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Crime Scene Management

Workbook

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POLICE REFORM PROGRAMME

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What is Forensic Science?

Introduction

Today, physical evidence plays a major role in the investigation and solution of criminal acts. Courts now quite rightfully question confessions made by suspects, as well as the testimony of eye witnesses. Physical evidence however, has the ability to corroborate the testimony of suspects and/or witnesses. Forensic science has greatly increased the value of physical evidence as a tool of today‘s law enforcement.

Learning Objective

At the end of this topic you should be able to:-

- Understand the origins of forensic science.
- Define forensic science.
- Discuss in general terms the application of forensic science to criminal investigations.
- Describe the various types of physical evidence which are commonly encountered at crime scenes.

Law supporting crime scene investigations

Evidence means and includes-

- all statements which the court permits or requires to be made before it by witnesses, in relation to matter of fact under enquiry: Such statements are called oral evidence.

- All documents produced for the inspection of the court:- such documents are called documentary evidence. (sec-3 of Evidence Act, 1872, Act No-I)

Documents means any matter expressed or described upon any substance by means of letters, figures or marks or by more than one of those means, intended to be used, or which may be used, for the purpose of recording matter. (sec-3 of Evidence Act)

Connectivity of Physical evidence in existing law-

Provided also that, if oral evidence refers to the existence or condition of any material thing other than a document, the Court may, if thinks fit, require the production of such material thing for its inspection. Sec-60 of Evidence Act,1872.

Investigation means-

Sec-4(k)(1) of Cr.P.C. –Investigation‖ includes all the proceedings under this code for the collection of evidence conducted by a police officer or by any person

The origins of forensic science

Forensic science is the application of science to criminal and civil laws that are enforced by police agencies in a criminal justice system.

In simple terms **forensic science is the application of science to law**.

Over the years there have been many people who could be cited for their various contributions towards the development of forensic science. However, the one thought by many to be the forefather of forensic science was a French scientist named Edmond Locard (1877-1966).

Locard became known as the founder and director of the Institute of Criminalistics at the University of Lyons; this quickly developed into a leading international center for the study of forensic sciences. It was Locard‘s belief that when a criminal came into contact with an object or person, a cross-transfer of evidence occurred. This became known as Locard‘s Principle of Exchange.

> *“When two objects come into contact, there is always a transfer of material from each object to the other. Often, this transfer of material is obvious, at least in one direction, but even when the amount of material transferred, or its nature is such that nothing is visible, there is always some transfer”.*

Examples of Forensic Science Disciplines

Fingerprints	Chemistry	Biology (DNA)
Documents examination	Handwriting	Firearm
Image processing	Photography	Toxicology
Shoe or tire impressions	Tool marks	Engineering
Fire investigation	Pathology (post mortem)	Linguistics
Anthropology (bones)	Odontology (teeth)	Ear identification
Palynology (pollen)	Psychology	

Examples of Physical Evidence (Locard’s Principle)

Introduced to the scene	**Removed from the scene**
Fingerprints	DNA
Blood	Blood
DNA	Glass
Shoe Impressions	Fibres
Tire Impressions	Hair
Fibres	Property
Hair	Soil
Property	Plant material
Paint	Paint
Handwriting	

NOTES

What can we learn from Physical Evidence?

1. Physical evidence can prove a crime has been committed or establish key elements of an offence.
   Example: In cases of alleged rape, the victim‘s torn clothing and injuries may be sufficient to prove non-consent.

2. Physical evidence can place the suspect in contact with the victim or with the crime scene.
   Example: Victims hair caught in the suspect‘s watch band.

3. Physical evidence can establish the identity of persons connected to the crime.
   Example: Fingerprints developed within the crime scene and subsequently identified to a person.

4. Physical evidence can exonerate the innocent.
   Example: In cases of alleged rape DNA analysis of samples taken from a victim may _clear‘ a suspect.

5. Physical evidence can corroborate the victim‘s testimony.
   Example: In cases of alleged assault, minor injuries to a suspect‘s knuckles may corroborate a victim‘s claim that he was punched in the mouth.

6. A suspect confronted with physical evidence may make admissions.
   Example: Stolen property found in the suspect‘s possession.

7. Physical evidence is more reliable than eye witnesses.
   Observations made during violent or stressful situations have often proved to be inaccurate.

Case Study

One of the first recorded uses of Forensic Science was in China in the 1200‘s. An investigator had to determine who murdered the victim, it was a remote village and a few strangers passed through. The victim had been slashed to death by a sickle (used to cut rice). The investigator had all the men of the village lay down their sickles together in the same area. After a while blowflies appeared and seemed to be attracted more to one particular sickle (probably due to tiny remnants of tissue and blood). The owner became the key suspect and soon confessed.

Scenario 1

Ali was looking through his front window to the house over the road. When the people who lived there left Ali seized his opportunity to break in. He crossed the road and went to the back of the house. Using a screw driver he forced the window louvers apart and removed three of them. As he was placing one of them on the ground he cut his finger which then started to bleed. He then climbed in through the window.

Once inside he found a small amount of cash and put it in his pocket. He did the same with some jewelry. Ali then opened a tin of biscuits and ate two of them. He was eating a third when he heard a noise behind him. He was startled and half of a biscuit fell from his mouth to the floor. He turned to see the front door open and one of the occupants Eva walked in. Ali ducked behind a cupboard and Eva didn't notice him at first. As she drew closer Ali jumped out and knocked her to the ground. Ali then further attacked Eva while she was on ground. Eva fought back scratching Ali's face but he was too strong. He then raped her and ran out the front door. Ali then went to a small park two houses away and hid some stolen jewelry and cash. Eva called the police.

ACTIVITY:
Remembering Locard's Principle of Exchange list the potential physical evidence from Scenario 1 on the previous page.

ACTIVITY:

Describe how each of the examples of evidence you provided in the previous activity could be used to implicate Ali.

Crime Scenes and the 'first responder'

Introduction

A crime scene can be a rapidly changing situation. The first officer to arrive at the scene of a crime must be concerned with a myriad of details. To a great extent, the very success of the investigation and perhaps the chance for a successful prosecution hinge upon the actions and steps taken by the first officer to arrive at the crime scene.

Learning Objective

At the end of this topic you should be able to:-

- Define Principle and Secondary Crime Scenes.
- Describe the responsibilities of the _first responder' at a crime scene.
- Understand the importance of crime scene and evidence preservation.
- Understand the importance of controlling the crime scene.

Definition of a Crime Scene

The scene of a crime is the area in the immediate vicinity of the occurrence, within which evidence might be found. In some cases, there may be a primary crime scene and one or more secondary scene.

A primary crime scene is the area in the immediate vicinity of the occurrence within which evidence might be found. Thus a bank where the armed robbery occurred is a primary crime scene.

A secondary crime scene is an area, although not in the immediate vicinity of the primary crime scene, still may afford evidence thereby linking the offenders with the offence. Therefore, in the case of an armed robbery, the place where the getaway car is parked is a secondary crime scene. Similarly, the route between the bank and the place where the getaway car is abandoned, both are secondary crime scenes. People such as suspects and victims could also be considered secondary scenes.

The limits of this area will vary according to the nature of the event. At times it can be localised but on other occasions it might cover a considerable area. (Such as a hit run accident, the investigator would extend his search a considerable distance from the point of impact to locate evidence).

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ACTIVITY:
List the potential primary and secondary scenes in Scenario 1.

Responsibilities of the First Responder

Where a crime scene is complex or of a serious nature and you have access to experienced investigators and forensic officers, you should not attempt to examine the scene alone if at all possible.

Ascertain if Crime Committed

The first Officer(s) attending the scene must, where appropriate:

- Conduct First Aid to any Victim
- Establish the extent (size) of the scene
- Establish if a crime has been committed.

Establish whether the incident is minor or major to enable you to determine the level of support that will be required to manage the crime scene.

Cordon the Scene

The following list demonstrates why it is important to ensure that the scene is not interfered with:

- To protect vital evidence especially if this evidence may be endangered prior to the arrival of a Forensic Officer.
- Mark the scene boundary with tape or any material that will clearly show the area not to be entered by unauthorized persons.
- To establish an entry/exit point at the scene.
- To prevent entry to the scene of any persons, including other police if they do not need to be there.

Suspect Management

Along with witnesses when first arriving at a crime scene there may often is a suspect still present.
You should
Separate the suspect from other witnesses
Search and secure the suspect

Note any relevant comments he may make about the crime and Do NOT interview or question the suspect as that is the role of the nominated investigator. However if you make the decision that you are to be the Investigator then you make take any action with the offender that you deem necessary in an inquiry. However you should make notes of anything the suspect says and if the suspect starts to make admissions then you must appropriately caution him according to law.

Notify Authorities

Persons in authority should be notified, especially if the crime is of a serious nature. They may be;

- The Command Centre
- Investigation Officer (IO), and
- Forensic Officers

This will ensure that specialized officers trained to deal with serious offences will attend the scene expeditiously.

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Record Crime Scene Movements

Duties of the Officer Preserving the Crime Scene include: -

- Commencing a Crime Scene Log/Administrative Log in which all actions occurring within the scene are recorded. An Officer may be nominated as a log keeper after consultation with the Officer in Charge of the investigation.
- Removing people through a common exit point.
- Recording who enters the scene and why, time of entry and exit to/from the crime scene.
- Maintaining control of the scene until it is taken over by an Investigator or Forensic Officer.
- Authority to restrict access to the scene to prevent contamination.

Inquiries

Isolate witnesses, record their details and, where possible, request them to stay.

- Take notes about issues relevant to the scene.
- Draw a basic sketch to record the scene if there appears any danger of the scene or exhibits being interfered with.
- Record all facts relating the incident and hand over it to the investigator after his arrival.

Examples: Name of eye witnesses, particulars of injured shifted to hospital, time and related person of all facts, related and parked vehicle numbers etc.

If there is doubt about the value of an object as an exhibit; treat it as evidence until a person examines it that is qualified to make a judgment. Assistance of other services is to be called for in the most expedient manner without you leaving the crime scene.

Handover

When you hand the scene over to Investigators and Forensic Officers you need to be in a position to carry out the following.

- Hand over the Crime Scene Log which should include
    - Initial observations
    - Witness List
    - Victim Details
    - Suspect details
    - Other information of interest such as comments the suspect has made whilst in your presence.

ACTIVITY:
Are you aware of any crime scenes which were perhaps not managed as well as they could have been? Were there preservation and evidence contamination issues? Describe what went wrong and any impacts this had.

Case Study

A dying man with a bullet wound in his head was found in his house. Ambulance personnel arrived and brought the man to a hospital where he was dead on arrival. The first responding police officer also accompanied the injured person to the hospital, a move that lengthened and complicated the investigation. Detectives immediately began an investigation of the scene. In the room where the victim had been found and where he was apparently shot, a cartridge case was found, but no weapon. An automatic pistol was, however found on the shelf in the hallway. It appeared to have been recently fired. Since the injured man could not have placed it there himself, a suspicion of murder arose immediately. A thorough and time-consuming examination of the house followed. After the first responding officer was spoken to the case was reduced to a suicide investigation. The first responder had apparently originally found the gun next to the injured man and without thinking of the consequences had examined it and placed it on the shelf.

Improving efficiency in Criminal Investigation!!!

Many people, both police and members of the community believe that the investigation of crime is the sole responsibility of Investigation officer and no other police officers are capable of, or are permitted to do so? This is a MYTH! All police officers have an investigative role.

Why Preserve a Crime Scene?

The scene of a crime is a very important area. The reason we preserve the scene is so that all of the available evidence can be found in its original position and condition to help us solve the crime and find out who committed the crime.

Constables are usually the first members to get to the scene of a serious crime. Most members know that a crime scene should be protected but often do not know why or how to go about it.

REMEMBER: EVERY CONTACT LEAVES ITS TRACES

Evidence found at the scene of a crime can be used later as exhibits in court to prove that an offender is guilty of the offence. It is very important that evidence found at the scene is kept in its original state.

The scene should be kept in its original state to stop contamination (interference) of the crime scene by people or other factors such as the weather.

Remember: every time something comes in contact with something else it leaves a trace. It may be a fingerprint, footprint or something that we can link the crime to the offender.

If we don't preserve a crime scene, then evidence can be:

- _____
- _____
- _____

What are we protecting the crime scene from?

- **People**

Crime scenes will often attract crowds of onlookers and friends and family of the victim. This may well lead to these people either deliberately or unintentionally moving or destroying valuable evidence. Some people may even steal exhibits such as guns, knives etc. Of particular concern are police members who may also contaminate the crime scene by handling or touching exhibits, walking over footprints or blood stains etc.

ACTIVITY:
List those things that Police should not do while at a crime scene and awaiting the arrival of assistance or commencing an investigation.

- Weather

Wind and rain, particularly, can destroy evidence quickly.

- Animals

Dogs, pigs and other animals generally may tend to scavenge or disturb a crime scene and will thus destroy or relocate valuable evidence.

- Traffic

Motor vehicles, particularly police cars will often drive over and destroy evidence such as tire marks, footprints and blood stains.

ACTIVITY:

Again think about Scenario 1. If you were the first responder‘ at this crime scene and you notice shoe impressions in the soil outside the point of entry and fingerprints and blood on the louvers, what steps could you take to preserve the physical evidence if it looked like it would soon rain?

Analysis and Interpretation of Evidence

Introduction

Collected exhibits or physical evidence can sometimes be analysed and interpreted enabling conclusions to be drawn. Often conclusions amount to determining the origin of the evidence through the comparison of _suspect samples' with _known samples'. The analysis s usually performed by specialists who have expertise relating to that specific evidence type. Other conclusions can be determined from the evidence by _non-experts' simply through observation and reasoning.

Learning Objective

At the end of this topic you should be able to:-

- Describe the analysis potential of various evidence types.
- Understand the importance of observation and reasoning to reconstruct the crime scenes.

Analysis of Evidence

It is impossible to list all the evidence types which can be analysed by a particular specialist as the list would be endless. As previously mentioned each crime scene has a different set of circumstances and therefore often differing available evidence. It is useful however for crime scene examiners to have a broad understanding of common evidence analysis types so that if the crime is serious enough external analysis can be considered. The list below could be used as a guide.

Blood, semen and other bodily fluids – can be analysed for DNA to determine identity and possible origin.

Documents – handwriting, typewriting and computer generated documents can be analysed to determine possible origin.

Drugs – can be analysed to determine type, chemical makeup and in some cases origin.

Explosives – can be analysed to determine type, mechanism, chemical makeup and in some cases origin.

Fingerprints – can be analysed to determine identity and possible origin.

Firearms and ammunition – can be analysed to determine type, mechanism and in some cases origin.

Glass – can be analysed to determine type, chemical makeup and in some cases origin.

Hair – can be analysed to determine colour and if the root or follicle is present DNA to determine identity and possible origin.

Impressions – from shoes, tires or tools can be analysed to determine type, style and in some cases origin.

Paint - can be analysed to determine type and chemical makeup.

Petroleum products - can be analysed to determine type and chemical makeup.

Observations and Crime Scene Interpretation

The evidence types mentioned on the previous page require specialist analysis techniques which are performed by experts. These services are expensive and are often not available unless the crime is of an extremely serious nature. Police can sometimes however reach significant conclusions simply by applying a thorough examination and by making observations to interpret the crime scene through a common sense approach. Consider the simple scenario below.

Scenario 3

Mother was mixing the ingredients for a chocolate cake within a bowl on the kitchen bench when the phone in the other room rang. The only other people in the house at the time were her two sons; Moslem aged 12 and Ramin aged 2. When mother returned from her phone call she noticed a chair had been pulled up to the kitchen bench next to the bowl of chocolate cake mix. Tiny chocolate finger marks could be seen on the kitchen bench. Little Ramin also had chocolate around his mouth.

ACTIVITY:
Think about Scenario 3. What do you think happened while mother was on the phone?

You probably concluded that Ramin dragged the chair over, climbed up to reach the bowl and ate some of the chocolate cake mix. What you have actually done is interpreted the events of the incident through observation, consideration of the evidence and deductive reasoning. You have not only identified evidence implicating the offender (Ramin) but whilst doing this you probably also eliminated the other suspect (Moslem).Whilst this is a very simple example the same principles can be applied to crime scenes. Try the next one.

Scenario 4

Kamal woke up in the middle of the night startled after hearing a noise coming from the yard outside his house. He went to investigate and found the front door wide open. His car was missing from the driveway. He then noticed that the back door to his house was also open. He noticed a strange mark on the outside of the back door next to the lock. It was square in shape and seemed to be impressed into the timber of the door. On the ground outside below the back door were some wood fragments which were the same colour as his door and three burnt matches. Kumar called the police and told them what had happened.

ACTIVITY:

Think about Scenario 4. What do you think happened while Kumar was asleep?

Hopefully, consideration of Scenario 4 has assisted you to understand that much can be learnt from the physical evidence present at a crime scene. Of course, physical evidence analysis by experts is a useful investigate tool given the right set of circumstances but in the absence of analysis capability crime scene interpretation can also be very useful to determine what has occurred. The next step would be to try and establish who is responsible.

Case Study

Napoleon Bonaparte was an army general who ruled Europe in the early 1800‘s. Upon being captured by his enemies he was exiled to an island. Napoleon wrote to a number of his friends that he believed that he was being slowly murdered in jail. Upon his death he was buried on the island. His death was reported at the time as being due to cancer. Twenty years after his death his body was exhumed and taken back to Paris and entombed. In the 1960‘s scalp hair was taken from the body and analysed for substances contained within it. Normal human scalp hair contains small amounts of arsenic but Napoleon‘s was found to contain thirteen times the normal amount.

Below are some examples of how physical evidence can assist the investigator to interpret the events of an incident.

Shoe or foot marks at a crime scene can be very useful. Their direction of travel and type of impression can assist to determine which way the offenders went and how many offenders there was. Blood deposited on surfaces at a crime scene can tell the investigator how the injury was caused, how many blows were delivered, sequences of events within an incident and direction of travel of an injured person.

Car seat and mirror positioning can give some indication of driver size.
Items such as chairs placed near fences or point of entries can give some indication of offender size.
Broken glass on the ground or floor can assist to determine what side the force came from.
Clothes and personal items thrown around the room in disarray can give an indication that the offender was searching for something.

Types of food items, drinks, etc. consumed within the scene may indicate offender age.
Burn patterns can assist the investigator to determine the direction in which a fire has travelled.
The list is by no means exhaustive.

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ACTIVITY:

Consider Scenario 1. Compile a crime scene case file. Use your imagination!

Crime Scene Examination

Introduction

The important thing to remember is that the crime scene contains significant information that if sought in a systematic, legal and scientific way may help determine what has happened and who was involved. It is the crime scene examiners responsibility to know how to gain the most from the crime scene.

Learning Objective

At the end of this topic you should be able to:-

- Understand the importance of an initial assessment.
- Describe crime scene recording processes.
- Describe crime scene examination methods.

The Initial Assessment of a Crime Scene

Many people think that crime scene examinations are only needed for very serious offences such as murders or rapes. This is not correct. When homes are broken into and property is stolen, to the victim this is often very serious. The principles of crime scene investigation apply equally to all types of offences. After the crime has been reported and the scene is controlled and preserved, an examination should follow. Before the crime scene examination commences however an initial assessment is required. With a serious offence the first responder may have already done this however the crime scene examiner must also perform an initial assessment to understand the circumstances of the scene which will in turn enable the planning of the examination.

Case Study

Offenders gained entry to a shop by cutting the metal roof sheets and then breaking a hole through the plaster ceiling. The offenders then dropped from the high ceiling onto the floor of the shop. After stealing money and property the offenders then broke a display window to make their escape. During the initial assessment of the scene dusty shoe prints were located on some of the large pieces of broken glass. Two suspects were apprehended nearby a short time later. One had white powdery material on his clothes, which later turned out to be plaster from the shop‘s ceiling. Both suspects had small pieces of glass embedded in the soles of their shoes and one of them had grazes under both arms, apparently from the sheets of roofing tin. Their shoes also matched the shoe prints found on the glass at the shop. When confronted with the overwhelming physical evidence both offenders confessed.

Things to do and consider during the initial assessment

1. Ascertain what has happened. Discussions with the first responder, other police officers, witnesses and other people at the scene may be of assistance in determining what has happened. Understanding the circumstances of the incident will help you to appreciate the scope of the crime scene.

2. Establish if the scene is safe by assessing and occupational safety and health risks. Risks to consider include:
   - Is the offender still in the vicinity?
   - Are there any physical risks such as unstable building structure, vehicular traffic or broken glass?
   - Could biological material pose any risks? (Hepatitis and AIDS are major concerns when blood or other human tissue is present at a scene)
   - Are there any chemical risks? (Such as materials stored in a factory)
   - Are there any electrical hazards?

3. Conduct a preliminary visual inspection and evaluation of the crime scene (walk through).

4. Take any precautionary initial action to preserve loss of evidence by destruction or contamination.

5. Plan a course of action.

Crime Scene Analysis:

In consideration to above mentioned circumstances the crime officer has to analyze the following matters even though it has been done by the first responder.

1. Initially it is to be assumed that the crime is still on going as long as it is confirmed that the crime has been complete.

