investigators to obtain knowledge from practice.

4.2 Findings regarding the research questions

The findings related to the research questions are presented below and are based on data collected from a literature study, interviews and case file analysis.

4.2.1 Research question one: What does physical matching entail?

- Through the literature the researcher determined that physical matching takes place when any piece (a sample) of solid object (physical evidence), such as glass, synthetic glass or plastic taillights are broken or fragmented and the resulting fragments can be physically matched or fitted together to establish a common origin or source. On the basis of the information gathered from the literature the researcher was able to conclude that in terms of physical matching of any piece or fragment of physical evidence such as glass, synthetic glass or plastic taillights found at an accident scene, what is important is that the fragment can be matched or fitted with other fragments and above all reasonable doubts can form or be part of a whole or complete object.

- Out of all the participants interviewed for the study, the researcher found only one forensic specialist who could provide a detailed explanation of physical matching. This specialist stated: “If the irregularly shaped fractured or torn edges of two pieces of any material can be joined together to form a continuous section, then it can be concluded that the two pieces at one time shared a common origin and refer to as a physical match.” The other 23 participants had a similar but less scientific explanation, stating that physical matching entails physically matching separate items, such as pieces of glass, synthetic glass or plastic taillights to each other to determine if they have the same point of origin or form part of a unique object.
- The viewpoint expressed in the literature was compared with the viewpoints of the participants and the researcher found no significant difference between them. It seems as if the participants had a good working knowledge, although not necessarily a scientific knowledge, of what physical matching is. The lack of scientific knowledge may be impacting on the effectiveness of the investigators of motor vehicle accidents in particular hit-and-run incidents.

4.2.2 Research question two: How could physical matching be used as an individualisation technique in the investigation of motor vehicle accidents?

- Through the literature the researcher established that it is the forensic scientist’s responsibility to test the unknown source or evidence from a crime scene and further to determine what the evidence is (the identification) and what sets this evidence apart from other evidence (the individualisation). The researcher noted that, according to the literature, the process of matching evidence for individualisation purposes involves the recognition, identification, classification, interpretation, and reconstruction of the unique breakage of physical evidence to link the pieces to a common source. The process of physical matching involves the analysis, comparison and evaluation of class and individual characteristics such as glass breaks randomly. Each breakage is unique and therefore currently the only way to link two glass fragments or samples to a common source is by the process of physical matching.
- Through interviewing the participants, the researcher found that they believed forensic investigation involves collecting the evidence at a scene of crime to

ascertain whether an individual took part in criminal activities and whether this evidence could determine the role the individual played in committing the crime. Physical matching is a process of gathering and comparing pieces or samples of evidence such as glass, synthetic glass or plastic taillights that was separated by tearing, breaking or cutting and then individualising the original source. According to one of the participants, the potential to match glass, synthetic glass or plastic taillights physically as an individualisation technique is limited. One participant mentioned that physical matching of glass, synthetic glass or plastic taillights possesses the greatest evidential value when it can be individualised to one source.

- The participants' views are in line with views expressed in the literature as they indicated that it is a process used to match pieces of physical evidence according to the object, colour, and size of the evidence and eventually to compare and evaluate the individual characteristics to link it to a common source. If the participants' answers are compared with the literature on the topic, it is clear that some have only basic knowledge about how physical matching can be used as an individualisation technique in the investigation of motor vehicle accidents.

4.3 Secondary Findings

Secondary findings are findings that are not directly related to the research questions but were identified by the researcher as being important to this research.

4.3.1 Objectives of physical matching

- According to the literature, the objectives of physical matching is to recognise, collect, interpret or compare and to reconstruct relevant physical evidence at the crime scene that will provide useful information to the crime investigator in solving cases.
- The participants specifically saw the objectives of physical matching as the fitting together of two or more pieces of a broken object to form a unit in order to link a suspect with the scene of crime or the victim. A main objective is to compare the piece of glass, synthetic glass or mirror found at the motor vehicle accident crime scene with the source of origin such as the headlight or taillight of the vehicle

involved. A related objective of physical matching is to use valuable physical evidence to place a suspect or an object used by the suspect at a scene of crime.

- The viewpoint of the literature was compared with the viewpoints of the participants and the researcher found no significant difference. It seems as if the participants had a good working knowledge of the objectives of physical matching and they were all in agreement with one another.

