Part TWO

Crime Scene Procedures, Techniques, and Analysis

Crime scene investigation is an important part of overall forensic science and criminal investigation. You could say that there are two aspects of overall crime scene investigation: crime scene processing and crime scene analysis. We will talk about both of them in Chapter 3.

Crime scene analysis is more complicated than crime scene processing, though processing is also to some extent dependent on analysis. Analysis implies that the scientific method—hypothesis testing—is used to help understand the events that occurred at the crime scene, to figure out what the relevant evidence is, and to work toward some kind of reconstruction. Overall crime scene analysis requires assimilating the data at the scene, collecting physical evidence and awaiting the results of its analysis, and often analyzing patterns at the scene. The results obtained in the investigation must also be factored in.

Many of the patterns found at scenes cannot be "collected," in the sense that they cannot be packaged and labeled. They can only be documented. We call those types of patterns "reconstruction patterns," and they are the subject of Chapter 4.

In Part Three, we will examine various physical patterns, like handwriting, fingerprints, footwear impressions, and so on. We will call those "individualization patterns" because the goal is to try to "individualize" the pattern, that is, figure out who or what was responsible for making it. The individualization patterns—those that are seen in connection with scene investigations—are discussed in Chapter 5.

Crime Scene Processing and Analysis

Outline

Processing Versus Analysis
Types of Scenes
Initial Actions and Scene Security
Steps in Scene Processing and Analysis
Scene Survey and Evidence Recognition
Scene Searches
Documentation
Collecting and Preserving Physical Evidence
Crime Scene Analysis and Reconstructions
Digital Evidence and Forensic Computer Science

Learning Objectives

- How crime scene processing is different from crime scene analysis
- The different types of crime scenes
- Initial actions at a crime scene
- Establishing crime scene security and reasons for maintaining security
- The steps in crime scene processing
- The process of evidence recognition based on hypothesis formulation
- The schemes for searching crime scenes
- The importance of and major methods for crime scene documentation
- Making notes
- Making sketches and types of sketches
- Technical and forensic guidelines for photography
- Videotaping crime scenes
- About the duty to preserve crime scene work product
- Different methods of collecting physical evidence and applicability to different categories of evidence
- Numbering and description of physical evidence from the scene
- Various types of packaging for different types of evidence
- Types of controls, and standards for each type of physical evidence
- Submission of physical evidence for laboratory analysis
- Crime scene analysis and crime scene reconstruction
- The difference between reconstruction and reenactment

chapter 3

Lead Case

State of Connecticut v. Duntz

In August 1985, the 234-year-old town hall in Salisbury, Connecticut, was burned down (see photo). The fire marshall searched the scene and determined that this fire was arson. Two local people, Earl Morey and Richard Duntz, were suspected of setting the fire. As the case developed, Morey decided to become a state witness and testify against Duntz on the arson charges. However, a day before Morey was set to testify, his body was found shot to death on the shores of a lake in the area called Long Pond.

The crime scene was investigated by the state police major crime squad and Dr. Henry Lee from the laboratory. A major storm was moving into the area from the west, and the investigators worked quickly to get to the crime scene and collect any available evidence before the rainstorm.

The physical evidence, laboratory and autopsy findings, and investigative information developed in the case included the following:

- Two sets of tire impressions were found at the scene. One set was consistent with a tire from Morey's car. A second set was on top of the first one, which was identified as having come from a tow truck. Service request records from the tow truck company showed that it was called to the scene to tow a disabled car at 7:30 A.M. This information indicated that the tire impressions of Morey's car were likely deposited the night before the tow truck was summoned.
- Two different types of shoe impressions were observed near the victim's body. One set of shoe prints had a parallel wave type of sole pattern that was identified as coming from the victim's own shoes. A second set of shoe prints had an unusual hexagonal sole pattern. A search of the laboratory footwear files showed that this pattern came from a FootJoy brand sneaker.
- A shoe print with the hexagonal design was found on the floor in the back of Duntz's van. The shoe imprint in the van had the same size and sole pattern as the shoe prints found at the crime scene. During a search of Richard Duntz's home, police were able to find a picture of Richard wearing the same brand of FootJoy shoes.
- Four spent cartridge cases were recovered from the scene. The head stamp showed that they were S&W (Smith & Wesson).
- Bullet holes and gunpowder residue were found in and on the victim's clothing. Green color paint deposits were found on his pants. A "nickel bag" of white powder was found in his shirt pocket. The white powder was identified as aspirin powder by Fourier transform infrared spectroscopy (FTIR) analysis.

Salisbury, Connecticut, Town Hall ablazed.

- A Red Devil chewing gum wrapper was found in his pants packet. Similar chewing gum wrappers were found in Richard Duntz's van. However, no positive linkage between the gum wrappers could be made.
- No gun was found during the police search. However, they did find an elastic belt with an impression of a weapon and a gun-cleaning kit. Laboratory examination of this gun impression showed that it could have come from 9 mm caliber weapon.
- Earl Morey's car was found in a parking lot with a large, fresh blood smear on the back left side panel. Serological analysis (this case happened before DNA analysis was routine) showed these bloodstains had the same blood and isoenzyme types as Morey. This fact indicated that the car was at the crime scene when Morey was shot.
- Fifteen latent prints were developed inside Morey's vehicle. However, none of them matched Richard Duntz's prints.
- Police searched Duntz's home and van but did not find any of the clothes that he was reportedly seen wearing on the evening in question.
- The dome light of Morey's car was found to be not working. Examining the dome light, an investigator found that the lightbulb was missing. During the search of Duntz's van, a lightbulb was found near the driver's seat. Toolmarks were found on the metal ends of the lightbulb during laboratory examination. Microscopical examination of toolmarks indicated that those toolmarks could have come from the metal clip housing of the dome light.