2. Clearly observe the situation, smell, hear and try to find all answer relating to completion of crime.

3. Confirmation of presence of any secondary device in connection with explosion.

4. Assessment of necessary assistance from other agencies like fire brigade

REMEMBER: EVERY CONTACT LEAVES ITS TRACES

ACTIVITY:

Think about Scenario 1. Make a list of things you might consider in relation to the scenario and the 5 points mentioned in the previous sections (Things to do and consider during the initial assessment).

Recording the Crime Scene

Processing the crime scene which includes careful examination, note taking, sketching, photography, and collecting physical evidence requires a careful plan of attack. The crime scene must be approached in a systematic and methodical way and recording is one of the most important steps.

Crime Scene Photography

You have no doubt heard the saying ―One picture is worth a thousand words‖. That saying certainly holds true with crime scene photography. The purpose of crime scene photography is to:

- Record the original scene and related areas.
- Record the initial appearance of physical evidence.
- Provide investigators & others permanent visual record of the scene.
- Provide a record to be utilised in court.

Photographs should be taken of all things of significance and should accurately record the location of items within the scene.

The photographs should be taken before scene is examined and items are moved as this will provide a record of items and the scene in its original state prior to police intervention.

The types of photographs taken should include:

- General photographs (exterior and interior) showing the location of the scene.
- Mid-range photographs (again exterior and interior) to record the positions of relevant items within the scene.
- Close-up photographs showing the item of interest in detail. When photographing an impression, a scale should be placed within the photograph.

Remember – You can never take too many photographs!

NOTES

Handwritten Notes

The crime scene examiner should take accurate and extensive notes. These can include entries in police notebooks and within forms specifically designed for crime scene recording. These notes need to be accurate and should include the following:

- The time and date the call was received to attend the scene.
- The time, date and with whom you attended at the scene.
- The names of those you spoke to at the scene.
- Actions carried out at the scene including exhibits collected, examinations carried out and conclusions reached.

Handwritten notes are important because they:

- Provide details permanent record of the investigation
- Enable the distribution of information to all investigators
- Enable the presentation of accurate information in court
- Assist to refresh your memory at a later time.

ACTIVITY:

Think about Scenario 1. What items of physical evidence might be present to assist in determining the identity of the offender and proving the elements of the offences involved?

Evidence which may be important may include:

- Items which are foreign to the scene. That is, items which may have been introduced by an offender.
- Items used in the commission of the offence. For example, weapons.
- Any damage or signs of interference to the scene.
- Evidence relationships. For example, the proximity of shoe impressions to the point of entry.

People as _Secondary Scenes‘

By definition, people can also be considered as secondary scenes as they too may afford evidence relevant the offence. This applies equally to suspects and victims.

Suspects
As potential _secondary scenes‘ suspects may be a useful source of relevant physical evidence which could link them to the primary crime scene or a victim. This could include things such as the suspect‘s fingerprints for comparison with those recovered from scenes, physical injury caused to the suspect during the commission of the offence, material on the person or their clothing which originated from the scene and shoes matching impressions left at the scene. Just like the primary scene the suspect will require careful examination under appropriate legislative provisions.

Victims
Victims of murder, assault and sexual assault may be a significant source of relevant physical evidence. The thorough examination of murder victims by forensic pathologists or medical examiners may reveal the cause or manner of death; or, what has happened. Physical evidence may also be present linking a suspect to the incident. The use of forensic medical examination as an aid to evidence collection in alleged sexual assault cases is now also frequently used as a part of an investigation. The sexual assault victim however, must be managed appropriately to provide maximum assistance to the investigation and to cater for the welfare of the individual. To achieve this, a collaborative approach needs be adopted with police investigators working closely with its partners from the various medical institutions and victim support centers. Remember, the victim has undoubtedly suffered significant physical and mental trauma during the actual incident. An insensitive police approach will not only cause the victim unnecessary additional trauma, but also dramatically reduce the opportunity for positive investigative outcomes.

ACTIVITY:
Think about Scenario 1. What relevant physical evidence might be available from the people mentioned?

Crime scene sketching

Photographs alone are not sufficient for the adequate recording a crime scene. A crime scene sketch will complement the photographs and notes made during the crime scene search. The purpose of a sketch is to portray the information accurately, not necessarily artistically. It is not required that the crime scene specialists have any artistic ability in order to construct an adequate sketch of a crime scene. Crime scene sketches clarify the appearance of the scene and make it easier to comprehend.

Information to be Included in the Sketch:

- The sketch should include at least the following information:
- The crime scene specialist‘s full name and assignment.
- The date, time, crime classification, and report number.
- The full name of any person who assists in taking measurements.
- Address of the crime scene, its position in building, landmarks, and compass direction.
- The scale of the drawing, if a scale drawing has been made.
- The major discernible items of physical evidence and the critical features of the crime scene. The location of such items is indicated by accurate measurements from at least two fixed points, or by other methods discussed below.
- A legend or key to the symbols used to identify objects or points of interest on the sketch.

Considerations Involved in Crime Scene Sketching

The measurements shown on the sketch should be as accurate as possible and they need to be made and recorded uniformly. Steel tapes are the best means of taking measurements. It is difficult to explain an erroneous measurement on a drawing, and can introduce doubt in the minds of others as to the competence of the entire search of the crime scene.

Rough Sketch
A rough sketch is drawn free hand by the crime scene specialist at the scene of the crime. Changes should not be made to it after the specialist has left the scene. This sketch will not normally be drawn to scale, but will indicate accurate distances, dimensions, and relative proportions.

Detailed Sketch
A smooth sketch is one that is finished and is frequently drawn to scale from the information provided in the rough sketch. If a sketch is drawn to scale, the numbers concerning the distances can be eliminated. However, if the sketch is not drawn to scale, the distances need to be shown.

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Methods of sketching

Coordinate Method

The coordinate method measures the distance of an object from two fixed points. One form of this method uses a baseline, which is drawn between two known points. The baseline could be a wall, or drawn as a mathematical center of a room, the exact dimensions of which are known. The measurements of a given object are then taken from left to right along the baseline, to a point at right angles to the object, which is to be plotted. The distance will be indicated in the legend with a number in parentheses following the name of the object.

Triangulation Method

The triangulation method is useful in an outdoor situation where there are no easily identifiable edges of roads or fields to use as reference points. Two or more reference points are located and should be widely separated if possible. The item of interest is located by measuring along a straight line from the reference points.

Cross-Projection Method

The cross-projection method is useful when the items or locations of interest are on or in the wall surfaces as well as elsewhere in an enclosed space. The walls, windows, and doors in a cross-projection sketch are drawn as though the walls had been folded flat on the floor. Then a sketch is drawn of the measurements from a given point on the floor to the wall.

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The sketch should include the location of victim, location of weapons and other exhibits and if possible a north point. After the sketch or plan is finished it should be endorsed with your name, signature, time and date.

Again, the sketch will be valuable to refresh your memory in the future and may be invaluable if photographic equipment fails.

ACTIVITY:

Think about Scenario 1. How would you record this scene? List the photographs that you would take.

ACTIVITY:

In the box provided below draw a sketch plan of the crime scene described in Scenario 1. Use your imagination!

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Crime Scene Examination Methods

Each crime scene is different according to the physical nature of the scene and the crime committed. Consequently, the scene is thoroughly searched to develop essential evidentiary facts pertinent to the offense. The actual crime scene search should not be confined to a specific area, but extend along the path of approach and follow the line of flight of the perpetrator. A search conducted in this manner will often uncover an item dropped or discarded by the offender, which may later be instrumental in obtaining identification or a conviction in court.

The Purpose of the Search
The crime scene search is conducted to uncover the physical evidence that will potentially do the following:

- Determine the facts of the crime
- Identify the criminal
- Aid in the arrest and conviction of the criminal

Crime scene searching

Prior to the search, the crime scene specialist should survey the crime scene and set limits on the area of the search for the purpose of determining how to organize the search procedure and to ascertain what assistance is needed. Before starting the search, the investigator and crime scene specialist should note the locations of obvious traces of evidence, probable entry and exit points used by the perpetrator, as well as the size, shape, and condition of the area to be searched.

Once the crime scene examiner has gathered as much information as possible through the initial assessment and completed initial photography the crime scene examination or search can begin.

As a general rule evidence of a fragile or vulnerable nature should be collected before material that is less likely to be lost or destroyed. Thus, crime scene photography and sketches should be done because the crime scene will change with passing time and the examiner‘s aim is to make a record of the scene as close to its original condition as possible.

When examining the scene, remember to apply Locard‘s Principle of Exchange.

Search techniques

Traditionally, there are three types of searches conducted at a crime scene: spiral search, grid search, and sector search. The specific technique used is not as important as having the process conducted in an organized and systematic manner. There are five (5) systematic search methods normally utilized to search crime scenes. They include the spiral search, strip search, grid search, zone or sector search, and the pie or wheel search. Let‘s look at each of these and discuss how they are conducted

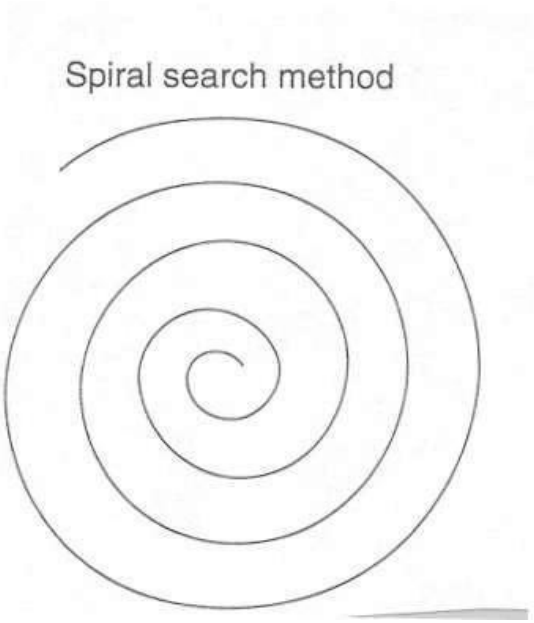
Spiral Search Method

This ever-widening circle technique is conducted with the searching officer starting at the focal point of the crime scene or the center of the area, working outward by circling in a clockwise or counterclockwise direction to the outside edges of the crime scene. A spiral technique is a good pattern for a rather confined area. This works well in a small room. In addition to using the spiral pattern in a room, it is also helpful to apply this pattern in layers. This can be done as follows:

- Visually search the top third of the rooms, as well as the ceiling. Police officers typically do not look up very often, but should in the case of a crime scene. There may be bullet holes in the ceiling, blood splatter or hidden items.

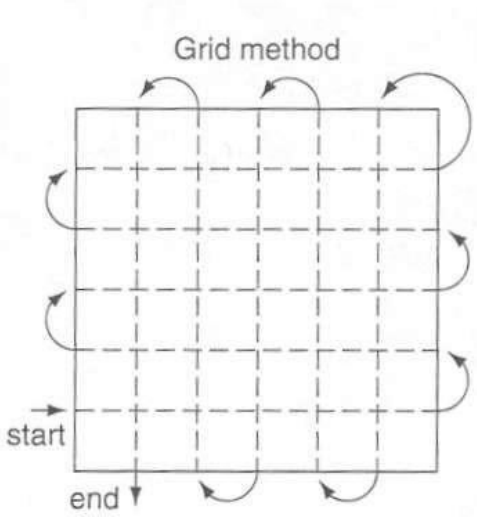
- Search the middle third of the room including drawers and cabinets.

- Search the lower third, using the spiral technique. The floor and lower cabinets are typically where most evidence is located.



Grid search

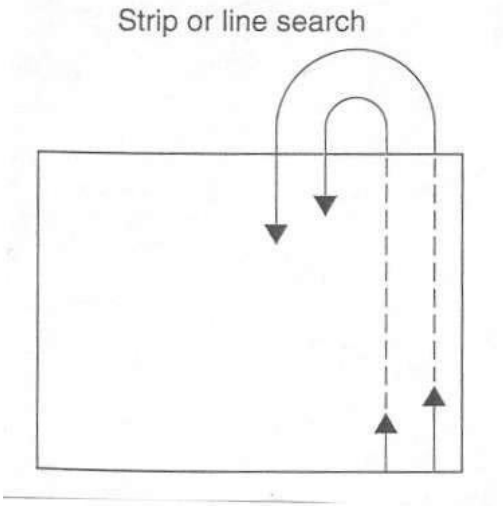
The grid search is a variation of the strip search and is useful for large crime scenes, particularly outdoor scenes. After completing the strip search, the searchers are doubled back perpendicularly across the area they just searched. It is very time consuming, but causes a very methodical and thorough examination of the area. It also has the advantage of allowing searchers to view and search the crime scene from two different viewpoints, thereby increasing the possibility of uncovering evidence not previously noticed.



Strip Search

A strip search is typically used in outdoor scenes to cover large areas in which detailed examination is necessary. It is a technique frequently used by archeologists when they search a particular area. The strip search uses a series of lanes across the crime scene. This method can be used by one person or a group of searchers. *It is done as follows*:

- Each lane contains a searcher that walks down the lane parallel to the other searchers.
- Once the searchers get to the end of the lane they reverse their direction and walk back adjacent to the lane they just searched.
- This process is continued until the entire crime scene area has been searched.
- If one of the searchers finds evidence, all searchers should stop until the evidence is properly processed and they receive additional information.



Zone or sector search

A zone or sector search is used when the search area is particularly large and cumbersome. The zone or sector search requires the crime scene to be divided into four large quadrants (the four large quadrants can also be sub-divided into four smaller quadrants). Each quadrant or sector is then searched separately as an individual unit, using the spiral, strip and/or grid search pattern.

Pie or Wheel Search

The pie or wheel search is based on the establishment of a circle surrounding the crime scene. The circle is then divided into six quadrants in a pie-like fashion.

It should be noted that a combination of search patterns can be applied if the circumstances of the scene demand it. The search should also be multi-dimensional meaning that the examiners need to look in all directions including up and down. The type of search applied can depend on:

- The type of scene (whether internal or external).
- The presence of a body (victim).
- The size of the area to be searched.
- The type of terrain.
- The size of the evidence.
- The need to move objects.
- The number of skilled officers available.

ACTIVITY:
Which search pattern would you apply to Scenario 1? Give your reasons.

During the search of the crime scene the forensic officer must closely examine relevant objects and identify their potential as evidence. Whilst doing so the examiner should consider:

- Physical evidence that may assist with the elimination of persons or establish the identity of suspects.
- Physical evidence that may assist with the corroboration of witnesses.
- Interpretation of any impression evidence.
- Relationships of evidence within the scene.
- Any sequences of events suggested by the physical evidence.
- Scenario development including alternative scenarios.

Who and what?

Crime Scene photography

Introduction

It is important to understand that all crime scenes should be properly recorded prior to any action by police. The recording of the crime scene ensures that the court has a view of the crime and how located exhibits relate to the crime, the loc. It is the crime scene examiners responsibility to know how to gain the most from the crime scene

Learning Objective

At the end of this topic you should be able to:-

- Explain the importance of photographing a crime scene
- Discuss the difference among long, mid and close range photographs of evidence and the need to use a scale in photographs
- Successfully photograph a crime scene
- In certain types of crime, particularly those involving physical violence, the crime scene and the location of all relevant objects within it are of vital importance in establishing points of proof.

Importance of Crime Scene Photography

A photograph is a permanent record of the crime scene and is considered indispensable to a successful presentation of the case in court. A crime scene that is altered through carelessness and haste can never be restored to its exact original condition.

In the initial stages of an investigation, the significance of certain aspects of the crime scene may not be evident, although later they may vitally affect the issues in the case. The first step in the investigation of any crime is to photograph all aspects of the crime scene completely and accurately before any of the objects of evidence are removed or otherwise disturbed. Photographs should also be taken after a body or bodies have been removed. It is always better to take too many photographs than too few.

A study of photographs can also assist the trained investigator or crime scene specialist in reconstructing the crime scene and developing conclusions about how the crime occurred. In addition, the photographs will make the job of the prosecutor much easier when a case is presented in a courtroom. When necessary, photographs can be coordinated with crime scene sketches or drawings that are made to scale.

Procedures for Photographing the Crime Scene

The goal is to record useful information in a series of photographs, which will enable the viewer to understand where and how the crime was committed. The term ―crime scene‖ refers to not only to the immediate locality in which the crime took place, but also to adjacent areas where important acts took place immediately before or after the crime was committed.

Photographs of the broad area of the crime scene should be supplemented by closer shots of sections containing important detail. Each area or object should be photographed so that it can be located readily in the overall pictures, which will enable the viewer to gain a clear concept of its position with reference to other objects at the scene.

Sequential Photographs of the Crime Scene

Each crime has individual features that should be photographed. Keep in mind the nature of the offense and try to show those features that establish the elements of the offense. Photographs should be taken of:

- Views of the exterior of the building/vehicle, with relations to other buildings/vehicles, roads, streets, etc.
- Points of entry, outside and inside.
- Point of exit, inside and outside.
- Condition(s) of the crime scene.
- Area from which valuable articles were removed.
- Articles left at the scene.
- Trace evidence, such as hairs, fibers, and cigarette butts.
- Toolmarks and impressions of shoes or tire tracks.
- Fingerprints and footprints, as well as articles on which these prints may be found.

NOTES

Range Photographs

An important aspect of consideration regarding the various ―range‖ photographs is the general point-of-view established by the camera locations. These locations will enable the viewer of the pictures to orient the crime scene in a logical manner. The three types of ―range‖ photographs are:

Long-range

Long-range photos of the overall scene fundamentally are taken to portray the areas as if a person viewing the scene is viewing the scene is seeing it from the standing position. To obtain this result, the photographer takes the photograph with the camera at eye level.

Mid-range

Mid-range photos are taken in a manner, which portrays the scene from approximately ten to twenty feet of distance from the subject matter. In order that the viewer is permitted to associate the crime scene with separate areas of the scene photographed, these areas should contain sufficient detail to permit the viewer this association.

Close-up range

Close-up range photos are normally taken approximately five feet or less from the subject matter. The attention of close-up photography is directed to objects, which could not effectively be seen in the long-range or mid-range photos.

Marking in the field of view

Measuring devices such as rulers, yardsticks, and tape measures should be used to show the relative size of, and distances between objects, or the degree of magnification of the enlargement. The markers should be placed beside the object in a manner that will not obscure any important piece of the evidence. In document and small-object photographs, a six-inch ruler placed at the bottom or just below the item of evidence will enable the photographer to determine the degree of enlargement quickly and also show the relative size of objects in the photographic exhibit.

Many times, courts object to the use of rulers and marking devices that appear in photographs of a crime scene. Therefore, photographs should be taken in two ways: first without the markers and then with them.

NOTES

Camera motion and categorizing photo evidence

Camera Motion

Camera motion can be the cause of a lack of sharpness. There are two prime causes of camera motion. The first cause is vibration and it is usually caused by body movement including the beating of the heart. The second cause of camera motion is actual camera movement caused by the improperly holding of the camera.

Categorizing Photo Evidence

The investigator must make a written record of what is recorded. The first frame of the crime scene photographs should be a photograph of a chalk slate or a piece of paper, preferably the size of a piece of notebook paper, which contains information identifying the case. This information should include the name of the photographer, the name of the victim, the address, date, case number, and time. By including this information on the roll of film, the chances of the film being misplaced or misdirected by the photo lab will be lessened. The following information should also be recorded in the crime scene specialist‘s notes:

- Department name, location, date & time
- Type of incident & objects photographed
- Type of film used and number of exposures
- Type of camera used
- Identity of the crime scene specialist
- Names of victims & witnesses
- Chain of Custody
- The chain-of-custody of the photographs must be maintained.

Exposure controls

The crime scene specialist must always remember that a camera makes adjustments to light much like the human eye. You might say that the eye has a built-in light meter. That same light meter is imperative for getting usable shots with a camera. A ―light meter‖ will tell the photographer what camera settings will give the best results. Two adjustments on the camera can control the amount of light that reaches the film. They are called the ―Shutter Speed Control‖ and the ―Lens Opening‖.

Shutter Speed Control
The ―Shutter Speed Control‖ determines the length of time that the film is exposed to light. The numbers found on the control correspond to fractions of a second.

Lens Opening
The size of the ―Lens Opening‖ on your camera is the other factor that determines the amount of light that reaches the film. The indicator on the camera for the degree of light passing through the camera lens is called the ―f-number‖. The smaller the ―f‖ number the smaller the opening and vice-versa. Much like fast films and slow films, there are fast and slow lenses. A fast lens, for instance, is one that transmits a lot of light. The user should be cautious, however, since fast lenses do not produce the sharpest images.

NOTES

Depth of Field

Definition

―Depth of Field‖ is usually misunderstood and thought to be the sharpness in front and in back of the subject of the photograph. The term is really used, however, to describe the distance that the crash investigator can move away from the subject and still maintain a sharp image. Depth is the area in front and in back of the photograph.

How to get depth

- *Use a small lens*
  To get depth, the crime scene specialist will use a small lens with a large ―f‖ number. Understanding this concept will control the sharpness of every photograph.

- *Change in depth*
  Increasing depth can be accomplished by moving further away from the subject of the photograph, but this often distorts the photograph by changing the size of the subject‘s image. A more plausible way to change depth is to set the aperture (lens opening) to a higher number. The shutter speed, however, must also be adjusted because of the corresponding light restriction that will naturally occur when going to a higher ―f‖ number. When depth is an important element of the photograph, use the smallest aperture possible to keep the picture sharp.