4.3.2 Importance of physical matching as investigative tool

- The view of the literature on the importance of physical matching in the investigative process is that it can establish the elements of a crime and that physical evidence can associate or link victims to crime scenes, offenders to crime scenes, victims to victims, instruments to crime scenes and offenders to instruments. Physical evidence submitted for analysis is intended to establish associations.
- The views of the participants were that by physically matching the different items to each other one can determine whether different items have the same point of origin. One might find a piece of evidence with a suspect and another at the scene of crime and, by physically matching the different items, one can ascertain that the suspect had to be at the scene of crime when the glass, synthetic glass or plastic taillights broke or that they passed by at the same stage. If pieces of a vehicle's lights are found at a scene of crime and the vehicle is recovered, the pieces of the light can be matched to the light, thereby placing the vehicle at the scene of crime.
- The researcher observed that when the viewpoints expressed in the literature were compared with the viewpoints of the participants interviewed, no significant difference was noted. It also seems as if the participants were all in agreement with each other.

4.3.3 Process of physical matching

- According to the literature, the process of physical matching entails identifying physical evidence, protecting all evidence at the scene of crime, minuting all evidence, correctly collecting and packaging all evidence, marking and labelling all evidence, maintaining the chain of custody of evidence, continuous safe keeping of evidence, and presenting evidence in court.

- The participants' responses, on the other hand, only dealt with visiting of the scene, and then the documenting, collecting, preserving, properly packaging and sealing of physical evidence. Other issues raised included looking at the size and colour of the object, and what the object is made of (the texture) and comparing straight lines with straight lines and not square blocks. None of the participants indicated the chain of custody and preserving of evidence to present before a court of law, as part of the process. Only three participants spoke about this process in their responses.
- The researcher found a difference in the views expressed in the literature and those given by the participants. The researcher is of the opinion that this can be ascribed to the fact that a minimum number of the participants have had formal training and/or experience in the collecting of glass, which is a large part of the process of physical matching.

4.3.4 Individualisation of evidence

- On the explanation of the individualisation of evidence, the literature stated that with physical matching samples of unknown origin are individualised or distinguished from the known standards. It may happen, though, that questioned samples cannot be individualised or are indistinguishable from the known. For example, glass pieces, synthetic glass or plastic taillight pieces found at a scene of crime may lead only to a list of possible vehicle brands or models and not to the culprit. Through the literature, the researcher established that physical evidence includes a large variety of objects and that almost any object, substance, trace or impression could constitute physical evidence, such as fingerprints, glass, hair, blood, or soil. The researcher established from the literature that not every crime scene has individualising physical evidence such as fingerprints, but every crime scene contains physical evidence that assists the investigator. Such evidence is considered unknown or of questioned origin until a comparison is made to a known standard.
- The participants argued that individualisation is the process of linking physical evidence to a common source, or rather comparing the known with the unknown and of individualising it as an original object. Individualisation of evidence can result in the evidence being linked to another piece of evidence that was found on the crime scene.

- The viewpoint of the participants on this matter was not as comprehensive as that given by the literature. Only seven participants knew that individualisation is the process of linking physical evidence to a common source, or rather comparing the known with the unknown and of individualising evidence as an original object. This can be attributed to the fact that only nine participants had more than 10 years of specific experience and had received specialised training in the collection of glass, synthetic glass or plastic taillights at motor vehicle accidents.

4.3.5 Difference between criminal and forensic investigation

- According to the literature reviewed, criminal investigations seek to establish the truth and in doing so follow a systematic process of obtaining evidence to identify the perpetrator and bring the case before the courts. The researcher established through the literature that forensic investigation is a type of investigation aimed at instituting court proceedings and where some or other scientific knowledge is applied to a legal problem. The researcher noted that in the literature forensic investigation is considered as investigation aimed at instituting criminal, civil and disciplinary proceedings and where scientific knowledge is applied while criminal investigation was considered to be a process in which people were identified and physical objects or evidence obtained at a crime scene, later to be used in criminal proceedings.
- By interviewing the participants, the researcher found that only seven participants knew that forensic investigation concerned investigation for a court of law, criminal and civil, while the viewpoints of the rest of the participants were very narrow. From the views of the participants, the researcher could establish that the participants had a good working knowledge of criminal investigation although not as detailed as that expressed in the literature consulted.
- The researcher compared the literature with views of the participants and found that there was no distinctive difference between the views expressed about the two types of investigation. Even though forensic investigation also includes civil proceedings, it has a similar meaning to criminal investigation. The discussions with the participants showed that apart from terminological differences, the meaning of forensic investigation and criminal investigation is the same.