- *Moving subject*
  When you are photographing a moving subject, a fast shutter speed will be needed to stop the action.

Focus
The sharpness or focus of a photograph will make a big difference in a court of law. If the jury can see exactly what has taken place through a series of photographs that are clear and concise, the evidence will be much easier to understand.

Sharp images
Getting sharp images may be difficult when close-up photography is required. Although the ―film speed‖ and the ―depth of field‖ is not critical in a close-up photograph, the crime scene specialist must always find a focal point that can serve as a visual reference point and be understood by a judge or jury. In other words, the photographer must decide how much meaning he/she would lose for any particular focal choice.

Tripod
Since the depth is so shallow, the crime scene specialist must concentrate on the most important part of the photograph. The tripod will be best used for a close-up photograph as described.

Type of lens
Sometimes the crime scene specialist may want to highlight a particular part of the photograph. To do so may require a different lens. Wide-angle lenses, for instance, make objects look smaller and distances between look greater. Conversely, zoom lenses can be adjusted to acquire a close-up photograph that can be taken from some distance.

NOTES

Glossary of Camera parts

- **Aperture**
  The circular adjustable lens opening through which light enters the camera. The lens can be adjusted to restrict the amount of light passing through.

- **Filter**
  A plastic or optical quality glass that is used in front of the lens to increase contrast or reduce glare. The glass is usually tinted or colored to absorb light.

- **Flash**
- The flash is used to provide artificial lighting in otherwise darkened pictures. The ordinary flash bulb has been replaced by the electronic flash in recent years.

- **Light Meter**
- Also known as exposure meter that measures light intensity in relation to film speed.

- **Shutter**
  A control on the camera that is set for a timed light interval that allows the appropriate quantity of light to pass through the lens.

- **Standard Lens**
  The 50mm lens sold with most 35mm cameras is known as a standard lens and most closely fits the perspective of the human eye.

- **Telephoto Lens**
  A long compact focus lens that yields a larger image than normal.

- **Tripod**
  A three legged support for a camera that steadies the camera and ultimately creates a better photographic image

- **Wide-Angle Lens**
  A lens with a wider than usual angle of coverage.

- **Zoom Lens**
  Using a zoom lens can give the photographer a different angle of view including different focal lengths over a certain range.

Photography Terminology

The following definitions reflect many of the terms used to describe the process of photographing. These definitions will provide a foundation upon which to describe techniques commonly used to obtain the sharpest, clearest and most valuable photographs for court purposes.

- ASA
  The measurement for rating the speed or light sensitivity of the film. The abbreviation stands for the American Standards Association. The higher the arithmetical designation, the more sensitive to light the film will be.

- **Balance**
  A term used to describe how the subject matter is arranged in a single frame.

- **Bracketing**
  Taking a subject photograph using what is perceived to be the best lighting, film, etc., then taking several more photographs at different exposures to make sure that a productive photograph exists.

- **Depth of Field**
  The area in front and in back of the focal point or object of the photograph. The smaller the lens aperture, the greater the subjective impression.

- **Distortion**
  Changes in the photograph normally caused by a particular lens and different from what would be seen on a standard lens. Distortion deforms the shape of an image.

- **Electronic Flash**
  Light produced by passing an electric charge at high voltage through a gas in a sealed transparent container.

- **Exposure**
  The effect of light striking the film can cause distortions after chemical processing (too little or too much). Overexposure can be the result of to much light and underexposure can be the result of inadequate light.

- **Film Speed**
  The numeric measure of the film‘s sensitivity to light is known as ―speed‖. The higher the numerical rating, the ―faster‖ the speed.

- **Focus**
  An adjustment used to bring the main subject into to sharp or clear focus.

- **Framing**
  Getting the picture you want within the boundaries of the frame being shot.

- **Overexposure**
  Excess light hitting the film will cause film distortion and overexposure.

- **Panning**
  Tracking a moving subject with a camera and trying to keep the subject of the photograph centered in the frame.

- **Viewpoint**
  Finding the correct camera position in order to capture the crash scene in the most realistic way.

Fingerprints

Introduction

The science of fingerprints is based on three fundamental principles:

- Fingerprints are unique to the individual.
- Fingerprints are persistent meaning they remain with us until after death.
- The fingerprint patterns are variable to the point where they can be systematically classified for filing.

It is these three principles which enable fingerprints to be such a useful tool in criminal investigation.

Learning Objective

At the end of this topic you should be able to:-

- Understand the fundamental principles of the fingerprint science.
- Describe how fingerprints can be used to assist in criminal investigation.
- Demonstrate how to take a set of inked fingerprints from another person.
- Detect, develop and preserve latent fingerprints.

Case Study

The FBI has over 250 million sets of fingerprints. All standard fingerprint cards are 20cm square pieces of paper with a thickness like that of thin cardboard. The FBI receives over 34,000 fingerprint cards each day. If all the fingerprint cards on file with the FBI were piled on top of each other, the stack would be one hundred and thirty times higher than the Empire State Building. Though I'm not sure why anyone would want to do that.

Inked Fingerprints

Inked fingerprints are used for two main purposes; compilation of the criminal history of an individual and comparison against fingerprints found at crime scenes. Another non-criminal use of inked fingerprints is for the elimination of fingerprints that may have been deposited by persons who may have had legitimate access to a crime scene. As someone will be attempting to use the inked impressions for comparison you must ensure that they are of the highest possible quality. Do not allow your work to be the cause of an unsuccessful fingerprint search!

In the early 1900's many countries established inked fingerprint collections and commenced the detection and development of fingerprints at crime scenes. Thus, began a new era in criminal investigation and the identification of suspects through fingerprint comparisons.

A Word of Caution

Before discussing the procedure for taking inked fingerprints some remarks are appropriate about the potential hazards of handling prisoners with open wounds or blood on their hands. Hepatitis and AIDS are major concerns among persons who handle blood-stained objects (including prisoner's hands). Nylon gloves should be worn to avoid coming into direct contact with blood.

Work station and equipment

Your police station may have permanent or temporary workspace for inked fingerprinting. In either case there are certain pieces of equipment that you will require to carry out the task. As with the tools of any trade, the equipment for taking inked fingerprints should be kept in top condition in order to achieve optimum results.

Read through the following descriptive list for an introduction to the required equipment

Working surface

The working surface should ideally be at the height of the forearm of a standing person of average height when the forearm is held parallel to the floor

It may be a permanent stand or a portable unit which, when placed on top of a desk or counter comes to the appropriate height. It is convenient to incorporate storage inside the unit for the equipment, forms and cleaning materials.

Inking Plate

The inking plate may be made of any smooth material such as glass, steel or a hard plastic that is not easily scratched. A standard glass louver is a convenient size,

Ink

The ink must give dark grey, almost black, impressions and must dry almost immediately. Specially formulated fingerprint inks give the best results. Other substitutes may appear light grey or be a particularly slippery consistency, both of which lead to poor results.

Fingerprint Forms.

Most fingerprint forms are laid out so that the right thumb is at the left end of the top row of spaces and the other digits are in sequence until the left little linger is reached at the right end of the second row. Below these two rows are spaces for the fingers of each hand to be recorded simultaneously without rolling (plain impressions). Also included on the front of the form are spaces for both the left and right thumb impressions, which are placed simultaneously between both sets of the plain impressions of the fingers

Cleaning Materials.

The working surface must always be kept clean. Non-flammable solvents and paper towels will remove the ink.

Washing Facilities.

Washing facilities for the subject must be provided before and after fingerprinting. Regular soap and water is usually adequate for preparation of the hands of the subject before printing. Waterless hand cleaner or a lotion is usually required to cleanly remove the ink after printing.

Control of the Subject.

The biggest single cause of poor quality fingerprints is lack of control of the subject. The position in front of the work surface, your control of the arms and hands and your grip on the fingers while rolling, all combine to determine the ease with which the task will be completed. This will, in turn, dictate the quality of the impressions. You will find it awkward at first and this will cause errors of smeared and poorly defined impressions. Careful practice will overcome the difficulty and eventually it will become second nature.

Relax the Subject

Encourage your subject to relax. The less tension in the arm and hand there is to overcome the better your results will be. Have your subject look away from the fingerprint form so there are fewer tendencies to anticipate the rolling action and to try to 'help' you. You must be in control of these motions, not the subject.

Stance of the Subject

Position the subject in front of the work surface so that there is no difficulty in reaching any part of the fingerprint form without having to stretch or change position.

Usually, if the forearm is at right angles to the workstation at a point midway between the fingerprint form and the inking plate, the subject will not need to move to reach either the form or the inking plate.

Stance of the Officer

There are two basic stances for the officer:

One stance positions the officer to the left of the subject when rolling the left hand and to the right when rolling the right hand. This method keeps the subject from standing directly behind the technician.

The disadvantage of this method is that you must learn to work both left and right-handed. It is, however, the preferred stance if you will be alone in the room with the subject.

Grasping the Hands of the Subject

A brief description of the technique is given here. Since the right hand impressions are at the top of the fingerprint form the right hand will be rolled first and you will, therefore, have the subject on your left.

Grip the right hand of the subject with your left while supporting the tip of the digit with your right thumb and index.

Your left hand will perform all of the rotating movement as you ink and roll the impressions (assuming a right handed officer).

Your right hand will merely support the tips of the digits, helping to position them in the boxes on the fingerprint form. This hand should place very little downward pressure on the tips of the digits otherwise the result is likely to be smeared impressions.

When you move to the left side of the subject to roll the left hand you may wish also to reverse your hand positions. Your right hand will now perform the rotation while your left becomes the support.

It takes a little practice to get the thumbs and fingers of the subject organised so that the uninvolved digits are not in the way. This is especially true of the thumbs. By the time the subject has curled the other fingers under and extended the thumb, and you have grasped the hand, you may find that there is very little thumb left to stretch onto the fingerprint form. The knuckles of the subject or your own fingers tend to catch on the edge of the form holder in this situation. This, of course, leads to uneven rolling which is another cause of smeared impressions. Practice will help teach you to overcome these difficulties.

In order to achieve full rotation it is important that the hand, wrist and forearm be in a straight line. (A work surface at the proper height makes this very much easier.)

Because of the skeletal structure in the forearms it is usually easier to roll the fingers outwards, away from the body of the subject and the thumbs inwards towards the body. Test each subject, before inking, by rotating the fingers to check for tension in the muscles. Always roll from a position of tension to one of less tension to avoid smearing the impression at the end of the roll.

You will find that you must adapt your technique to accommodate the differing sizes and shapes of hands. Experience will indicate how this is best accomplished.

The digits are inked and rolled starting with the right thumb and progressing to the left little finger. Ink and roll one digit before inking the next one. Grasp the right hand of your subject as described previously.

Rotate the hand outwards, away from the body of the subject, until the thumbnail is vertical. Lay it on the inking surface and roll inwards until it is again vertical on the other side of the nail. Check that the bulbous portion of the thumb is now evenly inked from the flexion crease to the tip and from nail to nail.

Rotate it outwards again and position it above the right side of the appropriate space on the fingerprint form so that the flexion crease is just above the bottom line.
When located satisfactorily above the form, in one smooth, continuous motion, place the thumb down onto the form, roll inwards and lift off the form.

The secret to success is to make these three actions form a single fluid motion. Keeping this motion fluid and continuous while, simultaneously using suitable pressure, rolling fully and positioning correctly will take much practice!

Many subjects will attempt to help and may put their fingers on the form before you are ready. This will almost invariably result in a smeared impression. To avoid this situation hold the digit in position above the form by resting your little finger, of the hand with which you are supporting the fingertips, on the work surface. A slight pause at this point often helps to relax your subject or at least take them by surprise when you begin the roll. Having the subject look away from the fingerprint stand may also help to prevent them from anticipating your actions.

Follow the same procedure with the other digits except that the fingers are rotated in the opposite direction to the thumbs. i.e. in towards the body first, then outwards while rolling on the form.

An important part of the inking procedure is to ensure that you roll each digit on an unused area of the inking surface. If you roll a finger over an area which has already been used you will often find that the ridge detail from the previous finger is also recorded on the new impression.

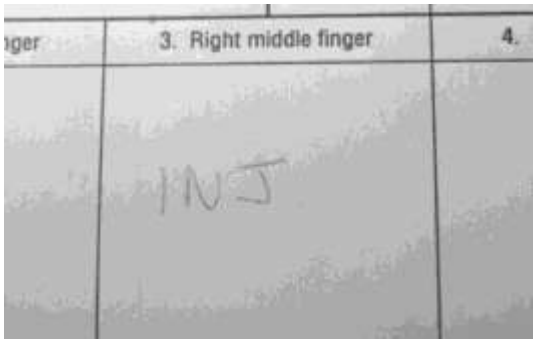
Plain Impressions.

Below the two rows of spaces for individual fingerprints on the form are spaces for simultaneously recording the four fingers of each hand.

They are inked together and placed flat on the form without rolling. These serve as a check that the rolled impressions are in the correct order. They are also often valuable for comparison work since they more closely resemble the fingerprints found at scenes of crime than do the rolled impressions.

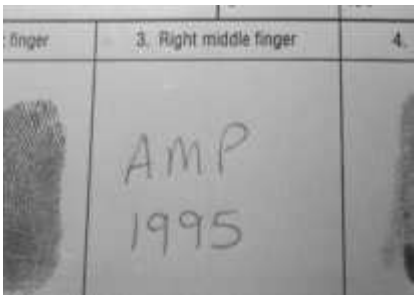
Injuries.

When a digit has an open wound it may be inadvisable to contaminate the injury with fingerprint ink. If a digit has a bandage that cannot be temporarily removed it will be impossible to record the impression. In these cases simply write "injured", and the reason, in the space. If possible note the general pattern type. (Don't forget to wear disposable gloves.)



Amputations

When the entire digit is amputated write "Amp." and the date of the amputation in the space. Also make a note in the descriptor area of the form. Writing the information in the digit box before you roll the other impressions helps to ensure that the remaining digits will be in the correct boxes. Otherwise it is easy to forget to skip the space for the missing digit.



When there is only a partial amputation, ink and roll the digit to record the remaining area of pattern and note the date of the amputation in the descriptor area of the form.

The final step in taking inked impressions is always a very careful check of your work. If poor -quality impressions are submitted they may be filed inaccurately or perhaps not filed at all. Subsequent fingerprint searches of that individual may then fail to reveal a criminal history and a crime scene impression search may indicate that there are no matches.

Keep in mind that all of your crime scene fingerprint work eventually relies on the original fingerprints being complete and accurate.

Checking the Impressions.

A good set of inked fingerprints will meet all of the following criteria:

- Rolled from nail to nail
- All deltas recorded
- Flexion crease 2-3 mm. above bottom line of digit box on the fingerprint form
- Impression centred in box, not overlapping next box or impression
- Impression square in box, not more than 15 degrees either side of vertical
- Inking even and of correct density across the whole impression
- Clear, sharp ridge detail, no smearing, missed or filled-in areas
- Rolled impressions in correct order

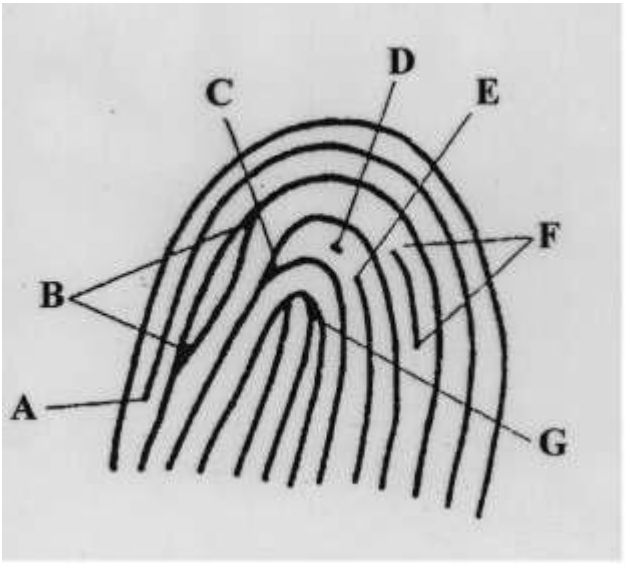
A good way to quickly check for sharpness and clarity of the rolled impressions is to compare them against the plain impressions. Keep practicing until you can produce rolled impressions just as clearly as good quality plain impressions.

ACTIVITY:
Team up with a partner and using the inked fingerprinting materials provided take a set of inked impressions from your partner. Refer to the guidelines when you need to.

NOTES

Fingerprint Fundamentals

The underside of the fingers, thumbs, palms, toes and soles of the feet consists of skin that is corrugated and referred to as ridged skin. This ridge skin assists with grip and provides the body with a non-slip finish. These ridges are not all continuous with many having natural variations called characteristics. It is these characteristics that are used for the process of identification.



Examples of Fingerprint Characteristics	
A	Ridge ending downwards
B	Lake or enclosure
C	Bifurcation upwards
D	Dot
E	Ridge ending upwards
F	Short ridge
G	Bifurcation downwards

These corrugations when coated with perspiration or other contaminate can leave a reproduction of the ridges upon a surface, much like an office stamp. Reproductions of this type are referred to as latent fingerprints and represent those normally located on exhibits and/or at crime scenes. As a matter of course, they generally require some form of development to make them visible.

For fingerprint recording purposes ink is used. As there is no physiological, biological or physical difference between the areas of the body bearing ridge skin the underside of the palms of the hands and soles of the feet are of equal value for identification purposes.

The ridges and characteristics are formed after the 3rd to 4th month of foetal development and remain unchanged throughout a person‘s life other than increasing in size with growth. Only deep injury or disease may cause some difference in the appearance of the ridges. The pattern types vary within limits that allow for classification.

The ‒flow‖ of the ridges on the underside of the fingertips demonstrates a variety of distinct patterns with every person having either all the same pattern or a combination of them. These patterns are not unique from person to person with many having the same types. However depending on the type of pattern or patterns a person has allows an examiner to group these patterns into file groups. This enables fingerprints to be classified, filed, searched or retrieved from a filing system.

From an identification perspective it is the first two criteria of the fundamental principles that the fingerprint science depends upon with criteria three being convenient for fingerprint processing.

NOTES

Fingerprint Crime Scene Examination

Upon arrival at the crime scene you should establish all information from the complainant, whilst conducting a general overview of all areas brought to your attention. Ensure that you question the complainant about other possibilities.

When commencing your examination stand 5-10 meters back from the Point of Entry (POE) and get an overview of what you are going to examine. This can reveal evidence that you may miss by being too close. Be methodical and work your way through the scene starting from the outside location of the POE. A large percentage of your results particularly those that pertain to the offender/s are going to be obtained from the POE, especially if it has been forced.

Always examine the exterior of the premises for other signs of forced entry. A general tour of the exterior of the premises examining all windows, doors etc. is recommended (undisturbed dust, cobwebs etc. can assist to establish if any attempt has been made on these areas). Additionally, it can assist your court testimony to state that you examined areas apart from those of the actual scene area. An area of attempted forced entry can sometimes reveal more forensic evidence than the actual POE.

Note the method of entry whilst examining from outside as this will assist what areas should be examined inside. i.e.: the height, design and how the window opens, what the offender may have used to assist entry i.e.: a chair to climb in will indicate to you what areas of the window frame and surrounds need to be examined.

If practicable take portable exhibits outside for examination and when re-powdering the brush take outside or place over a bin etc. to remove excess. Again, ensure any necessary photographs are taken before fingerprinting.

Approach each examination with an open mind and try to view the scene as the offender would. If possible follow the route used by the offender and use your knowledge of police work to establish what he may and may not have handled. It is advisable not to waste time on items that will not render evidence.

Upon completion of the main areas of examination, make a quick inspection of other rooms to satisfy yourself that all possible areas of interest have been exploited.

ACTIVITY:
Think about the route taken by the offender in Scenario 1 and describe in sequence which items or surfaces you would consider for fingerprints.

Fingerprint Equipment

Brush applied powders

There are three powders that are generally used for scene examinations:

- Black powder: designed to contrast with light coloured surfaces and comprises principally of graphite.
- Silver powder: designed to contrast with dark coloured surfaces and comprises principally of aluminium.
- Bi-chromatic powder: composition of both silver and black powders that can be used on both light and dark surfaces.

Bi-chromatic powder is dark grey in colour and has a gritty textured appearance and can be readily distinguished from black powder, which is distinctly black in colour and has a very fine texture.

Magnetic Powders

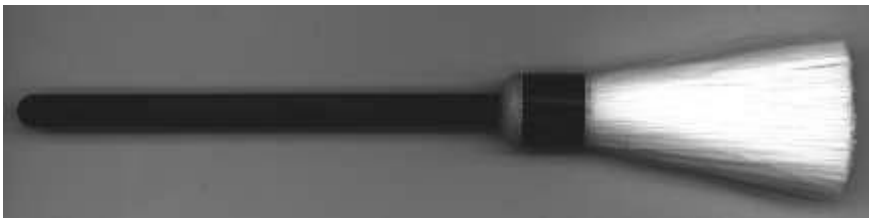
Magnetic powders are available in both silver and black and comprises of the same composition as the above powders but with the addition of very fine iron filings. This increases the powders‘ density and adhesive potential on some surfaces.

Containers of magnetic powder are notably heavy and can be easily distinguished from containers of brush-applied powders. All powders can be used on any smooth non-porous surface however magnetic powder has superior results on surfaces such as ceramic, PVC, aluminium, glossy magazines and plastics.

Brushes

Powdering brushes are made from white fibreglass bristles mounted on either a plastic or wooden handle and are designed for longevity, ability to suspend the fingerprint powders and minimise risk of physical damage to developing fingerprints.

A brush should be dedicated to each type of powder especially silver and black as mixing of powders on a brush will reduce its contrasting efficiency. Once a brush discolours to the powder used it will work very effectively without constantly re-dipping the brush into the powders.



Fingerprint brushes must never be allowed to come in contact with anything that is wet, i.e. water, oil, blood, as this will destroy the brush and render it permanently unusable.

The end of the brush handle should be carefully trimmed or sharpened to a point to assist with endorsements. Always ensure the appropriate brush is used with the correct powder.

Magnetic wand

These comprise of a magnet mounted on a spindle inside a sleeve. When the spindle is in the down position the magnetic powder can be picked up. Sliding the spindle up removes the magnet and releases the powder.

Brushing out brush

These are a course bristled brush used to remove excess fingerprint powder or residual dirt and dust from around the developed latent impression. They must NOT be used for applying fingerprint powders.

Adhesive fingerprint lifters

Adhesive fingerprint lifters comprise of a 12cm x 14cm clear adhesive film attached to either a black or white backing sheet. The two colors of the backing sheet are to compliment the contrast depending on what fingerprint powder is used.

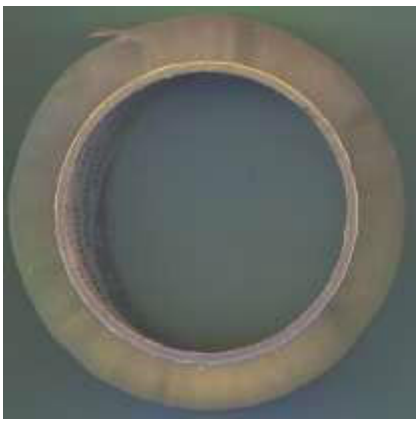
When the adhesive film is removed from the backing keep contact with either surface to a minimum, as it is very easy to leave your own fingerprints on the surfaces. The exposed backing sheets are slightly static therefore care must be taken to avoid dust, dirt etc being attracted to the surface. Bi-chromatic powder can be placed on either backing but superior contrast is always achieved by placing it onto the white backing. Lifters can also be cut no smaller than across the width to produce two 7cm x 12cm pieces.

Hinge lifters

These are similar to adhesive fingerprint lifters except the adhesive surface is placed onto a clear backing once the fingerprint has been lifted.

Roll of lifting tape

Book binding tape can be used but again is not recommended. Its main advantage is cost as it is very cheap compared to adhesive fingerprint lifters. The tape often has scratches and impurities in its finish that may affect the lift and/or appearance of the developed fingerprint. The tape must be placed on some form of backing of which exposed/unexposed photographic paper is normally used.



ACTIVITY:

Using the fingerprint kit provided familiarize yourself with fingerprint powders, brushes and adhesive lifting material.

Fingerprint Development Techniques

How powders work

All fingerprint powders simply adhere to any residue moisture left on a surface from the fingers and produces a contrast with the surface. This will make the fingerprint visible. Unfortunately, fingerprint powders do not discriminate and will adhere to any residual moisture, matter or contaminates left upon a surface.

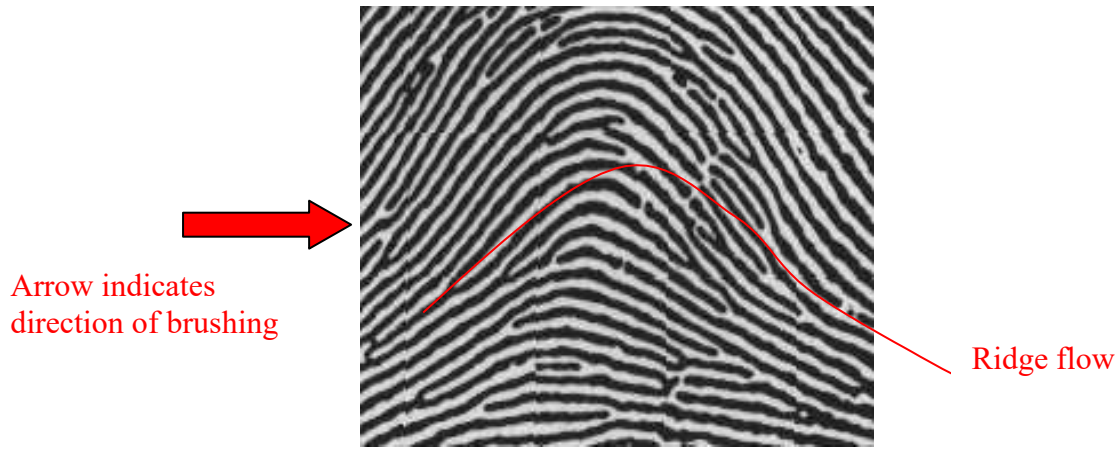
Application

The fingerprint brush can be gently stroked or twirled over the surface or a combination of both methods for best results. Surfaces can be treated quickly and as fingerprint impressions begin to develop further attention can be concentrated on those areas. Brush applied powders can cover a large surface area in very quick time. Additional powder should only be placed on the brush if powdering is proving difficult. However non-development of fingerprints could simply be because there are no impressions on the surface. Excess fingerprint powder can spoil or destroy fingerprint impressions.

Magna wands must be dipped into the powder so that the powder suspends from the wand. The wand is carefully stroked over the surface ensuring only the powder makes contact. Excess pressure or lack of powder can cause the wand to come in contact with the surface and damage the fingerprint. Residue powder left on the surface can be collected using the wand and returned to the container.

NOTE: If the surface is particularly dusty or dirty do not return the powder to its container, as this will contaminate the powder spoiling its adhesive properties. Using a magna-wand and magnetic powders is restricted to small surface areas, those that are non-magnetic and are on a horizontal plane.

Excess fingerprint powder or residue dust should then be removed using the dust out brush. This is done by carefully and very lightly cleaning the area of the developed fingerprint. Ideally, stroking the brush in the direction flow of the ridges is recommended. Extreme care must be practiced, as these brushes will damage the impression if excess pressure is applied.



The developed impression/s must be then lifted using a contrasting adhesive fingerprint lifter. The clear adhesive film can be removed entirely from the backing or peeled back and held in one corner. The adhesive is carefully place onto the developed fingerprint ensuring all of the impression and endorsement are preserved. Rub gently over the lifter to ensure contact with the surface. Peel the adhesive from the surface and place back onto the backing card. Rub the surface to remove excess air bubbles.

A second lift may be made if the first proves unsuccessful or unclear. Both lifters must be retained and endorsed accordingly as lifter 1, lifter 2 etc.

NOTES

More fingerprint tips

Fingerprint impressions that appear in natural dust on a surface cannot be further developed using fingerprint powders. These must be photographed first and a lift of the impression with an adhesive fingerprint lifter can be attempted. Select a backing colour that best contrasts with the colour of the dust. Minimal success is achieved by lifting these types of impressions.

Fingerprint impressions in substances such as grease, oil, blood, or in a soft medium such as putty or an etched fingerprint will require to be photographed for recording.

Endorsements

Every latent fingerprint lifted from an exhibit or crime scene must have an endorsement on the rear of the fingerprint lifter. The endorsement is your notes at the time and must be done A.S.A.P. after lifting to ensure accuracy.

The rear endorsement should include specific information such as:

- Address
- Date
- Location of fingerprints
- Fingerprint officers name and police number
- Inside or outside of glass
- If a 2nd or 3rd lift
- Small diagram of item or area from where fingerprint was lifted.
- If the lifter relates to another lifter (i.e. a large area of hand that does not fit onto one lifter)

The rear endorsement **should not** include:

- POE or Point of entry
- Offender/suspect names
- Other hearsay, unrelated or unnecessary information.

Routinely officers are requested to fingerprint items that have been moved from their original location by the complainant or by other police officers. It is imperative that your endorsement reflects where you actually examined the item. DO NOT endorse the location from where you are told it originated. That is the evidence of the person who moved it to provide.

ACTIVITY:

Deposit your fingerprints on various surfaces such as bottles, cans and windows and then develop and lift them using the equipment in the kit. Remember to correctly endorse the fingerprints and please retain them afterwards.

NOTES

Fingerprint Comparison and Identification

It is useful for the any crime scene fingerprint officer to understand the fingerprint comparison and identification process as this will help them to appreciate the required quality and clarity of fingerprint detail. Fully-trained and qualified fingerprint specialists compare crime scene fingerprints with inked fingerprints and inked fingerprints with other inked fingerprints. The steps that are taken during the comparison process are as follows:

1. The fingerprint impressions in both fingerprints are compared to determine if patterns correspond.

2. Using an eye-glass a common ridge characteristic (starting point) should be located in both impressions. That is, a common characteristic of the same type, facing the same direction and in the same relative position in both prints.

3. From this starting point the number of intervening ridges to the next matching characteristic should be counted. This process should be continued until a sequence of matching ridge characteristics that have the same number of intervening ridges have been located. A minimum of 12 matching characteristics is required to complete an identification allowing the examiner to reach the conclusion that the fingerprint impressions are identical, that is made by one and the same person.

ACTIVITY:

Using the three steps of the comparison and identification process can you determine if any of the following fingerprints match?

A 
B 
C 
D 

E 
F 
G 
H 

I 
J 
K 
M 

Evidence Collection

Introduction

An exhibit according to the Collins English Dictionary as referred to within the context of these notes, states in part:

> ***'A document or object produced in Court and referred to or identified by a witness in giving evidence".***

Therefore the exhibit can be any object or document from a microscopic speck to a large truck, which in view of the Crime Scene Examiner may bear some information that may assist the Police or the courts at a later date in determining the sequence of events that may have occurred, or may prove guilt or innocence of the alleged offender. This evidence is referred to as PHYSICAL EVIDENCE, and this evidence should stand alone, to enable the courts to interpret that value of the evidence on its own merit.

Learning Objective

At the end of this topic you should be able to:-

- Understand why evidence must be collected from the crime scene.
- Describe the evidence packaging and labeling requirements.
- Describe the Chain of Custody and evidence security requirements.

What are Exhibits? Why Collect Exhibits?

Exhibit handling and management was covered in Refresher Workshop (2) however it is worthwhile revising that topic as exhibits play a critical role in the investigation and prosecution of criminal offences. In fact, there are very few serious criminal cases that could be successfully prosecuted without the presentation of exhibits to the court and members of a jury. Inevitably all criminals acquire whether willingly or unwillingly, evidence in the form of exhibits that can be collected by thorough investigators.

Evaluate each Potential Exhibit

Consider each potential exhibit and assess its value.

- Is it likely to be useful as evidence?
- Is it unlikely to be useful as evidence?
- Is it of no evidentiary value?

No instructor can tell you what to collect and why it should be collected, as each case is different and the significance of particular items will vary from scene to scene. However, when collecting exhibits you should do so with an ‑open mind‖. It is important to establish the relevance of individual pieces of evidence, (eg. their position and how that position relates to the incident), as this information must be passed onto the Investigating Officer, and ultimately to the Prosecutor and the court. The evidence could be rejected by the court on the application of the defence counsel if it is not shown to be relevant.

Beware of Hazards!
Before collecting re handling an exhibit the crime scene examiner should assess potential hazards and take the necessary precautions before proceeding. As mentioned in a previous section the hazards could be physical, biological or chemical.

Avoid Contamination!
Your exhibit may need to be examined or analysed by someone else. Therefore you should avoid contaminating your exhibit by wearing gloves.

Avoiding Cross Contamination!
Each item collected should be placed in a separate bag to avoid the possible cross transfer of material from one item to the other. One exhibit in each container

Exhibit handling and management is an area where all police organisations tend to have weaknesses in their systems and processes. Nine times out of ten, these weaknesses will go unnoticed, or cause no consequences for Police investigators and police management. However, it is the tenth occasion that the content of this session seeks to overcome. Poor exhibit handling and management can result in serious criminal prosecutions being challenged and defeated on the basis of handling, security and continuity of exhibits when presented to the court. There will be an increase in challenges in relation to the validity and admissibility of exhibits throughout the Pacific Region as communities and individuals become more aware of their rights under legal systems and judicial and investigative procedure. As an outcome many police organisations and individual officers are likely to suffer criticism and experience a loss of credibility and public confidence.

Whilst the handling and management of exhibits is not the most glamorous and interesting aspect of criminal investigation and prosecution, it is a critical aspect and one that police officers, supervisors and managers need to complete more thoroughly and professionally.

Traditionally police have always attempted to present the actual _exhibit‘ relating to a crime to the court. The motivation for this belongs to a belief that the _actual‘ item, viewed and considered by a magistrate, judge and / or members of a jury, is far more persuasive and informative than a description offered in a statement by the police, victim or owner. This is true to a certain extent, however, it is quite obvious that large exhibits, or live exhibits have never been able to be presented to a court, and so the belief is really only partially true! Where exhibits are personal property and are of some value, quite obviously the owner/s requires them to be returned at the earliest opportunity, for this reason and for the equally important reason that police do not need to keep and be responsible for valuable or bulky exhibits for long periods, **Do not keep exhibits longer than necessary**.

There are sufficient means by which exhibits can be recorded and presented to the court, without retention of the actual item. Photographing, fingerprinting or analysis as needed can be undertaken, allowing return to the owner or disposal at the earliest opportunity as sufficient accountability and continuity, two important _ideas‘ in terms of police investigations and exhibits, can be generated to satisfy the onus of presenting evidence to the court. Photographers, Property Officers and Analysts, through tendering photos, sworn testimony and Certificates are able to corroborates and confirm the existence of an exhibit and its relevance to a case.

Only items of a unique or controversial nature need necessarily be actually tendered such as murder weapons, implements used in armed hold ups or serious assaults, documents, defective vehicle parts, money or other articles with unique or distinctive characteristics.

At times, something seized as an exhibit might prove not to have any evidentiary value. In such circumstances, there is no need to tender it in court. Return it to the lawful owner.

Scenario 2

Muang the crime scene examiner was called to the scene of a break in. After arriving at the scene he had a brief chat with the complainant and then commenced his examination. He developed and lifted some fingerprints from a louver at the point of entry and from a bottle which was allegedly handled by the offender inside the house. The offender left a baseball cap behind at the scene. Muang had to go off to another scene so he forgot to write anything on his fingerprint exhibits. He put the baseball cap in a plastic shopping bag provided by the complainant. Muang got back to the office quite late that day and as he was going on a month long holiday he knocked off straight away. Six months later Muang received a summons to attend court for the break in he had attended. Luckily, when he checked the fingerprint kit in the back of the crime scene car his fingerprint exhibits were still there. Someone had previously found the cap in the plastic bag and had left it on the desk in the office.

ACTIVITY:
Consider the above Scenario 2. Can you identify any problems with Muangs exhibit management?

Obtaining evidence from clothing

The purpose of this session is to look at the importance of preserving items of clothing from suspects and victims of violent crime so that valuable physical evidence, which may be present on the clothing, can be obtained. The evidence may be so small or disguised by the colour of the garment, that it is virtually invisible to the naked eye. It is easily and often overlooked by initial response police, investigators and medical personnel.

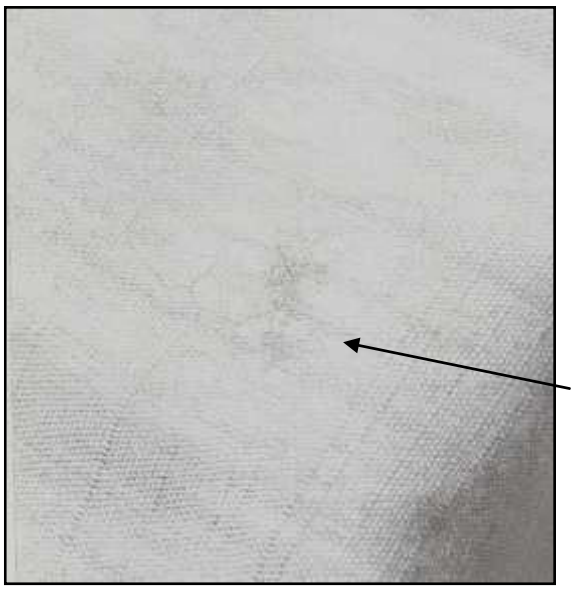
An offender and victim may transfer some trace of themselves, some trace of their previous or immediate environment or some trace of an associated article such as a motor vehicle or weapon, onto each other during the course of a violent crime. The types of evidence are many and varied however, physical evidence from clothing can generally be divided into the following categories.

Case Study 1
A pedestrian crossing the road is hit by an unknown vehicle traveling at speed. The pedestrian is seriously injured and the driver continues on without stopping. The victim is transported to hospital and treated in the Accident and Emergency Section. His clothing is cut from him and discarded by hospital staff whom were unaware the clothing contained valuable evidence in the form of minute chips of paint and glass from the offending vehicle.

Trace Evidence

This means materials which are very small and are often detected with the aid of magnification and specialised lighting. These include the following examples.

- Blood
- Semen and vaginal secretion
- saliva
- Urine
- Perspiration….ect



The relevance of trace evidence to an investigation may be to associate a suspect to a victim or location. Examples would include fibres transferred from an offender's clothing to the victim's clothing or paint fragments transferred from a damaged motor vehicle to the clothing of a victim involved in a hit and run collision.

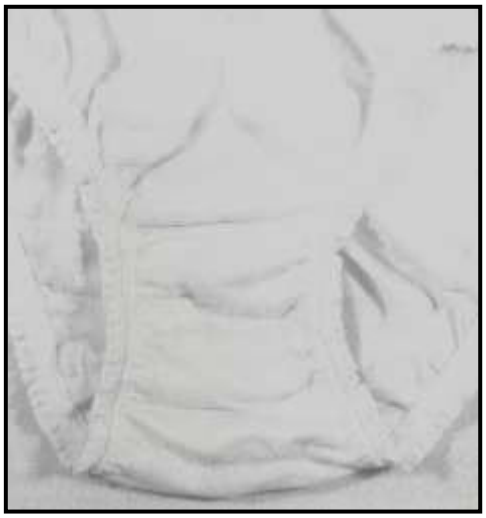
Shows fibre bunch located on shirt of victim of robbery with wounding. Fibres transferred to the shirt of victim from balaclava of the offender when victim had offender in headlock.

Case Study 2

A female is dragged into a deserted area of bush land and sexually assaulted by an unknown offender. During the course of the incident semen from the offender is deposited onto her jeans. The victim does not report the matter immediately and subsequently changes her clothes before attending the local police station some hours later. Nobody thinks to immediately obtain the clothing worn by her at the time of the offence. Following a medical examination and interview by police, she returns home and washes the clothes worn during the assault. The semen evidence on her jeans is thereby destroyed and important evidence is lost.

Biological Evidence

As the name suggests this is evidence of a biological nature. Its evidentiary value is extremely high due to the use of modem DNA technology which can point directly to a particular individual, or at least place that individual within a very small group of the population. As with trace evidence, biological evidence generally links a suspect to a victim or location. An example would be semen from a suspect located on the clothing of a victim of sexual assault.



Photograph of underpants of sexual assault victim with normal lighting and semen present from offender is not visible.

Photograph taken with forensic light source showing semen stains present on underpants but not normally visible with normal lighting.

The following examples are the most commonly encountered forms of biological evidence on clothing.

- Blood
- Semen
- Hair
- Saliva

Blood Stain Pattern Evidence

This is the interpretation of blood stain patterns which may be present on the clothing of a suspect or victim. It is only undertaken by experienced crime scene examiners or civilian analysts with extensive training in this highly specialised area of forensic science.

Shoes covered with blood spatters located in boot of suspects car after serious assault. The blood matched that of the victim.

NOTES

Damage to clothing

Damage to clothing from a weapon such as a knife or as a result of a gunshot is very important. Tears, cuts or missing buttons may be extremely important. An example would be in supporting a victim's statement that she was struggling and therefore was not consenting in relation to an allegation of sexual assault. Portions of clothing, such as buttons or small pieces of fabric torn from an offender during the course of a violent crime, may also be found within a crime scene and later matched to a garment owned by a suspect. In some cases of pedestrian hit and run motor vehicle collisions, there may be an imprint of the impact area from the offending vehicle on the clothing of the victim.

Damage Evidence:
T-shirt with portion missing from rear upper left side located in the car of a suspect of a malicious wounding offence.

The same T-shirt showing physical match with torn portion of fabric located within the crime scene. The victim and offender struggled violently and the portion of fabric was torn from the T-shirt during the course of the struggle. This evidence positively linked the suspect to the crime scene.

Flammable Liquid Evidence

In arson cases it is not unusual to find petrol or other flammable liquids on the clothing and shoes of suspects. Flammable liquids are often spilled onto the clothing of offenders as they splash the liquid around a premises or vehicle prior to lighting the fire.