4.3.6 Objectives of investigation

- The literature reviewed established that the objectives of investigation are to determine whether a crime has actually been committed, identify and apprehend the suspect(s), gather and safely keep evidence, recover stolen property and assist in the prosecution of the person charged with the crime. Investigation can also be defined as a systematic planned process that has to be followed. Investigation has the additional objective of individualising crime.
- The researcher further noted that the knowledge expressed by the participants was less comprehensive in this regard. Only three participants provided a succinct explanation that agreed with the literature, while all the other participants only indicated one objective of investigation as follows: to gather evidence; arrest the suspect; establish who the suspect is; recover stolen property; prepare a solid case for prosecution purposes; and obtain reliable court-acceptable results. The participants each only listed one or two of the above objectives. No participant mentioned all objectives as in the literature.
- The researcher is of the opinion that the participants' views did not differ from that of the literature, although the participants each mentioned one or two objectives. The fact that the participants did not mention all objectives, however, does not mean they did not understand the objectives, rather that the majority of participants had not received formal training in forensic investigation.

4.3.7 Difference between identification and individualisation

- The viewpoint expressed in the literature is that identification takes place when the object in question, such as glass or synthetic glass headlamps of a vehicle, and the original source share the same confirmed characteristic and that by the good features of the object in question, in the opinion of an experienced investigator, this characteristic could not be found on another object sharing the same description. Identification involves sorting items on the basis of similar general characteristics. The more characteristics two or more items have in common the more complex or discriminating the identification. The researcher noted that the viewpoint conveyed by the literature is that individualisation is achieved when a similarity is found between the disputed object found at the scene such as the glass, synthetic glass or

plastic taillight pieces and one of known origin obtained, such as the headlight or taillights on the vehicle causing and fleeing the accident. With individualisation a particular sample is unique, even among the same class. So the glass, synthetic glass or plastic taillight pieces found at the scene can be found to be unique, even among other glass, synthetic glass or plastic taillight fragments. Comparing the concept “individualisation” to “identification,” the researcher found that individualisation goes beyond identification, since individualisation implies that physical evidence found at a crime scene comes from one source only. Physical evidence can thus be individualised to one unique source after a series of identifications.

- The viewpoints of the participants on identification were superficial. The participants only indicated that people and objects are identified as belonging to a certain group. Other participants indicated that people are identified and objects are individualised. It is clear that their understanding of identification was narrow and this could be because of the lack of training of participants in forensic investigation and also the inexperience of officials. The researcher found that even though their knowledge of this topic was superficial, the majority of participants did understand individualisation as the comparison of two samples to establish whether they are the same (similarity), with both sets of evidence coming from one individual, and that each person is unique.
- The researcher found a difference between the views of the literature and the participants. This can possibly be attributed to the fact that the majority of participants indicated that they did not have experience in collecting glass, synthetic glass or plastic taillight and that investigators had no formal training dealing with the individualisation of glass.

4.3.8 Important principles of how glass, synthetic glass, plastic lights and glass mirrors should be collected, packaged and dispatched

- According to the literature consulted, the principles behind the handling of evidence are that evidence is collected legally at a crime scene, evidence is not contaminated when collected, crime scenes are searched thoroughly for evidence, evidence is packed properly to prevent further contamination, the chain of custody of evidence is maintained and evidence is delivered to court. The literature clearly indicated the steps in collecting, packaging and dispatching glass, synthetic glass or plastic taillight as follows: mark each piece of glass, synthetic glass or plastic taillight and photograph the scene; collect glass, synthetic glass or plastic taillight by hand and place each piece into a separate marked evidence bag; record or log each piece of glass, synthetic glass or plastic taillight collected onto the evidence record sheets; package each glass, synthetic glass or plastic taillight piece so that it does not break in order to avoid damage; package glass, synthetic glass or plastic taillight pieces from different locations into different containers; package large pieces of glass, synthetic glass or plastic taillight in a rigid container such as a cardboard box; depending of the size, package small glass pieces into envelopes; and ensure that the official chain of custody is maintained.
- Participants were in agreement with each other regarding the principles behind collecting, packaging and dispatching glass, synthetic glass or plastic taillight. Glass, synthetic glass or plastic taillight of different types and from different areas should be packed separately. All pieces of broken glass, synthetic glass or plastic taillight at the scene must be collected. Glass, synthetic glass or plastic taillight should be packed in film canisters to prevent further breakage. Glass, synthetic glass or plastic taillight must be clearly marked and documented.
- The views of the participants were clearly in agreement with that of the literature, which shows that the participants understood the important principles regarding collecting, packaging and dispatching glass collected for individualisation at motor vehicle accidents. They also showed an understanding of how evidence for physical matching must be packed correctly to maintain the chain of evidence.

4.4 Recommendations

At the beginning of this research, the researcher stated that the purpose of this study was to arrive at recommendations for good practice with regard to the use of physical matching as an individualisation technique in the investigation of motor vehicle accidents and to empower those involved in investigations. On the basis of the findings of this research, recommendations are made regarding training of investigators and skills transfer.