The Value of Evidence from Clothing

Evidence from a victim or suspect's clothing can prove to be crucial in the investigation of a violent crime. The outcome of the case may not depend entirely on the forensic evidence obtained, but could strongly support other direct or circumstantial evidence.

An example of this was a murder in Australia during the early sixties. Sand, later identified as a pink lime mortar, was found on the clothing of the victim. Botanical items from two trees, one of which was very rare, as well as Pekingese dog hair and bleached human hair, were located on a rug the body was wrapped in. Eventually a suspect was identified who had recently moved from a house which had similar mortar and a similar combination of trees in the front yard. The suspect also owned a Pekingese dog and his wife bleached her hair. This evidence along with other solid circumstantial evidence resulted in the killer, being convicted and sentenced to life.

The evidence located on clothing items may also go toward supporting a suspect's version of events. In these cases suspects may be eliminated from further suspicion, giving investigations a clearer sense of objectivity.

Preserving items of clothing from a victim or suspect

Generally clothing evidence will be collected and preserved by the attending crime scene examiner. There will be occasions however, when the evidence is in danger of damage or contamination and it is crucial to preserve or obtain clothing items prior to the attendance of the crime scene examiner.

NOTES

Clothing located within the Crime Scene

If the victim is deceased as the result of a violent crime do not touch or in any other way interfere with the body, the clothing items on the body or any other clothing items that may be associated with the crime scene unless it is absolutely necessary. This means that unless the clothing item or any possible evidence it may contain is likely to be destroyed, do not touch it.

Police with forensic investigative skills should carry out examinations of the deceased and clothing items in conjunction with a forensic pathologist. This may occur at the crime scene or at the mortuary, depending on the circumstances of the particular case.

It often occurs that ambulance personnel, nurses or medical practitioners may remove items of clothing from a seriously injured or apparently deceased victim. This is usually to gain clear access to the chest region for the placement of defibrillator pads or to apply manual resuscitation during attempts to revive the victim. There will also be occasions when loose clothing items relating to either the victim or offender will be located within a crime scene. Again, in these cases it is preferable to leave the clothing where it is situated unless it is in further danger of damage or contamination.

Victims Transported to Hospital

In cases of sexual assault or hit and run motor vehicle collisions, where it is believed the offender may have suffered a bleeding injury and most other violent crimes where the offender and victim have come into close contact, it is critically important to obtain the clothing from the victim.

It would be advisable to contact medical staff at the hospital as soon as possible and ask them to preserve the clothing from the victim for forensic examination. Never assume the hospital will routinely retain or preserve the clothing items from the victim. It is an unfortunate fact that most medical personnel are not trained to recognise the value of forensic evidence on clothing. If possible, have the hospital staff place each item of clothing into separate paper bags and secure them in a safe location. The clothing should be collected as soon as possible from the hospital.

DNA - a brief overview

DNA stands for Dioxy-ribo Nucleic Acid. The history of DNA used as evidence is not too long. It was used in England in the year of 1987 to convict a person who was a suspect of a serial murder with rape case and to release an innocent one. Every individual‘s DNA has unique characteristics bearing genetic character. So, it is being used as a unique and modern tool of person identification.

- The Introduction of DNA technology in criminal investigation is nearly two decades old.
- First used in casework in 1987 in UK, to convict a criminal who allegedly raped two teenage school girls.
- The prosecutors never had such a powerful tool at their disposal both to convict the guilty and exonerate the innocent.
- Over the past two decades identification based on DNA has become an established crime solving tool
- Like latent fingerprint that occurs on our fingertips, every person has a unique DNA profile (except identical twins)
- A person‘s DNA is virtually same in each cell (except red blood cells)
- It does not change throughout a person‘s lifetime
- It can be obtained from traces of biological evidence (e.g. blood, semen, saliva, hair etc.)
- It cannot be altered by any known treatment

What is DNA

- DNA or Deoxyribo Nucleic Acid is a tiny threadlike molecule
- Called the genetic material of an organism
- Contains all the information required for life process in a coded form
- Hereditary blueprint passed on to us by our parents

Collection techniques

- In standard crime scene procedure, the recovery of blood samples is accomplished by scrapping, swabbing, or collection of the stained item itself.
- A scalpel is used to scrape the stain onto a clean piece of paper, evidence envelope, or kem-wipe sterile tissue. After each scrapping the scalpel needs to be cleaned, so as not to contaminate the next sample.
- The stain can be swabbed by using sterile cotton patches or cotton swabs slightly moistened with distilled water.
- If the stained item can be collected it should be packaged in a clean paper container or wrap. If the stain is wet, the stain has to be allowed to air dry before packaging.
- All items should be consistently labelled with the appropriate information for identification

NOTES

Tool marks

Introduction

Tool-marks and firearms evidence are both types of evidence that involve comparisons of known standards versus the unknown. The manner in which the examinations are conducted in the laboratory is often very similar. The crime scene specialist must not only be aware of the wide array of both types of evidence, but also be familiar with the proper methods of collecting it for subsequent comparison purposes. This lesson will examine the particulars of each type of evidence, its evidentiary value, and lastly how it is collected.

Use of tools

Crimes against property frequently involve the use of a tool in order for the criminal to gain entry into the premises. By applying force with the tool the criminal usually accomplishes two distinct things. He/she gains entry and unwittingly leaves tool marks. These tool marks can be highly identifiable and be of great evidentiary value. Let‘s look at some of the definitions relating to tools and tool marks:

Tools
Any object capable of making an impression on another solid object. Examples include axes, knives, screwdrivers, chisels, crowbars, pliers, cutters, and drill bits. Tools may be store-bought or homemade.

Tool marks
Any impression, cut, abrasion, or gouge left by a tool after coming in contact with an object. There are two general types of tool marks:

Impressions
Those tool marks in which only the general form and size of the tool are apparent. When a tool is pressed into some type of material, it produces a negative impression. These negative impressions, or marks, may not make a definite identification of the tool possible. However, they can serve as a guide when it is necessary to decide whether or not the tool of a suspect could have produced the marks.

Striations
Those toolmarks in which peculiar characteristics or irregularities of the tool are reproduced in the form of indentations or striations. These marks are the most valuable as evidence since they can sometimes positively identify a particular tool to the exclusion of all others.

NOTES

Creation of tool marks and evidentiary value

How tool-marks are created

1. **Compression**
   Compression is a static indentation made by blows using a tool (e.g., hammer marks–sledge, ball pen, claw; screwdriver pry marks; opposed jaw marks made by pliers, bolt cutters, pipe wrench.)

2. **Friction**
   Friction is a dynamic mark, most often leaving striations made by the unique edge irregularities of a particular tool (e.g., shears, screwdrivers, knives, axes, etc.)

3. **Repetition**
   Repetition is the repeated dynamic marks left by tools such as files or saws. These are very difficult to identify because of the great number of teeth and the confusion of marks left.

4. **Combination**
   Often, tools can leave a combination of compression and friction marks.

Evidentiary Value of Tool-marks

1. **Class characteristics**
   Tool-marks left at the scene of a crime usually will reveal microscopic characteristics that can help reveal the class characteristics of the tool that was used. The class characteristics of a tool are usually considered to distinguish it functionally from another. Therefore, screwdrivers may be considered as a class apart from crowbars since they have different intended functions. The class characteristics of tools serve as a screening device in criminal investigations and allow one to narrow the field of search, which is especially valuable in achieving positive identification of the tool that left the impression.

2. **Individual characteristics**
   Tools that are similar in class characteristics are often quite different in their individual characteristics. These individual characteristics are derived from the processes used to produce the tool and the manner in which the tool has been used. Often, small burrs or nicks will develop on the bit of the screwdriver, producing individual characteristics of that tool. If the material subjected to the tool-mark is soft enough, it will retain minute impressions or striations reflecting these individual characteristics.

3. **What tool-marks can reveal**
   When a screwdriver is used to pry open a window or door, it may leave an impression that reveals not only the outline and width of the head of the tool, but also the shape of the shaft and how it joins the head. Through past experience, the crime scene specialist will frequently have a fairly good idea what class or type of tool caused a tool-mark.

Frequently, tools used by criminals are of poor quality and are easily damaged. This damage, in turn, is reflected in the marks that the tools leave, providing the receiving material is hard enough to sustain the marks. Evidence left by this type of tool provides a ―signature‖ of the tool used.

Trace materials such as paint and pieces of wood or metal may be found adhering to the tool itself. Likewise, the tool may also deposit minute particles of trace evidence that may have been stuck to the tool before it was used.

NOTES

Searching for tools and tool marks

The crime scene specialist should make a conscientious effort to thoroughly examine the scene of a crime to determine if the perpetrator left any tool-marks. It is also important for the crime scene specialist to search for any evidence of a broken tool that may have been left behind. If pieces are located, they must be recovered since they can become valuable evidence when the tool and suspect are located. Through microscopic examination, a minute chip can be associated with a questioned tool.
Crime scene specialists should ensure that they look in the following areas for potential tool-marks:

1. Doors
   Around the locking mechanisms, paying particular attention to the wood of the doorframe and jamb.

2. Windows
   On the bottom edge of the window, the sill and framework of the window jamb.

3. Safes
   All around the door, locking mechanism and hinges.

4. Drawers of desks, filing cabinets, or other secured drawers
   Pay particular attention to the area around any locks, as well as the joining edges of each.

5. Wire fences exhibiting cuts
   Compression marks from the cutting device are often quite noticeable.

6. Cut locks
   Brass locks are particularly good at retaining compression marks from the cutting tool due to the soft nature of the metal.

Searching for tools
The crime scene should be searched for any obvious tools that were left behind, as well as tools recovered from suspects. Each tool located should be examined carefully and treated as potential evidence. These tools have the potential to link the suspect with the crime scene, depending on where they are located.

Repetitive tools
Crime scene specialists should pay attention to repetitive tools that may have been left behind, or later recovered from a suspect. They should look carefully for the following:

1. Material between the teeth of files or saws.
   Repetitive tools containing pieces of material can be analyzed and possibly matched to the crime scene. For example, these particles may be linked to locks that were sawed or filed.

2. Separation of teeth.
   Missing teeth of a cutting device have the potential to cause a unique pattern as they are used and can possibly be linked later to the crime scene.

NOTES

Collecting tool mark evidence

- **Photography**
  Before any attempt is made to collect tool-mark evidence, it should first be photographed in its original state. It is crucial that the tool-mark is permanently recorded before any attempt is made to replicate or recover it.

- **Original state**
  Whenever possible, every effort should be made to collect tool-mark evidence in its original state. Moveable objects such as cash registers, small safes, and cash boxes offer little difficulty since the marks can be collected by recovering the entire object.

  Sometimes, the entire object cannot be recovered due to its size or construction. Marks found on a window frame or doorjamb can sometimes be recovered by removing the damaged portion of the object, particularly when the home or business owner needs to replace it anyhow.

Casting tool-marks

When it‘s impractical to collect an item containing a tool-mark in its entirety, the crime scene specialist should consider using casting procedures to replicate the tool-mark. Making casts of tool-mark evidence will prevent the temptation to directly place recovered tools into tool-marks to verify a match. Great care should be used to ensure that the original tool-mark is not damaged or altered in any manner. The crime scene specialist should never put a tool in the mark – not only will it contaminate the evidence, the potential exists to actually alter or destroy the original tool-mark, and possibly contaminate the tool by transferring trace evidence from the tool-mark to the suspect tool.
Use silicone rubber (dental silicone may be used quite successfully) for best results. Casts should be used to make comparisons with tools or test marks.

Types of tool-mark examinations

The crime laboratory can make several comparisons between a tool and a toolmark. These comparisons include the following:

1. **Tool-mark with Tool.**
   - Establishment of the presence or non-presence of class characteristics.
   - Examination of the tool for foreign deposits, such as paint or metal to compare with the marked object.
   - Microscopic comparison with several test marks or cuts made with the tool.

2. **Tool-mark without Tool**
   - Size of the tool used (class characteristics only).
   - Type of tool used (class characteristics only).
   - Unusual features of the tool (class or individual characteristics).
   - Action employed by the tool in its normal operation, and/or in its present condition.
   - If the tool-mark is of value for identification purposes.

NOTES

Related examinations

In addition to tool-marks, the crime laboratory can also conduct similar examinations of related materials. The manner in which these examinations are conducted are almost identical to tool-mark examinations. These examinations are based on the premise that when two objects come into contact, the harder object will impart a mark on the softer object. These examinations include:

- Identification of objects which forcibly contacted each other, i.e. a weapon or object that is used to strike a surface.
- Objects, which were joined together under pressure for a period of time and then, removed from contact, i.e. the parts of a piece of machinery or a vehicle.
- Items that were originally a single item before being broken or cut apart, i.e. a piece of pipe, or the barrel of a weapon that has been shortened.

Conclusions

The following conclusions can be drawn from these examinations:

- That the tool produced the tool-mark.
- That the tool did not produce the tool-mark.
- That there are not sufficient individual characteristics within the tool-mark to determine if the tool did or did not produce the questioned tool-mark.

NOTES

Tire and shoe Impressions

Introduction

Shoe print and tire impression evidence is another form of valuable physical evidence that is often encountered at crime scenes. Since criminals must either walk or drive into and out of the crime scene, it should be reasonably assumed that traces of impression evidence would be left behind. The recognition, collection, and examination of this impression evidence can provide irrefutable proof of the presence of an individual or a vehicle at a crime scene or in contact with a victim.

Laboratory examination of shoe and tire impressions evidence

Although the value of shoe and tire impression evidence is often overlooked when considering the forms of physical evidence that yield positive identification such as fingerprints and the DNA analysis of physiological fluids, the probative information that can be gained as a result of the forensic laboratory examination of this evidence warrants its careful consideration and recovery. Impression evidence can be left behind at a crime scene any time that a shoe sole or tire tread comes in contact with a surface that will retain characteristics of that contact. The impressions may be either of a two-dimensional or three-dimensional configuration depending upon the type of surface and the conditions of the encounter.

The laboratory examination of shoe print and tire impression evidence can lead to one of several conclusions that is usually dependent upon the quality and degree of discernible detail that has been left behind with the impression. Examinations may be either comparative or investigative in nature. Comparative examinations are conducted to determine if a known shoe or tire made the impression. Investigative examinations are conducted on impressions to provide information regarding manufacture or a design description that may provide investigative leads.

The examination may yield:

- Positive proof of contact between the shoe/tire with the surface
- The possibility that contact either did or did not occur.

Shoe or tire impressions can help us to identify the type and the size of the shoe or of the tire and later also to define the exact make of the shoe/tire. These pieces of information can be important for further investigation.

NOTES

Shoe impressions

The characteristics of impression evidence that allow for a comparative examination largely consist of three elements:

Design characteristics:

This is the basic pattern of the shoe sole or tire tread design. These patterns are usually patented (although illegal copies or ―knock-offs‖ are often reproduced) and are somewhat specific to a manufacturer. Usually many shoes or tires are produced that have this basic pattern design.

Wear patterns:

As the shoe or tire is worn or used on a vehicle the pattern area will wear down as erosion of the tread or sole material takes place. This wear pattern generally follows a somewhat ―normal‖ progression. However, other factors such as the gait or walking pattern of a individual wearing the shoes, or the front end misalignment of the tires on a vehicle or the under or over inflation of the tires will have an effect on the overall wear pattern. Although normally the wear pattern alone will not provide the basis for positive identification, it does impart some individuality or agreement between the comparison of the known shoe/tire and the unknown found at the crime scene.

Accidental characteristics:

During the normal use of a shoe or tire some damage such as small cuts and nicks are imparted on the tread or pattern surface. These characteristics are known as ―accidental‖ and occur randomly on all tire and shoe designs commonly in use. Assuming the agreement of the design characteristics and wear patterns, the ―match‖ of accidental characteristics may allow for the positive identification of a particular shoe or tire as having made a particular impression.

Types of shoe print and tire impression evidence

Generally, impression evidence is found in either a two-dimensional or three-dimensional format.

Two-dimensional

These impressions are usually found on a hard surface that has been contacted by a shoe sole or tire tread that has left behind or removed residue or other materials. Details of the sole or tread pattern can be seen on the surface. Impressions that are made when the shoe or tire tread has deposited or left behind residue are known as positive impressions. Negative impressions occur when preexisting residue is removed when contacted by a shoe sole or tire tread.

Visible prints

These prints (impressions) are usually readily apparent an are normally discovered during the preliminary stages of the crime scene response. When a shoe or tire comes in contact with either a liquid substance such as paint, grease, blood, water; or a dry residue such as fire extinguisher powder, flour, safe insulation; and then contacts a hard surface, a visible print will be deposited. Usually these prints are fairly stable and can be recovered during normal crime scene processing as long as they are adequately protected from inadvertent destruction. The exception would be if the print consists of water or a volatile liquid (such as gasoline) that may quickly evaporate, documentation and recovery should then be an immediate priority.

A sample of the material that the print consists of should be collected from an adjacent non-detailed portion of the print. Eventual laboratory analysis of this material may provide important information that not only is the shoe print identical to the shoes from the suspect, but the shoe print is in fact made of the blood of the victim.

Latent prints

These prints (impressions) are usually made when relatively clean, dry shoes deposit or remove a very thin layer of residue such as dust. Because these deposits occur in trace quantities and often lack contrast to the surface, they may not be readily visible and are often overlooked. Searching the crime scene with a strong oblique light source or making a blind search with an electro-static lifting device (see Section VII) may reveal these impressions.

Wet impressions made of water, dew, snow, etc., that have dried prior to discovery may also be difficult to locate due to a lack of contrast. These prints are often located just inside the point of entry, as any residual moisture will normally be deposited during the first few steps into the crime scene.

Three-dimensional

These impressions are created when a shoe sole or tire tread contacts the ground or a soft surface with sufficient force to cause a deformation of that surface. The resultant impression is a negative impression of the shoe sole or tire tread and will reveal length, width, and depth characteristics. Typically, these impressions will be photographed, the surface will be prepared (stabilized) for casting, the impression will be re-photographed, and a plaster cast will be made.

NOTES

Environmental Factors
This category of impression evidence is often subjected to environmental factors (rain, wind, drying from the sun that can cause a deterioration of the impression detail. Measures should be taken to protect the impression and recovery should proceed as soon as is reasonably possible.

CRIME SCENE SEARCH

During the crime scene search for physical evidence, special attention must be directed to the discovery and documentation of impression evidence. Impression evidence is often not readily apparent, therefore, each of the areas of possible contact between the perpetrator and the scene must be carefully examined with the full expectation that it will contain impression evidence.

Point of Observation
Perpetrators sometimes observe a scene from a distance prior to committing a crime, or they may stalk a victim in preparation for an assault. Such vantage points , which offer the perpetrator a hidden viewpoint, should be searched for shoe or tire impressions.

Route to Scene
Take note of any contaminants (soil, dew, etc.). That may have collected on shoe soles along the route used to approach a crime scene. These contaminants may be deposited at the point of entry and within the scene.

Soft outdoor surfaces along the approach route may contain impression evidence that can be collected and may allow for an interpretation of the number of perpetrators by noting the number of different shoe sole patterns that are present.

Point of Entry
The point of entry is often a likely location to recover impression evidence. Contaminants that have collected on the shoe soles are often deposited on interior surfaces upon entry. Pay special attention to window sills, chair seats, desk and table tops at or near the point of entry. Additionally, forced entry may have been accomplished by kicking in a door or climbing to access a window. These surfaces should be thoroughly searched for impression evidence.

Route through the Crime Scene
A methodical visible search with existing light should be conducted anywhere that the route of the perpetrator is apparent or suggested. Search for impressions in blood, grease, dust, etc. Take note and collect any objects that bear indentations that may have been caused by being stepped on by the perpetrator. Strewn or dropped paper items (envelopes, magazines, boxes, etc.) should be recovered from floor surfaces to be examined for the presence of dust or residue impressions.

Following the search with existing light, a thorough search should be made using a bright floodlight held just off of the surface to direct a beam of oblique (low angle) lighting across the surface. This should be done in darkened room conditions and may reveal dust or residue impressions that were not otherwise apparent.

Point of Occurrence
This is the area in a crime scene that the focal point of the criminal activity is obvious. This may be an area where ransacking has taken place, where a struggle with the victim has taken place, or where the victim‘s body is located. Impressions may be deposited in blood or other body fluids or on objects that have been displaced or knocked over. In murder cases, the victim‘s body and clothing are a potential source of impressions.

Point of Exit
Recover impressions from the area immediately adjacent to the point of exit. This includes impressions in soft exterior ground surfaces. Any surface that may have been contacted during exit should be searched.

Escape Route from the Scene
Attempt to reconstruct the direction and means of escape from the scene. Be alert for other evidence associated with pathways from the scene such as discarded weapons and other property.

Search for areas where a vehicle may have been parked, and recover associated tire impression evidence.

NOTES

Photography

Photographic Documentation
The proper photographic documentation of shoe print and tire impression evidence is essential to permanently record all characteristics and details of the impression. In addition, the location of impression evidence at the crime scene must be recorded to allow for the future interpretation of directionality, the relevancy of relationships to other objects and items of evidence, etc.

Crime scene photography
Crime scene photographs should accompany any submission of shoe print and tire impression evidence to a laboratory for examination.
The recovery site of impression evidence should be indicated to establish the relationship between this location and the victim, other items of evidence, fixed points of reference, etc.

When photographing shoe and tire impression evidence, the crime scene specialist should observe the following:

Close up Photographs:

- Prior to casting, lifting, or employing any other recovery technique, a series of high-quality, close up photographs must be taken of each impression.
- Use a slow speed, fine-grained black & white film (100 ISO).
- Position the camera mounted on a tripod directly over the impression with the film‘s plane parallel to the impression‘s surface.
- The first photograph should be taken without the addition of a scale or label.
- Place a ruler or scale (in centimeters) next to the impression.
- When photographing a three-dimension impression, the ruler or scale should be impressed into the adjacent surface until it is at the same depth as the bottom-detailed surface of the impression.
- Place a label adjacent to the impression. This label should contain the following information:
    - Identifying number of the impression being recorded
    - a north arrow and/or a position indicator to locate the impression relative to its surroundings
    - Case number
    - Date and time
    - Photographer‘s name or initials.
- Fill the frame of the camera viewfinder to include the impression, the scale, and the label. The camera should normally be positioned no higher than 2-3 feet above the impression.
- Focus the camera on the bottom of the impression where the details are present.
- Position the flash so that it is 4-5 feet from the impression at an oblique (low level) angle. The deeper the impression, the higher the flash should be positioned to prevent excessive shadowing.
- Use a cable shutter release or self-timer to avoid movement of the camera.

- Photograph each impression with at least three oblique flash directions at least 100 degrees apart.
- Bracket the exposures and take several photographs from each of the flash positions. If necessary, block out the ambient light to allow for the flash illumination without overexposure.
- Photographically record long tire impression tracks via consecutive overlapping photos continue as long as discernible details are present in the track.
- Follow the instructions outlined under Section VI to first photograph these impressions before any recovery techniques are attempted, when you recover two dimensional impressions. The use of extreme oblique lighting, such as laying a flashlight on the floor illuminating the pattern area, will provide the most detail. The impression must also be re-photographed after any attempt at enhancement and prior to lifting.

NOTES

Lifting of impressions

Recovery of object
Generally, any object that contains a two-dimensional impression should be recovered intact if at all possible. Enhancement and recovery can then be carried out in a controlled laboratory environment. The object should be photographed in place before recovery is attempted. These objects may include envelopes, paper items, cardboard, wooden boards, etc.

Gelatin lifters
These lifters may be used to recover impressions on both porous and non-porous surfaces. Both visible *original residue impressions (such as dirt or mud) or impressions that have been enhanced with the application* of fingerprint powders (such as those impressions with a wet origin that have dried and present poor contrast to the surrounding surface if left untreated) can be recovered with these lifters. The following techniques should be used.

Electro-Static Lifting Device:
This portable device produces a high static electricity charge that attracts and transfers dust or residue particles from a surface to a dark colored lifting film of metalized polyester. The deposit or removal of dust by shoe soles can be nearly invisible and impossible to detect on certain surfaces. This device can allow for a ―blind‖ search and recovery of these impressions. The device works best on dry dust or dry residue shoe impressions which are on surfaces that are relatively clean. Although the device will not work well on impressions that are of a wet origin, it is nondestructive and can be attempted on any impression without causing any damage or deterioration. After recovery, the film with the dust deposits must be carefully transported to the laboratory to be photographed on a copy stand with oblique lighting. The lift can be taped to the inside of a flat box with the dust side up to avoid any contact that will obliterate the image.

Casting
A cast is a three-dimensional, properly oriented, life-sized reproduction of the positive image of an impression-making object. Casts should always be made of three-dimensional impressions to supplement the photographs.

Impressions in sand and soil
Dental stone is the preferred casting material and will provide superior detail and tensile strength over plaster-of-paris or other casting mediums.

Prior to casting, remove leaves, twigs, or loose objects that may have fallen into the impression. Debris that is imbedded in the surface of the impression should remain.

Preparation of the surface

- The impression should be gently sprayed with a fixative silicone spray aerosol (such as hairspray) to make the surface impervious to the liquid central stone that will be poured in.
- If the impression medium is of very loose or porous material it is desirable to spray several light coats of gray primer paint or snow print wax over the impression. Again being careful to avoid disrupting the impression surface with the force of the aerosol propellant.
- Re-photograph the impression at this point as more detail may be highlighted by the addition of the fixative agent.

Preparation and pouring of the casting material

- The casting material (Dental Stone or Die Stone) should be ready for use in a disposable plastic zip-lock bag (8"x12" size). A premeasured portion of two pounds should be divided into each bag.
- Add 12 ounces of water to the bag and reseal. Massage the mixture through the closed bag until it is thoroughly mixed with no lumps and has a smooth consistency with the viscosity of pancake batter.
- The casting material should be poured on the ground adjacent to the impression, and allowed to flow into the impression. Continue to add casting material in one continuous pour until the impression is full and overflows.
- Several bags or a larger amount of casting material must be mixed for most tire impressions. The amount described above is sufficient for most shoe impressions.
- Case and impression identifiers can be scratched into the back of the cast as it begins to harden.
- Allow at least 20 minutes for the cast to harden before carefully attempting to lift it. Do not attempt to clean any dirt or other materials that are adhering to the underside of the cast at this point.
- Allow the cast to cure for at least 48 hours before packaging it in paper for storage or shipment to a forensic laboratory.

Impressions that are underwater

- Carefully place a casting frame around the impression so that the sides of the form are above the water line.
- Lightly sprinkle a layer of dry dental stone over the impression until there is approximately a one-inch thick layer of casting material in the bottom of the impression.
- Prepare a premixed plastic bag of casting material as described above (except that less water should be used to make the material thicker to pour). Fill the framed area with at least two inches of dental stone.

Summary

In this lesson we learned the importance of the recognition and proper collection of shoe print and tire impression evidence. Often criminals will make great efforts to avoid detection by being careful to avoid leaving behind physical evidence and disguising their identity. However, usually impression evidence is not considered and is inadvertently left behind. The crime scene specialist must take advantage of this oversight and make a concerted effort to recognize the significance of this evidence and to ensure its recovery.

NOTES

Arson

Introduction
In general the occurrence of a fire that requires a co-coordinated emergency response MUST be investigated. Police are responsible for investigating fires and fire scenes are to be regarded as crime scenes until they are proven otherwise.

Establishing the crime scene.

The aim of any initial action at any crime scene is to preserve the scene and prevent contamination of any evidence within that scene.

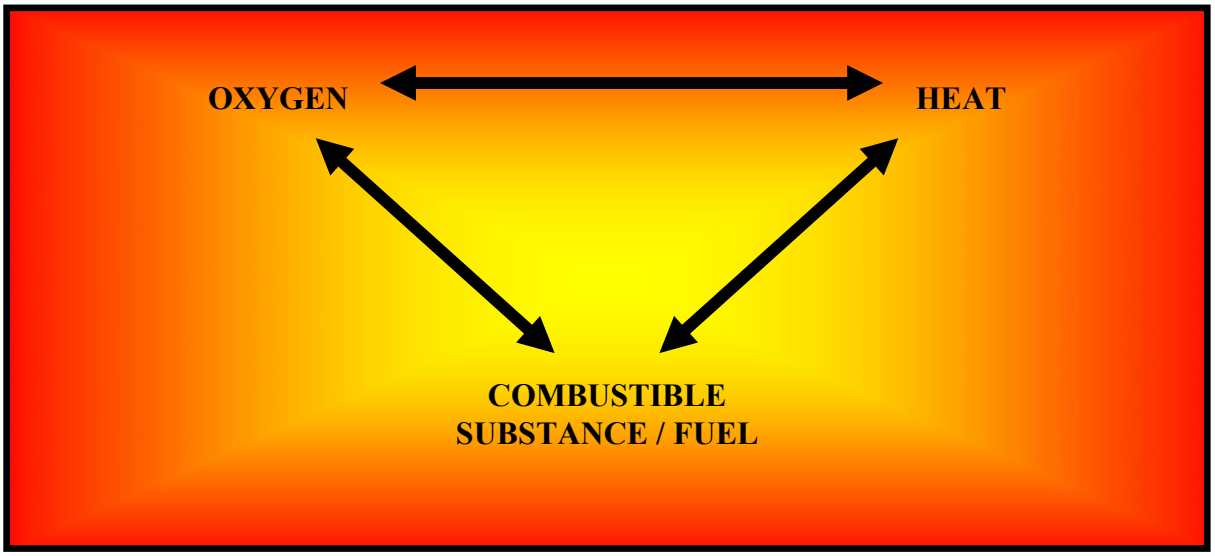
The difficulty with the scene of a fire is that there will always be personnel from numerous other agencies in attendance with certain responsibilities to be fulfilled. This situation is unique to the investigation of arson and as such it is extremely important that the determination of the extent of the crime scene and securing with an established scene guard and log keeper be carried out as soon as possible.

Fire is a phenomenon of combustion manifested in intense heat and light in the form of a glow or flames. The word fire when used with an indefinite article is commonly used to describe either a fuel in a state of combustion (such as a campfire or a fire in a fireplace or kitchen stove) or an instance of violent, destructive and uncontrolled burning (such as a wildfire and fires in buildings and vehicles).
Creation of fire

Fires start when a flammable or combustible material with adequate supply of oxygen or other flammable gases is subjected to enough heat. The common fire-causing sources of heat include a spark, another fire (such as an explosion, a fire in the oven or fireplace, or a lit match, lighter or cigarette) and sources of intense thermal radiation (such as sunlight, a flue, an incandescent light bulb or a radiant heater). Mechanical and electrical machinery may cause fire when combustible materials used on or located near the equipment are exposed to intense heat from Joule heating, friction or exhaust gas. Fires can sustain themselves by the further release of heat energy in the process of combustion and may spread and grow, provided there is continuous supply of oxygen and fuel. Fires may become uncontrolled and cause great damage to and destruction of human life, animals, plants and property.

NOTES

Fire is extinguished when any of the elements of so-called fire triangle—heat, oxygen or fuel—is removed. The unburnable solid remains of fire are called ash.



Just as the removal of one or more sides of a triangle causes it to 'break down', so the removal of one or more sides of the triangle of combustion causes the particular type of combustion to cease. In other words, a fire depends on three factors‘ remove one or more and the fire goes out.

Fire

Fire is a rapid oxidation process that creates light, heat, smoke, and releases energy in varying intensities. It is commonly used to describe either a fuel in a state of combustion (e.g., a campfire, or a lit fireplace or stove) or a violent, destructive and uncontrolled burning (e.g., in buildings or a wildfire). The discovery of how to make fire is considered one of humankind's most important advances, allowing higher hominids to ward off wild animals, cook food, and control their own source of light and warmth.

NOTES

Establishing the origin of a fire

Fire investigation, sometimes referred to as origin and cause investigation, is the analysis of fire-related incidents. After firefighters extinguish a fire, an investigation is launched to determine the origin and cause of the fire or explosion. Investigations of such incidents are done using a systematic approach and knowledge of basic fire science.

Spread of fire
Fire and heat may spread through the building. The spread of fire depends of four factors:

Conduction
Conduction is the transmission of heat from molecule to molecule without the molecules themselves moving visibly out of place, e.g., heat being transmitted through steel roller doors and igniting combustible material on the other side.

Convection
Convection is the transmission of heat by the molecules within a liquid or a gas and is due to their differences in density. As a liquid or gas is heated the molecules expand and become lighter thus rising and being replaced by the heavier cooler molecules, e.g.; in a fire these heated gases rise up vertical shafts etc. thus involving upper floors, this we call a mushrooming fire.

Radiation
Radiation is the transmission of heat energy by waves traveling through space until their heat energy is absorbed or reflected by intercepting bodies, e.g. radiated heat from a burning building igniting combustible material in an adjoining building.

Direct Burning
Direct burning is self-explanatory.

The movement of fire
When combustion starts air pressure rises. Hot gases and flames unobstructed under normal conditions always travel upwards seeking the highest point. In doing so, they travel through vents and openings, e.g. stairwells, elevator shafts, holes or breaks.

If no outlets are found the investigator may find the ceiling directly above the point of origin, discoloured, charred or burnt through.

If hot gases are able to travel upwards via lifts or stairwells, these hot gases will ignite combustible material without any apparent connection to the original fire. Fire will travel vertically on the outside of a concrete and brick building, floor by floor, via windows and not spread horizontally, floor by floor.

Room sealed - smouldering mass
Normally, you do not get too much burning in the lower areas of the room, however, you will if the fire originates in a room that is closed or sealed, and the fire changes from open flame to a smoldering mass due to a lack of oxygen. Under these conditions, the fire will either extinguish itself, or because of a large build-up of heat, will char everything in the room including the floor and you will find no definite fire pattern.

Flash fire
If you have a flash fire in the area caused by the ignition of a flammable vapour, you could also have a searing or charring effect all over the room right down to floor level.

Oxygen
By the physical damage that has occurred in the building, it is very easy to establish whether or not there was a lack of, or a good supply of oxygen for the fire. Where there is a lack of oxygen in the building which was caused by all doors and windows being closed, then the walls and ceiling area and general condition throughout the dwelling will be covered with a heavy deposit of soot. It is not abnormal in these conditions to find that if a fire had originated in a chair, that the fire, due to lack of oxygen, turned into a smoldering mass and burned the flooring, sub-floor and joists, and the springs have dropped into the basement or floor below without damaging a table or other pieces of furniture nearby.

Curtains
You may find the appearance of different points of origin of fire, in that the floor area is charred underneath each window. By checking further, you will probably find this was caused by the curtains, which, when caught on fire, dropped down to the floor area or on the furniture and started another fire. This could also spread the fire. It is well known by all fire investigators that fire and heat travel upwards and once they hit an obstruction, such as ceiling, will fan out across the ceiling area. By examining open frame joists, you will find that one side of the joists is more deeply charred or burned than the other. By tracing back, you will find that the direction of which the fire had come across the ceiling, directs you to the point of origin of the fire.

NOTES

Establishing a crime

Fire investigation is one of the most difficult of the forensic sciences practice. In most forensic disciplines, even the basic question of whether a crime has been committed is normally obvious. During a fire investigation, an entire process must be undertaken just to determine if the case involves arson or not. The difficulty of determining whether an arson fire has occurred or not arises because fires destroy evidence.

A crime scene examiner looks at what is left behind after a fire and obtains information to piece together the events that occurred in the moments leading up to the fire. One of the challenging aspects of fire investigation is the multi-disciplinary base of the investigator's job. Fires can be caused by or involve most things people see or use. For this reason, fire investigators need to know not only basic science of fire behavior, but knowledge of many different areas of study (including construction, electricity, human behaviour, vehicles etc) is helpful. If the fire origin has, for example, a gas appliance, an investigator should know enough about appliances to either include or exclude it as a possible cause of the fire. Fire investigators must also know their own limitations and call upon experts to assist when needed. Accordingly, fire investigators sometimes work with forensic electrical engineers (when examining electrical appliances, household wiring, etc.) or others skilled in forensic engineering (gas-powered appliances, air handling equipment, gas delivery systems, etc.).

Floors -similar combustible materials

Examine similar combustible materials or metals in the room. If there are two exact types and compositions of combustible materials or metals and one is more heavily charred or melted than the other, it is obvious then where the greatest amount of heat was located. Normally, you do not get a lot of heat or charring all over the floor area, as we know flame and heat usually goes to the ceiling and fills up from the ceiling downward. Examine the floor, skirting board to locate the lowest point of burning in the room. If the flooring is charred, thoroughly examine this area. On several fire scenes that have been examined, it has been found that the walls and even roof areas have been completely burnt through, however, it has been found that the floor area such as hardwood flooring, rugs, linoleum etc, have been relatively untouched by fire. If you find this condition existing, then it is reasonable to assume the fire was of a high burning nature in the room, and started above floor level. Examine the layers of burnt debris to establish what burned first, i.e. charred newspapers found on the floor beneath charred drapery material.

Drop burning

Fire will spread from one section of the building to another, as a result of drop burning. Fire will burn through the floor and debris, will drop down to the floor below and ignite combustible materials, starting a fire in that area.

Starting Points of Fire / Point of Origin

Having established a starting point of the fire, clear the debris carefully looking for evidence of cause, i.e. candle grease or stubs which may have been placed in position, or other igniters which have been poured on the floor to lead the fire through the premises. These show very well on carpets or mats and floor coverings such as plastic or linoleum sheets or tiles.

Materials such as plastics or shining metal surfaces, which by melting or discoloration, show amount of heat at different distances from fire. Try to find out which materials were first burnt and why, i.e. lamp shade in contact with globe or cigarette dropped in or on inflammable materials.

Where it is suspected that inflammable materials were used, check under skirting boards to see if charring is present. These areas will normally be the last to be burned. Inflammable liquids will often run under these and take the fire with them due to the fact that floors are not level. Where the fire is suspected to have been caused by inflammable liquids, it may be found that it has seeped through to the underlay of the carpet. Samples of carpet and underlay can be examined by an analyst in investigations into major fires.

NOTES

Determining the point of origin of the fire

When examining the fire scene one of the most important aspects to ascertain is the point of origin of the fire. Generally, the point of origin of the fire will reveal evidence that will assist the investigator with the cause of the fire, whether being the ignition of available materials, a faulty electrical appliance or the location of an accelerant that was used by the offender to assist with the spread and intensity of the fire.

Giving consideration to the behaviour patterns of fire, to determine the point and origin of the fire the investigator must first locate the lowest point of burning with the greatest amount of fire damage. This theory is based on the fact that the fire has been burning the longest where it started, however there are considerations to be taken into account.

A fire normally burns upwards and outwards creating a V PATTERN effect with the base being at the seat of the fire, however a fire will travel on a horizontal plane or even downwards through flooring or walls to reach a source of oxygen. Fire will also follow the trail of flammable liquids or combustible materials.

Another consideration is that where the fire originated may have been easily accessible by the fire fighter and extinguished, however, the fire may have progressed into another area that may not be as easily accessible by the fire fighter and would burn longer before being extinguished. This area would naturally have greater charring and heat damage. More combustible materials in one area of the building could result in more damage in a particular area.

There are numerous indicators that the investigator should keep in mind when viewing the scene as to the position of the point of origin of the fire.

Charring:
Inspecting timber joists, wall studs etc for charring effects will indicate the direction of travel of the fire. The side which has the most severe charring (crocodile skin effect) will be on the side on which the fire has originated, whereas the other side will be protected and so undamaged by the fire, or will have a much lesser degree of charring.

Floors:
If a fire has burned a hole in flooring, either in a room or in a wardrobe or similar, examination of the edges of the hole will indicate if it has originated on top and burned downwards or originated beneath and burned upwards.

In the first instance a cross-section of the flooring around the hole will show a tapering off away from the edge on the top surface, whereas in the latter there will be a tapering off on the underside of the flooring.

Melting:
Observations should be made of items such as light bulbs, plastic fittings or even candles, particularly in restaurants, which characteristically melt towards the direction of the heat, pointing in the direction of the origin of the fire.

Overall damage
An initial overall view of a large fire scene, in the case of a factory or similar, paying attention to the area in which the least amount of damage has occurred and gradually progressing to the area where the most severe damage can be of assistance in determining the point of origin. In these situations an aerial view, depicting where roof beams are more severely heat affected can also be of assistance.

Overhead damage
Locate the area of the most intense overhead burning/damage as this may indicate the fire starting directly below. This should be taken into perspective in relation to fuel load below such damage.

Determining the cause of the fire.
Having determined the point of origin of the fire, the next step is to determine the cause of the fire or the ignition source. Given that generally evidence of the cause will be in the vicinity of the point of origin of the fire, the investigator must establish what ignition was present at the point of origin and is the temperature of the ignition source high enough to ignite the combustible materials.

It will be within this area that samples will need to be collected for testing for the presence of flammable liquids. In doing this the debris will need to be cleared carefully down to the lowest level to look for evidence of the cause. For example... candle grease or stubs which may have been placed in position or other igniters which have been poured on the floor to assist with the spread of the fire. These show particularly well on carpets.

NOTES

Explosives - IED

Definition of Explosives

> *An explosive is a material that is capable of rapid conversion from either a solid or liquid to a gas with resultant heat, pressure, and loud noise.*

General Information about explosives

Explosives can be useful tools to accomplish remarkable engineering feats. However, explosives are also used for criminal acts as well. The explosion may have occurred to cover up another crime such as homicide, burglary, or theft.
It is estimated that approximately 80 percent of all explosions are proved to be accidental, even though they occur under seemingly suspicious circumstances. An explosion may result from a faulty gas line or fixture, or from a gas valve carelessly left open. Determining whether or not a crime has been committed is the basic problem facing the investigator and crime scene specialist.

Types of Explosives
There are two broad groups of explosives:

Low Explosives
Low explosives burn rather than explode. Damage by low explosives is caused by the force exerted by the rapid expansion of gases formed by burning. To explode, low explosives must be confined.

- *Black powder*
  The most common type of low explosive is black powder, which is a mixture of potassium or sodium nitrate, sulfur, and charcoal. Black powder is sensitive to heat, impact, friction, and sparks. Black powder can be a destructive explosive when put into a confined area such as a pipe bomb. Detonation can be easily accomplished by means of a safety fuse, which is used to initiate explosives non-electrically.

  If an unexploded pipe bomb is encountered, it is very important to use extreme care when opening the device, because it can be set off by friction.