The researcher established that there is a lack of knowledge due to no or insufficient training of investigators in the different aspects of physical matching as an individualisation technique addressed earlier in this research. It is therefore recommended that the following topics should be incorporated in the training curricula of detectives to equip them with specialised skills and knowledge regarding proper crime scene investigation processes:

- Investigation, its purpose and objectives
- The difference between identification and individualisation
- Process of physical matching for individualisation purposes
- Individualisation of evidence
- Physical matching as an individualisation technique in the investigation of motor vehicle accidents

Consideration should be given to mentoring investigators. This is where inexperienced investigators are assigned to work with investigators that are skilled and experienced in individualisation techniques in motor vehicle accidents. If this is not possible, then investigators should be rotated during investigations so as to expose them to cases that involve physical matching at motor vehicle accidents. This research has shown that forensic scientists and analysts and investigators exposed to physical matching of glass, synthetic glass or plastic taillight at motor vehicle accidents have a better knowledge of the procedures and the process of individualisation techniques at motor vehicle accidents.

There are many opportunities to educate a variety of individuals involved in investigations. In-service training can be given by experienced forensic specialists in the

form of workshops and meetings. Published scientific articles or well-written reports that clearly state the results of analyses conducted can aid forensic specialists. Investigators will have to be educated in the significant value of physical matching of glass, synthetic glass or plastic taillight at motor vehicle accidents.

Forensic specialists should continually review current literature, and attend seminars and work sessions to be familiar with advances in technology.

4.5 Conclusion

The aim of this study was to research how physical matching can be used as an individualisation technique in the investigation of motor vehicle accidents. Throughout Chapters 2 and 3 this aim was addressed and discussed. The researcher determined that with physical matching questioned samples are individualised or distinguished from the known standards. It may happen, though, that questioned samples cannot be individualised or are indistinguishable from the known. For example, glass, synthetic glass or plastic taillight pieces found at a scene of crime may lead only to a list of possible vehicle brands or models and not to the culprit.

The immediate challenge for SAPS management is to improve investigators' understanding of the individualisation techniques at motor vehicle accidents. The following key findings of this research reveal that investigators have:

- A narrow understanding of the purpose and objectives of investigation;
- Minimal knowledge of the individualisation of evidence;
- A narrow understanding of the difference between identification and individualisation;
- Minimal knowledge in respect of the process of physical matching for individualisation purposes; and
- Minimal knowledge in respect of physical matching as an individualisation technique in the investigation of motor vehicle accidents.

The researcher believes that investigators and all members of the SAPS can benefit to a great extent from applying proper physical matching as an individualisation technique in the investigation of motor vehicle accidents.

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Participant 2. Brig S. De Klerk. Forensic Specialist in the South African Police Services. 2010. Statement to author, 13 November. Pretoria.

Participant 3. Col R. Dixon. Forensic Specialist in the South African Police Services. 2010. Statement to author, 13 November. Pretoria.

Participant 4. Warrant Officer J. Nieuwenhuys. Forensic Specialist in the South African Police Services. 2010. Statement to author, 13 November. Pretoria.

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Interview schedule

Physical matching as individualization technique in the investigation of hit-and-run incidents

Participant number ……

Section A: Background information

1. What is the title of your current position in your department?
2. What is your highest qualification?
3. How many years of experience do you have in your department?
4. What formal training did you receive in dealing with individualization of glass?
5. How many years of experience do you have in the collection of glass in motor vehicle accidents?

Section B: Importance of Physical Matching and Forensic Investigation

6. What is physical matching?
7. What is the objective of physical matching?
8. Explain the importance of physical matching as an investigative tool.
9. Explain the individualization of evidence
10. Explain the process of physical matching for individualization purposes.
11. How would you define forensic investigation?
12. Define criminal investigation
13. Give your opinion on the difference between forensic investigation and criminal investigation.

14. What are the objectives of forensic/criminal investigation?

Section C:The collection of glass/synthetic glass/plastic and role of individualization in the investigation of motor vehicle accidents

15. What is the difference between identification and individualization?

16. What is the role of individualization in the investigation process?

17. How should glass be collected for physical matching purposes and how many pieces of glass are needed to make a match which can be admissible as evidence in court?

18. Explain the process of matching for individualization purposes

19. What are the important principles that should be adhered to when collecting, packaging and dispatching glass/synthetic glass/plastic for individualization in motor vehicle accidents?

20. Name the most common mistakes that investigators make in collecting glass/synthetic glass/plastic in motor vehicle accidents.