- *Smokeless powder*
  Another low explosive found in bomb investigations is smokeless powder, which is used mainly for small arms ammunition. It is also frequently used in pipe bombs. There are two types of smokeless powder marketed:

  - Single base - consists of nitrocellulose
  - Double base - composed of nitrocellulose and nitroglycerine.

  Smokeless powder is not as sensitive to friction as black powder, however, it should be handled with the same care used as when handling black powder.

High Explosives

In general, high explosives are detonated by shock, have much higher detonation velocities, and don‘t need to be confined to explode.

NOTES

Primary and secondary explosives

Primary explosives
Primary explosives detonate when subjected to heat and shock, and are typically used as initiators of high explosives, to detonate main charges, in blasting caps, and in firearm primers. In bomb investigation, the major interest in this type of explosive is in blasting caps.

Blasting caps
There are two types of blasting caps: electric and nonelectric. Blasting caps are small explosive devices, about 1/4 inch in diameter and from 1 to 3 inches in length. The case may be made of aluminum, copper, or bronze. Electric blasting caps have colored wires extending from them.

Blasting caps are ignited in one of two ways:

- Ignition by safety fuse
  Crimpers must be used to clamp the detonator to the fuse. The tool marks left by the crimpers on detonator case fragments found at the scene of the explosion may help to make positive identification of suspect tools.
- Electrical ignition
  Detonators are wired into an electrical source. Closing the circuit will result in instantaneous or timed explosions. The connecting wires usually remain intact after the explosion and may be valuable trace evidence.

Secondary explosives
Secondary explosives detonate by shock from a suitable primary explosive. Detonation velocities range from 3300 feet per second to 29,900 feet per second. High explosives are typically used to shatter or destroy objects.

- Detonating cord
  A cord-like explosive, similar in appearance to a safety fuse. The explosive will be wrapped in a protective casing that makes them insensitive to shock. The cord detonates at velocities from 18,000 to 23,000 feet per second. The cord is very insensitive to shock and heat and presents no special problems in handling.

  Detonating cord is used to set off charges of high explosives in much the same way as safety fuse is used to set off multiple pyrotechnic devices. A detonating cord may be inserted, tied, or knotted inside the high explosive to initiate detonation. It is used to set off simultaneous charges and is itself detonated by means of a blasting cap.

- Boosters or primary explosives
  Used to detonate very insensitive high explosives and is detonated by means of a blasting cap. An explosive charge is sometimes used to amplify or boost the shock provided by detonators or blasting caps in order to detonate main charge explosives. Boosters are usually cylindrical in shape and have a small opening to permit insertion of a blasting cap.

NOTES

Homemade explosives

Individuals can produce a highly destructive explosive device by mixing a large number of chemicals. Crime scene specialists should recognize at least some of the more common materials that often find their way into homemade explosive devices. Materials such as starch, flour, sugar, cellulose, etc., can be treated to become effective explosives. Also, powder from small arms ammunition, powder from firecrackers, match heads, and ammonium nitrate from fertilizers can all be used in explosive devices.

Several methods are available to detonate an improvised explosive device:

- ***Blasting Caps***
  Caps, especially electrical blasting caps, lend themselves to homemade bombs. Blasting caps can be set off by a timing mechanism, by movement, by wiring into an automobile ignition system, etc.

- ***Percussion Primers***
  Primers from rifle, shotgun, or pistol ammunition can sometimes be used to detonate explosives that are heat sensitive.

- ***Flashbulbs***
  These may be used to ignite heat-sensitive explosives such as black powder. If the bulb is placed in contact with the explosive, the resulting heat from it will ignite materials such as black powder, smokeless powder, incendiary mixtures, etc.

- ***Match heads***
  Frequently found confined inside pipe bombs. Match heads are sensitive to heat, friction, and shock. They can produce an effective explosion when confined in this type of device.

- ***Smokeless Powder***
  Powder from ammunition or for reloading purposes is commonly used as the main charge in pipe bombs.

- ***Ammonium Nitrate Fertilizer***
  When mixed with fuel and an appropriate booster, ammonium nitrate fertilizer makes an extremely effective homemade explosive device.

- ***Potassium or Sodium Chlorate***
  These compounds and sugar are used as incendiary and explosives materials.

Explosive Accessories

- ***Safety Fuse***
  Usually consists of a train of black powder in waterproof casing. The fuse is the medium for carrying a flame to the explosive device.

- ***Timing Devices***
  Electrical, mechanical, or chemical devices may be used to trigger an explosive device at a predetermined time.

NOTES

Conducting a bombing crime scene search

Principles

The basic principles of conducting a crime scene search apply to a bomb scene search. Processing a bombing crime scene, in spite of often massive destruction, must be conducted on the theory that everything at the crime scene, prior to the explosion, is still present unless it has been vaporized by the explosion. Valuable evidence can be recovered at the crime scene which can assist in linking possible suspects to the crime. A thorough processing of the bomb scene should be conducted as soon as possible after the incident. The primary objectives of the crime scene search are to identify and secure evidence regarding the suspects and their method of developing the bomb, and the recovery of bomb remains.

Safety Issues

The safety of crime scene specialists will be a major area of concern. The scene of a bombing is generally very unsafe. Prior to processing a bomb scene, the damaged area should first be checked by bomb disposal technicians for unexploded bombs and secondarily by engineers for hazardous structural conditions. All damaged utilities should be identified and turned off before starting the processing operations. Safety conditions should be evaluated on a continuing basis throughout the search.

Handling Explosives

Bombs or other explosive devices should only be handled by qualified bomb disposal personnel. Undetonated explosive residues, spilled explosives, and explosive devices left behind by the suspect must not be touched. Even a small amount of explosive residue can be detonated and cause a serious explosion.

Photography

Never photograph a bomb or other explosive device with a flash bulb. The heat from the bulb may cause detonation.

Protection of the Crime Scene

Adequate safeguards should be taken to protect the crime scene. Unlike most crime scenes, the scene of an explosion frequently attracts a large number of people such as police, fire department personnel, medical personnel, utility companies, property owners, the media, and on-lookers. Any individuals who are not needed at the crime scene need to be removed. Since most residues remaining after detonation of an explosive are water soluble, the crime scene should be protected as much as possible from exposure to moisture, such as rain, snow, broken water pipes, etc.

Extent of the Crime Scene

The extent of the crime scene must be identified. The site of the explosion can be a focal point, and the location furthest from the site where fragments from the explosion were located can define the outer perimeter of the scene. A buffer area should also be added and should be equal to approximately half the distance from the site to where the most remote piece of evidence was located. Evidence has been found up to several blocks away from a large explosion.

The initiation of the search normally starts at the site of the explosion and works outward. If the bomb crater is in earth, obtain soil samples from the perimeter, sides, and bottom of the crater. Soil samples should also be taken away from the scene for comparison purposes.

Photographing the Crime Scene

Appropriate photographs should be taken to give an accurate photographic representation of the crime scene. These photos should be taken immediately before, periodically during, and at the completion of the crime scene processing. Each photograph should be properly identified as to location and orientation. They should be coordinated with diagrams, maps, and/or blueprints. Aerial photographs may also be considered.

Photographs should also be taken of any item of evidence located before the item is collected.

Equipment

It will be necessary to have the proper equipment when searching the crime scene. The following items may be required:

- Coveralls
- Gloves
- Hard hats and goggles
- Work shoes
- Shovels, rakes, and brooms
- Various cutting tools
- Sifting screens of various sizes
- Wheelbarrows and trash cans
- Portable lighting and ladders

NOTES

Searching the scene for evidence

The search for evidence at a bombing crime scene is critical. The crime scene will contain important evidence for identifying the suspect and assist in the successful prosecution of the crime. The exact method of searching will depend on various uncontrollable factors.

Investigation of the scene of a bombing is a time-consuming task that requires a considerable amount of physical work and attention to minute pieces of physical evidence. The search is also dirty work and will require the crime scene specialist to sift through large quantities of debris to locate items of evidence.

One person should be placed in charge of the collection of evidence from the various collectors. Valuable evidence may not be admissible in court if a proper ―chain of custody‖ cannot be established. The location where any evidence is recovered must be documented.

The search for evidence should not be concentrated on only obvious explosive-related physical evidence such as safety fuse, blasting caps, timing mechanisms, pieces of wire, batteries, and explosive residues. This may cause other valuable evidence to be overlooked. Other evidence to look for includes:

- Fingerprints
- Hairs and fibers
- Soil, blood, paint, plastic, and tape
- Tools and/or tool marks
- Metals
- Writing paper, printing, cardboard, leather, and wood
- Tire tread and shoe print impressions

The search of the crime scene should not be stopped after a few items have located. The search must be well-organized and thorough to prevent the necessity of a second search.

The probable flight path of the bomb components should be determined to prevent needless searches. Trees, shrubbery, telephone poles, and the roofs, ledges and gutters of nearby buildings need to be searched. A search pattern should be established for large areas. A satisfactory method is a line of searchers who move forward. The areas to be searched should be charted to ensure a thorough search pattern.

Any items that are foreign to the scene and items that the searchers cannot identify need to be retained. Small debris should be sifted through a 1/4" wire screen onto an insect-type screen. These screens are usually placed onto 2 foot square wooden frames constructed from 2 x 4 inches lumber.

Evidence Log
Due to the large number of persons involved with the bomb scene search and the amount of evidence collected, an evidence log should be kept to detail each item collected, including the date, time, and name of the person who collected the material. Using this log facilitates establishing a chain of evidence and makes the inventory of all the evidence easier.

Firearm identification

Introduction

Two of the most frequent questions asked of the firearms examiner are—

- What kind of firearm was used?
- Was this the particular weapon used?

Both of these questions involve a study of the markings left on the fired bullet, cartridge case or both. Experience has shown that no two firearms, even those of the same make and model, and made consecutively by the same tools, will produce the same marks on fired bullets and cartridge cases. There will, of course, be a "family resemblance," i.e. fired bullets will be of the same calibre, will have the same width and number of grooves, and the rifling will have the same angle and direction of twist. The weapons are said to have the same "rifling characteristics" or the same "class characteristics."

On the other hand, bullets fired through the same barrel and cartridge cases fired in the same weapon may be expected to show markings which are peculiar to that weapon and to no other. These markings or "individual characteristics" serve to identify the weapon used in the crime.

Firearms used in crimes

Firearms used in crimes are of two types—

- Rifled arms
- Smooth bore weapons

Rifled Arms

In the rifled arm, the inside of the barrel is cut longitudinally with a number of spiral grooves. The portion of the barrel left between these grooves is called "the lands." These lands and grooves can differ in direction and twist, i.e. right or left hand twist, the amount of twist and their relative width and depth. Therefore, the class characteristics as applied to a rifled barrel may be set out as follows—

- Calibre
- Number of lands and grooves
- Relative width of lands and grooves.
- Direction of twist

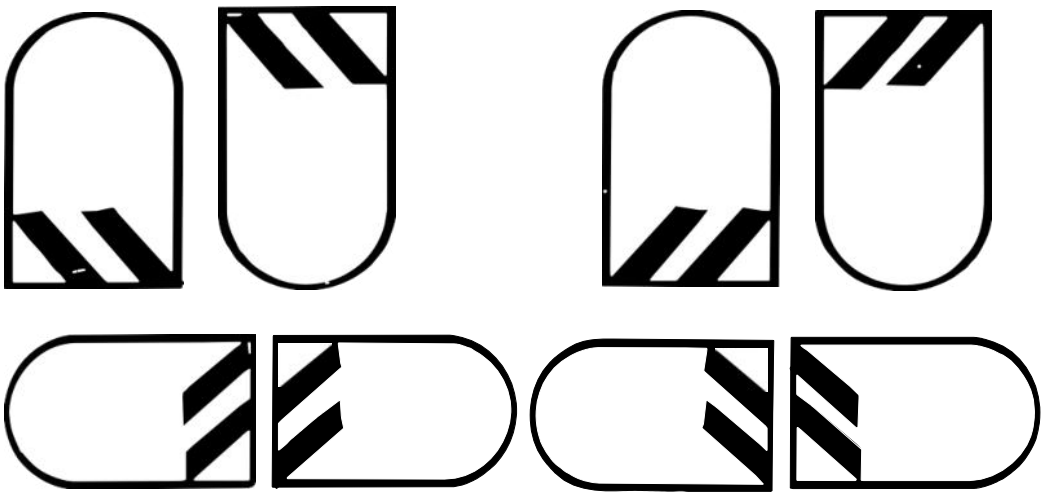


Diagram of improvised method of comparing the class characteristics of two bullets

The term "calibre" is a figure which approximates the diameter of the bore of the rifle, pistol or revolver. In the case of a .32 calibre Colt automatic pistol the "32" refers to a diameter of 32/100th of an inch. Actually it is a rather general term, as it does not, except in a few cases, precisely describe the diameter of the bore. The more modern trend to classify a firearm is by the diameter of the bullet intended to be fired through the barrel.

Smooth Bore Weapons

In the smooth bore weapon the inside of the barrel or bore is smooth from the chamber to the muzzle. Unlike the rifled arms, there is no way of determining whether shotgun pellets were fired from a certain gun. However, cartridge cases from both types of firearms can be related to a particular weapon by comparing firing pin impressions, breech-face markings, etc.

Notes

Firearm terminology

The following terms are used in describing the main parts of a weapon—

- *Bore*—The inside of the barrel of the firearm.
- *Breech face*—That part of the firearm that closes behind the cartridge seated in the chamber.
- *Chamber*—That part of the firearm which holds the cartridge at the time of firing.
- *Choke*—In a shotgun, a muzzle that has been reduced to less than bore diameter.
- *Ejector*—A small cam or projection inside the firearm which causes the cartridge case to be thrown clear of the weapon.
- *Extractor*—A small claw or other device which engages the rim of the cartridge or cartridge case causing it to be removed from the chamber when the action is opened.
- *Fore-end*—That part of the stock or wooden grip under the barrel or barrels forward of the receiver.
- *Muzzle*—The extreme end of the barrel.
- *Receiver*—The metal portion of the firearm which houses the firing mechanism. In revolvers and self-loading pistols it is also called the frame.

Shotguns

Shot guns are the most common weapons used by criminals. They are common because they can be easily manufactured by criminals from basic materials including wood, rubber bands, nails, pipes, bolts, etc. It is not possible here to describe the many variations of homemade shotguns but the basic design is common to all.

Shotguns can be single or double barrel, hammer or hammerless, extractor or ejector type. In the ejector type shotgun the fired cartridge case or cases ejected upon opening the weapon. Other types of shotguns are repeaters and "automatics." The repeaters may be bolt action, lever or pump action (pump action is often described as trombone action). The automatic shotgun is really a self-loader in which the trigger must be released between the firing of each shot. With a double barrel shotgun having two triggers, the front trigger fires the right barrel, the rear trigger fires the left.

Shotguns are also made with "under and over" barrels. In these weapons the front trigger fires the under barrel. Some weapons are made with rifled barrel combined with one or two shotgun barrels.

Revolvers

A revolver gets its name from the rotating cylindrical magazine (cylinder) which normally has five or six chambers and is situated immediately behind the barrel.

Revolvers can be—

- Single action
- Double action
- Selective double action

Single Action
In this type of revolver the hammer must be manually pulled back to the cocked position. This operation also turns the cylinder. To fire, the trigger is pulled. If the trigger is held in the pulled position and the hammer manually cocked and released, the weapon will fire.

Double Action
A revolver in which by applying a continual pressure on the trigger, the hammer is cocked, the cylinder rotates and the weapon fires.

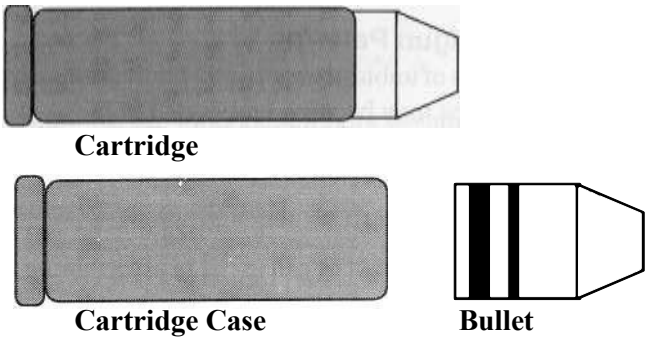
Selective Double Action
A revolver which allows the shooter to use either the single or double action. Manufacturers of revolvers have developed certain characteristics or peculiarities in their firearms and it may be important to ascertain these prior to questioning the offender, i.e. the cylinder of a Smith &Wesson revolver rotates in an anti-clockwise direction, whereas the Colt and most other well-known makes rotate in a clockwise direction.

Very few revolvers are fitted with manually operated safety catches. Nevertheless, safety features are included in most well-known makes, which are designed to prevent accidental discharge.

Automatic Firearms (Self-loading)
Although commonly known as "automatics," these weapons are actually semi-automatics or more correctly, self-loaders. They will fire only one shot each time the trigger is pulled.

Ammunition

In the description of ammunition for use in small arms, three terms are used-



Shotgun ammunition has no bullet, in the usual sense, as the projectile or projectiles are either slugs or pellets. In shotgun cartridges, wads are used to separate the propellant from the projectiles and to keep the pellets in a compact mass during their passage through the barrel.

After firing shotgun cartridges, wads which were originally in the cartridge may be found at the scene, and are of use in an investigation.

Notes

Distance Determination

When a firearm is discharged, the bullet leaves the muzzle and is accompanied for a short distance by both burning and un-burnt powder and gas. If the target is relatively close to the muzzle, some of this material other than the bullet will strike the target. As the distance between the muzzle and the target increases, the amount of this material decreases until a stage is reached when only the bullet strikes the target.

There can be three distinct results visible in or around a firearm wound of a shot fired at close range

These are —

- **Burning**
  Caused by flash or flame from the muzzle, was common when black powder was extensively used, but not often seen these days.
- **Blackening**
  May occur in or around the wound and is caused by the deposition of soot on the skin or clothing. In the case of suicide or other close range wounds, particularly those caused by .22 calibre rifles, this soot deposit may become embedded in the skin resembling a burn.

- **Powder deposits and shotgun patterns**
  Powder deposits are left in the form of un-burnt or partially burnt grains of powder around the wound. Under some circumstances these grains may become embedded in the skin.

The distance over which these three characteristics are produced varies with different firearms and ammunition. With firearms discharging a single projectile, no estimate of distance can be given beyond the ―powder range‖.

In an accident involving a shotgun the spread of shot can assist in ascertaining the distance, beyond the powder range. The average rate of spread of shot when fired from a shotgun is 25 mm spread to every meter traveled. This is not a hard and fast rule as a lot depends on barrel length and type of cartridge, but it can be used as a rough guide to the investigator and should not be quoted in court.

To establish at what distance the shot was fired, it is desirable that tests be conducted with the exhibit firearm using the same type of ammunition. For this reason an investigator should always try to locate the ammunition.

Notes

Firearm Residues

Residues from the primer of the cartridge can deposit on the hands of a person whilst discharging a firearm. The amount of residue deposited varies according to—

- the type of weapon
- the age or condition of the weapon .the ammunition used
- the number of shots fired
- the environmental conditions, i.e. indoors/outdoors, weather conditions, etc.

Any residue detected not only varies with the above factors but also with the time between the event and the swabbing. Such residues are easily removed by contact of the hand with other objects such as clothing.

At the crime scene

- Search for any weapon possibly concerned- the type of firearm may be apparent by the wound or damage. The firearm should first be photographed in situ (where it lays), then fingerprinted after rendering the weapon safe by minimal handling.
  - Examine the weapon—
    - Thoroughly examine any weapon found, prior to proving it, taking particular notice of the position of the hammer and safety catch. If necessary a chalk or pencil mark on the firearm may assist in recalling the condition of the weapon when found.
    - When satisfied, "prove" the weapon. Be prepared for the flight of ejecting cartridge cases.
    - Note position of cartridges and cartridge case in weapon. If necessary draw a diagram, remove and place same in a labeled envelope.
    - Do not allow these items to remain in or to be returned to the firearm.
    - Check any weapon found for odour or discharge, and inspect bores for signs of powder deposits.

- Search the scene for fired bullets, cartridge cases, wads and pellets. .Remove bullets in a manner not likely to cause further damage.
- When cartridge cases are found it would be wise to mark their position on a plan, as most weapons will throw their fired cartridge cases in one general direction-this may assist is establishing the position of the weapon at the time of the shooting. Never interfere with the sights or the adjustable choke of a weapon.

At the hospital or post mortem examination

Ask the doctor or hospital staff to—

- Remove clothing, leaving the bullet holes intact.
- Note position and size of entry wound and exit (if any). These wounds should be photographed as close as possible and at right angles to the wound. The photograph should include a ruler.
- Note the size and type of "powder deposits," if present.
- Remove bullets, pellets and wads without damage. Blood should be washed from these items before packing.

It may not be possible to carry out the above suggestions if the patient is still alive as his survival must come first. Clothing should be handled and packed as described in previous notes.

Notes

Gunshot wounds

Effect of Bullet on Tissue

In order to illustrate the penetrating projectile- body tissue interaction, the ―wound profile‖ method was developed. It is an attempt to present a useful approximation of the pertinent, useful, factual data to clarify bullet effects in a form that can be readily understood. The profiles depict the maximum disruption that a given bullet can be expected to produce in the elastic soft tissue of the living animal. The ―permanent cavity‖ indicated on the wound profiles is the ‗bullet hole‖ produced by the projectile crushing the tissue it strikes. The ‗temporary cavity‖ shows the approximate extent to which the walls of this hole were stretched a few milliseconds after bullet passage (entirely analogous to a splash in water). Much of the damage done by a bullet results from the tumbling motion and the cavitation in the tissue.

The type of tissue affects wounding potential, as well as the depth of penetration. Specific gravity (density) and elasticity are the major tissue factors.

The higher the specific gravity, the greater the damage.

- The greater the elasticity, the less damage.
- Thus, lung of low density and high elasticity is damaged less than muscle with higher density but some elasticity.
- Liver, spleen, and brain have no elasticity and are easily injured.
- Fluid-filled organs (bladder, heart, great vessels, bowel) can burst because of pressure waves generated. A bullet striking bone may cause fragmentation of bone and/or bullet, with numerous secondary missiles formed, each producing additional wounding

Anatomy of a bullet wound

One of the tools used to compare the effects of ammunition is the ―wound profile‖. Wound profiles are simply dimensioned photographs or carefully prepared scale drawings of test firings in calibrated ballistic gelatine. The wound profiles above are some typical examples of what a bullet does on impact.

When the muzzle of the firearm gets next to or is in contact with the target, hot gases escaping from the muzzle at high velocity will typically rip, tear, shred, and/or melt the material of the target. A very intense deposit of gunshot residues will be found around the margins of a contact or near contact entrance hole.

There have actually been cases where a hard contact gunshot (muzzle pressed hard against the victim) caused the residues to blow through the wound tract in the victim and be deposited around the inside of the exit hole of the victim‘s clothing.

Evidentiary value of firearms and ammunition

Handling of exhibits

Any time a crime scene specialist discovers firearms or ammunition at the scene of a crime, the utmost care must be exercised in handling them. Before moving or disturbing a weapon, the crime scene specialist should have indicated in his/her notes a general description of its positioning, taken photographs, and ensured that there was sufficient information for the crime scene sketch. The make, model, serial number, and calibre, as well as other descriptive information should be included in the notes.

Before picking up a firearm, the crime scene specialist should note the position of the hammer if the weapon has one, observe whether the breech is open, whether the weapon has a magazine in it, and the position of the safety if the weapon has one. Safe handling of the weapon should be paramount. Only if the weapon presents a direct hazard, such as the hammer still being cocked, should the crime scene specialist attempt to render it safe. This is the one time that trace evidence collection should be attempted immediately, as long as safety is not jeopardized.

The crime scene specialist should always ensure that fingerprints or other trace evidence are not disturbed or destroyed on the weapon. The weapon should never be picked up by a smooth surface, such as the barrel or frame, as this could allow the deposit of fingerprints. Any rough surfaces on the weapon, such as the serrations on the grip of a handgun or the stock and fore piece of a long weapon, should be used to collect the weapon.

The crime scene specialist should never insert a pencil or other object into the barrel of the weapon while recovering it. Doing this can cause trace materials such as dust, blood, particles of tissue or fibres to become dislodged or destroyed. Likewise, the potential also exists for the transfer of paint or wood from the pencil itself to the weapon.

The weapon should always be processed in a controlled environment instead of the crime scene if at all possible. In the controlled environment trace evidence can be better collected and the weapon then subjected to closer inspection. Following the trace evidence collection, the crime scene specialist can open the weapon, note the amount of ammunition it contains, and record the position and content of the cylinder and chambers if it is a revolver.

NOTES

Bullets

The rifling on the barrel of the weapon produces marks on bullets when fired. As the bullet is forced out the barrel of the weapon microscopic striations are produced by the rifling (land and grooves). The striations are invaluable for later identification purposes. The possibility also exists that marks can also be produced on bullets during the loading of some weapons. These marks can also be compared with the suspect weapon in hopes of producing a positive match.

Recovered bullets
Recovered bullets can be examined by the laboratory to determine manufacturer, specific caliber, type, and make of weapon from which the bullet was fired. In addition to these general identifications, if sufficient marks (striations) are present, the bullet can also be used for positive identification purposes.

Bullet versus weapon
The crime laboratory can determine whether a particular bullet was fired from a particular weapon, provided the bullet is not destroyed or mutilated too badly upon recovery and has sufficient striations for identification purposes.

Fired cartridge or shotgun shell casings
Marks on a fired cartridge case or shotgun shell casing can be produced by the breech face, firing pin, chamber, extractor, and ejector. Each one of these marks has the potential to be connected to a particular weapon due to its unique characteristics.

Fired cartridge cases found at the scene can be used to determine specific caliber type and possible make of weapon from which it was fired, as well as whether or not there are sufficient marks present for identification.

Fired shotgun shells found at the scene can be used to determine gauge, original factory loading, and whether there are sufficient marks on the casing present for identification.
Wadding or shot from the victim or scene can be used to determine gauge and possible manufacturer of the wadding. Shot can be examined to determine size, however it cannot be identified with a suspect weapon since the barrel of a shotgun is smooth and does not produce striations on the projectile.

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If sufficient identifiable fire pin impressions, breech face or chamber marks are present, it is possible to establish whether they were fired from a particular weapon.
Extractor or ejector marks can only be used to identify whether the cartridge case or shotgun shell casing may have been loaded into or extracted from a specific weapon.

Gunshot Primer Residues
When a person discharges a firearm, whether it is a long weapon or handgun, primer residue can be deposited on the shooter‘s hands in varying amounts. These amounts are dependent upon the type, calibre, and condition of the firearm, as well as the environmental conditions at the time of the shooting. Residue samples can be collected from a suspect‘s hands and later analysed for the presence of the chemical elements antimony, barium, and lead. All of these elements are components of most primer mixtures. The analytical technique used to test these hand samples is dependent upon the type of hand samples collected from the suspect.

If the suspect washes his/her hands, or engages in various other activities, it is possible to remove substantial amounts of the residue. It is imperative that the crime scene specialists obtain samples as soon after the shooting as possible. Samples older than six hours following a shooting are generally of little value. Samples obtained from the hands of a victim of a close range shooting (approximately three meters) are also generally of no value. Due to close proximity of victim and shooter, it is nearly impossible to differentiate between residue deposited on the hands of the shooter or the victim of a close range shooting.

Several commercial sampling kits are available for use by the crime scene specialist. These kits come with individually sealed plastic applicators that can be opened at the scene and then rubbed across the hands to recover gunshot residue. Fabricated sampling kits can also be made using commercially available cotton-tipped applicator swabs (Q-tips) with plastic bags (Ziploc or equivalent), and a five-percent nitric acid solution. The solution should be stored in a sealed plastic bottle only.

Muzzle-to-garment testing can also be conducted to determine distance from the shooter to the victim. Test firings using the suspect weapon and identical ammunition are made and then microscopic examinations and chemicals processing around the bullet hole are analyzed. It is necessary to have a suspect firearm and the same type of ammunition used in the shooting in order to conduct this test.

Shot Pattern Examinations
A shot pattern examination can also be conducted to determine muzzle-to-garment distance if a suspect shotgun is recovered and the same type of ammunition (shotgun shells) is recovered, or at minimum identified.

Function Examinations
The crime laboratory can determine if a firearm is capable of firing as it was designed and if all safeties are functioning properly.

Alteration Examinations
A firearm can be examined to determine if it has been altered in any way from its original design, particularly if it was altered to allow it to fire in a fully automatic mode, or if the trigger pressure was changed in any manner.

NOTES

Scene of Death Examination

Initial action at the scene of the crime

For practical purposes, the scene of the crime will usually be the place where the body of the deceased is found. This, however, may not be the place where the death occurred or the fatal injury was inflicted.

On arrival, the investigator may find the crime scene in a state of confusion and disorder. It is the responsibility of the first investigator to arrive at the scene to take charge and to bring order from chaos. The investigator must make an initial appreciation of the nature of the situation:-

- is the victim dead?
- is medical attention required?
- is there a possibility of a dying declaration?
- prospective witnesses and suspects should be kept near the scene but separated, if possible. Onlookers should be excluded from the scene including police officers.
- protection of the crime scene from contamination or interference is vital.

Examining the crime scene

The crime scene examination and subsequent search should be done in a careful and methodical manner. After talking to the officer(s) who were the first ones on the scene and learning from them of any changes that might have been made to the scene since their arrival, such as turning lights on or off or opening doors or windows, start the examination by working your way into the body using great care to avoid disturbing or destroying any evidence as you do. Carefully observe the floor or ground surrounding the body. Look for items of evidence or of evidential value such as stains, marks, etc. Remember to look up too, every crime scene is 3 dimensional. Another technique to you assist in locating evidence is to shine a flashlight on the ground at an oblique angle. Yes, even in the daytime. Look at the items as they are located. Pay close attention to everything as you approach the body at this time. do not dismiss anything until its evidentiary value can be determined. Are there any footprints or drag marks? Is there anything on the floor or ground that may be stepped on or destroyed?

NOTES

Initial examination of the body

Only one investigator at a time should approach the body! Determine what, if anything has been moved or altered by the suspect(s) or anyone else prior to your arrival. Has the body been moved?

If so, by whom and for what reason?

- Never move or alter the positioning of the body!
- Make close visual examinations of the body and the area immediately around it. Look between the arms and legs without moving them. Look at the arms, hands and fingers. Are there defense wounds?
- Is there anything under the nails that you can see at this time?
- If you can, try to determine the cause of death and the instrument or method used.
- Take careful notes of the external appearance of the body and the clothing or lack of clothing.
- Look at or for lividity, decomposition, direction of blood flow patterns, remember the law of gravity. Is the blood flow consistent with it?
- Make detailed notes.
- Describe the clothing, and especially the condition of the clothing.
    - Do folds or rolls indicate the body had been dragged? If so, in what direction?
    - Note those folds and rolls, diagram them then photograph them. They could assist you in determining the method of transportation or placement of the body at the location where it was found.
    - There could be trace evidence in the folds and rolls too.
- Describe the location and appearance of wounds, bruises, etc.
    - Make careful and detailed observations.
    - Describe not only what you see, but also what you do not see!
    - Forget about what you think you see!
    - If something is missing, note it. For example, if you observe an area on the wrist that is not tanned by the sun, note it. DO NOT state that a wristwatch is missing. What if the victim had an I.D. bracelet or sweatband on instead? Never ASSUME!
- Examine the scene for the presence and absence of blood.
    - If any is located, note the amount, size and shape of the drops and degree of coagulation or separation of it.
    - Photograph it using a scale and always taking the pictures from a 90 degree angle.

At this time, you should be making a sketch of the scene. It can be a rough, freehand sketch drawn on a blank piece of paper or in your notebook. You should include in the sketch things like the location of all doors, windows, furniture, the victim and anything else you feel it is necessary to document. A sketch should be made in all murder cases and any other case involving a death where there is any question of cause or at the discretion of the investigator. Measurements can then be made of the location to show the size of the area drawn, the width and height of doors, windows, tables, the bed or any other items needed. This will also geographically locate the victim‘s body and items of evidence within the scene.

If the investigator is reasonably sure this is not a natural death and he/she is going to proceed with the investigation as if it is a murder, then at a later date, a detailed formal diagram should be drawn using drafting tools, a scale and a uniform format.

Photos of the scene can give a distorted view of the relationship of the body to other fixed objects due to camera angle, size of lense, lighting, etc. To accurately depict the scene it is possible to use photos in conjunction with the finished diagram. Something to keep in mind about the sketch is this, you should have enough information in it so you could give it to another investigator and that person would be able to complete a finished diagram without the need to revisit the scene.

NOTES

Photographs

The crime scene examiner should ensure that;
Overall photos of the scene are taken to show the approach to the area, street signs, and street light locations in relation to the actual scene, street addresses and identifying objects at the scene.
Pictures should also be taken of every room in the house, even if their relationship to the crime scene is not readily apparent.

Photograph the scene in a clockwise pattern before altering the body's position or any other evidence within the scene.

Photograph the scene from at least two opposite corners, but from all four corners is even better. This way, nothing is missed or hidden from view by intervening objects.

Photograph the body and the immediate vicinity around the body. If you have a camera boom, take pictures from ceiling height down of the victim and any other evidence. This perspective often shows things missed when viewed from ground or eye level.

Keep a photo log.

Another idea to keep in mind when photographing the exterior of an indoor scene or an exterior scene is to take photos of the spectators who are standing around watching the activities. Many times the perpetrator will return to observe the actions of the police or fire personnel. This seems to be especially true in arson cases. Additionally, photos may help identify reluctant witnesses who can be identified and interviewed at a later time.

Examination of body

Once the photos are taken, the investigator should now make a detailed examination of the victim;

- begin at the head and work down to the feet. Look for cuts, bruises, stab wounds or bullet holes
- are the eyes and/or mouth open or closed,
- what is the color of skin, of the nails and hands or lips
- the presence or absence of blood, saliva, vomit, lung purge, their direction and flow
- Document maggot activity if present.

When the body is moved,

- check the underside of the body for wounds and underneath the body for items of an evidentiary value.
- Record the temperature of the body, the surface it is laying on, and the interface area between the two.
- Obtain the ambient temperature.
- If a maggot mass is present, take the temperature of the mass.

Write everything in details and take signature of the identifier and other present witnesses.

Continuing the Search

Search the immediate area around the body (divide the room into a grid and work outward from the body). Have another investigator retrace your steps and recheck the grids for any missed evidence. REMEMBER, all scenes are three dimensional, never forget too look up too! Do not touch areas or articles which have the possibility of being processed for latent fingerprints.

Expand the search to the remainder of the building or scene. Personal notepads, diaries, phone books and answering machines or the tapes in them are good sources of information. Check the caller I.D. unit. Missing personal belongings or items that have been moved or removed may provide valuable information.

Searching for the Evidence

Searching should be continued for fingerprint, foot or shoe impression, other trace evidences.

Expanding the Search

Once the primary crime scene has been examined and the body has been removed, the investigators should take time to systematically check the remainder of the house, business, vehicle or location and carefully note items of evidence or conditions which may shed any additional light on the investigation. These can include;

- Doors, are they locked or bolted (from the inside or outside), are there marks of forced entry, does the doorbell work, is there a doorknocker, are there scratches around the keyhole, etc.

- Windows, what type, are they locked or unlocked, open or broken, note the type and position of curtains, drapes or blinds.

- Newspapers and mail, is the mail unopened or read or not, check the postmarks on envelopes and the dates of newspapers.

- Lights, which ones were on when the crime was discovered, how are they controlled, by timers, motion sensors or switches. Can they be seen from the outside. Are the bulbs broken or unscrewed?

- Smells, do you or did the first responding officer notice the smell of gas, tobacco, alcohol, perfume, gun powder or anything else unusual.

- Kitchens, was food being prepared, if so, what kind (it may or may not correspond with the victims stomach contents). Is there food that was partially eaten, utensils, glasses or plates?
    - Is the stove warm or still on,
    - Are there signs of attempts to burn or wash away evidence.
    - Are there signs of clean up attempts.

- Heating/Air Conditioners,
    - what type is it,
    - is it vented or unvented (carbon monoxide can kill).
    - What is the thermostat setting.

- Are there signs of a party, such as empty bottles (note the labels, brands, types of liquor, etc.) are there cups, glasses and what is their contents, how many are there, is lipstick on any of them, how many places are set at the table.
    - Note contents of ashtrays, cigarette packs and butts, brands, is there tooth marks or lipstick on them. Remember, DNA is easily obtained from the butts, preserve them properly.

- Contents of waste baskets and trash cans, has anyone been going through them looking for anything, is the trash in proper order (dates on newspapers, letters, etc.).

- Clocks and watches. Are they wind-up or electric. Are they running, do they show the right time, what time are alarm clocks set for. Check timers on VCR's, microwave ovens, etc.

- Bathrooms and vanities,
    - are towels, rags etc. damp to touch or dry.
    - are they bloodstained.

- Check for signs that the suspect cleaned up afterwards or was injured and bled at the scene.

- General disorder, is there evidence of a struggle, is the place just dirty, etc.

- Shootings, how many bullets were fired, account for all of them if possible, find cartridge cases (number and location found) if there are any bullet holes (number and location), was the weapon left at the scene. There may be expended cartridge casings found laying on the floor, rug or on furniture.
    - It is recommended to mark these items, after photographing them first, with numbered markers to prevent their being moved, altered or damaged. If necessary, they may be protected by placing water glasses over them.

- Stabbing and beatings, was the instrument left at the scene, could it have come from that location or was it brought to the scene by the suspect.

- Blood, document the location, degree of coagulation, type (spots, stains, spatters, pooling, etc.).

- Sketch and photograph the bloodstains.

- Remember, when a body fluid begins to decompose, it will discharge a reddish brown fluid which resembles blood, when describing this, be objective, call it what it is, a reddish brown fluid.

- Blood-spatter analysis may be used to reconstruct violent crimes. Carefully photograph all blood patterns using scales.
    - DO NOT cover up patterns with the scales if possible. Remember, always look up, cast-off spatter will probably be on the ceiling.

- Hangings and strangulation, what instrument or means was used, was it obtained in the house or brought to the scene, are there any portions remaining. If a suspected auto-erotic death, look for signs of prior activities such as rope marks on door frames or rafters.
    - Be prepared for scene re-arranging by ashamed family members.
    - Remember, do not cut the victim down if he/she is obviously dead until all aspects of the investigation have been covered.
    - Never cut through the knot and always use a piece of string tied to each end of the cut to re-connect the circle.

- Look at stairs, hallways, entries and exits to the scene, check for footprints, debris, discarded items and fingerprints.
    - Attempt to determine the route used to enter and exit the scene by the suspect and avoid contaminating it.

- Presence of items that do not belong there, many suspects, in the heat of the moment, will leave items of great evidential value, don't overlook this possibility.

- Are there signs of ransacking, to what degree, if any, has the scene been ransacked? Was anything taken (relatives and friends can assist in making this determination).

- Look for hiding places for weapons which the suspect may have had to conceal quickly, check behind stoves, on top of tall furniture, behind books, among bedclothes, under the mattress, on the roof.

NOTES

Dead body evidence checklist

- Thoroughly photograph everything before moving or touching anything
- Collect fragile evidence on the body
- Collect other types of evidence
- Remove hair, fingernails and other trace evidence. Place in waxed paper, bindle them, and place them in envelopes.
- Brush head hair and pubic region (if naked). Hold butcher paper under the area you are brushing. Book paper into evidence.
- Remove trace evidence from skin and clothing from entire body with scotch pads or lint rollers. Only use frosted tape. Take from face, hands, feet, legs, torso, pubic area and neck.
- Collect samples of pooled blood.
- Use Hemasticks to confirm it is actually blood
- Collect control samples (as close to the area as possible)
- Use cotton swab with one drop of distilled water on it. Place the swab in wax paper loosely and then place it in an envelope. Break stick if necessary.
- Place in freezer
- Collect exemplars
- Environment (vegetation, soil, maggots, other)
- Residence (carpet fibers, paint, misc. fibers, other)
- Vehicle (carpet fibers, seat fibers, roll the tires, vin number, wheel base)
- Animals (hairs, bedding)
- Collect blood samples from victim using "Sexual Assault Evidence Collection Kit" blood tubes
- Collect fingernail clippings. Use toothpicks if nails are very short.
- Swab bite mark areas
- Swab oral cavity
- Collect exemplar hairs

Evidence Presentation

Preparation for court should begin long before the court date. Crime scene examiners who fail to prepare properly should not be surprised when a skillful lawyer cuts them to shreds in the witness stand. The culmination of any crime scene examination is to describe in court observations made, actions carried out and evidence recovered. The crime scene examiner should never take the trial and their appearance to present evidence lightly.

Following is a list of tips which may assist an officer to deal with the daunting prospect of presenting crime scene related evidence in court.

Prepared – Be well-prepared for court by knowing your evidence well. Review your notes, photographs, case file and exhibits and try and anticipate any questions which might be asked.

Dress – Project a professional image by dressing professionally for court. Whether in uniform or plain clothes ensure your clothes are neat and clean.

Etiquette – Abide by the expected etiquette and rules of the courtroom.

Confidence – Be confident! If you know you did your best at the crime scene and whilst preparing for court you have the right to feel confident.

Knowledgeable – Know your subject! A little research or revision leading up to the court date will assist.

Demeanor – Be respectful to the court and the people asking you the questions.

Objective – Be objective and impartial when giving evidence by sticking to the facts. Do not speculate.

Responsiveness – It pays to pause occasionally before answering questions but not too often or for too long. The court expects a timely response to questions.

Clear and concise – Explain your answers clearly without needlessly over elaborating.

Explain in lay terms – Do not use technical terms which the court may have trouble understanding. If technical terms must be used you will need to qualify them with an explanation of their meaning.

Voice control – Your tone must be non-confrontation and the volume audible.

Body language – Be careful of your posture and body language. Do not shrug your shoulders or rock or slump in the chair.

Eye contact – Your responses should be directed to the judge or magistrate not the lawyer cross-examining.

Visual aids – Use charts or photographs to illustrate responses if you need to.

Limitations – Understand your limitations relating to what you can comment on and do not extend beyond that boundary.