Autopsy showed that Earl Morey was shot three times. Three 9 mm bullets were recovered from his body. The bullets had been fired from a weapon with a 5- right twist. The firearms examiner was able to say that these bullets were more than likely fired from a Smith & Wesson Model 55, 9 mm pistol.

Information was developed through witness interviews that Richard Duntz in fact owned a 9 mm pistol. He fired the weapon into a tree in his friend's backyard in upstate New York for target practice. Detectives went to New York and removed a section of tree from the yard. The firearms examiner was able to recover several 9 mm bullets from the tree. Those bullets exhibited identical class and individual characteristics to the 9 mm bullets from Earl Morey's body.

Duntz's brother, Ronald, was arrested on drug charges. He later admitted that he sold a stolen 9 mm S&W Model 55 pistol to his brother, Richard.

A weapon of the same type was used for test fires and reconstruction experiments. The cartridge case ejection pattern helped to reconstruct the shooter's and victim's position relative to the tire mark at the time of shooting. Muzzle to target distance was estimated by comparing the GSR (gunshot residue) pattern on the victim's clothing with the test firing results at measured distances.

Based on the forensic testing results and physical evidence, police arrested and charged Richard Duntz with the murder of Earl Morey. The case went to trial in 1990. The jury found him guilty of the murder of Earl Morey, and he was sentenced to 60 years in prison. However, in 1992, the Connecticut Supreme Court set aside the verdict, stating that the warrants used to search Richard's home and van were not valid. In 1994, a second trial began and within days, Richard accepted a plea bargain and was sentenced to prison for 15 years. He died from a heart attack a year before his scheduled release date.

Processing versus Analysis

You can think of crime scene investigation as having two aspects: processing and analysis. There is no way to set out a "formula" for crime scene investigation. It requires a scientific (logical and systematic) approach, forensic science knowledge, and experience. Processing has some common guidelines that we will discuss. However, there is almost always some variation in the processing depending on the individual scene and case. And some analysis is necessarily part of the evidence recognition process. A series of fairly standard steps can be followed in processing most scenes.

Analysis depends on detailed observation, proper processing, and making logical connections. It also depends on the results of the laboratory analysis of evidence, analysis of scene patterns, and integrating all the data available from the scene and the investigation. In death cases, the data will include the findings and opinions of the forensic pathologist. Crime scene analysis and reconstruction is a distinctly scientific activity; that is, proper crime scene analysis roughly follows the steps of the scientific method itself (Chapter 1). It requires scientific background, forensic knowledge, and experience. This is the main reason some people have argued that crime scene investigators should be trained in forensic science and criminalistics. Except in a handful of jurisdictions, however, crime scene investigators are not usually forensic scientists; they are police personnel. Most crime scene investigators have learned their specialty through a combination of training and experience.

Television programming about forensic science in recent years would have you believe that the same people who do crime scene processing also do the laboratory analysis, interview witnesses, and investigate the case. This is almost never true. Most of the time, police investigators—sometimes with special training in crime scene investigation—do the crime scene processing. Laboratory analysts generally go out to scenes only rarely. There are some laboratory analysts with crime scene skills and experience as well as some crime scene investigators with considerable knowledge and experience. Sometimes, working through a scene is a collaborative effort between laboratory analysts and crime scene investigators. This tends to happen more often in major cases that have complicated scenes or special requirements.

Types of Scenes

Crime scenes can be classified in many ways, but just a couple will help us organize our thinking about this. The point here is that each scene should be approached a little differently. Actions at scenes may be affected by where the scene is located, how much control we have over the scene, weather conditions, what equipment and personnel are available, what type of case it is, and other legal or scientific issues.

Scenes could be classified broadly according to the type of crime. Remember that not every crime has a crime scene. Crimes like extortion, various "white-collar" criminal activities, and crimes like driving under the influence, prostitution, illegal activities using the Internet, dealing in controlled substances, and even some simple larcenies may not have scenes as such. The two major categories of criminal activities that do have scenes are property crimes and crimes against persons. Property crimes are primarily larceny, burglary, and auto theft. Person crimes are primarily assault, battery, sexual assault, robbery, attempted murder, and murder. Virtually all death cases occurring outside a medical facility have a scene, regardless of whether they are homicides, suicides, or accidental or natural deaths. Generally, person crime gets higher priority from police investigators. To some extent, the type of crime suggests looking for certain types of evidence. For instance, we would tend to expect semen or other biological fluid evidence in connection with a sexual assault investigation or scene, but not in connection with a robbery or larceny. As we will note again later, however, it is important to try not to overlook anything at any crime scene.

Scenes could also be classified broadly according to whether they occurred indoors or outdoors, and whether they are on public or private property. Indoor scenes have built-in protection from the elements; outdoor scenes do not and may require special setups to try to protect evidence. Further, evidence can be compromised or destroyed, by rainfall for example, before investigators even have a chance to look. Whether a scene is on public or private property, and whether it is a private home or apartment, or a place with a lot of human traffic, all have implications for the way the scene is handled. A scene in a public area of any kind may have experienced a lot of human activity before police or investigators arrive. In addition, these areas may be difficult to secure.

Another important matter that will seriously affect any resulting legal case arising from the scene is how the evidence is acquired. Do the investigators have the right to be at the scene? Do they have the right to seize any physical evidence without a search warrant? Do they have the right to take pictures, or to ask people who belong there or who own the premises to stand back? These are all questions with potentially complex answers that revolve around search and seizure law. Moreover, these laws vary somewhat from state to state. Note that any evidence collected or seized that is later found to have been collected or seized illegally will be inadmissible—and that inadmissibility includes all the laboratory findings associated with it. A blood or semen stain that is matched to a suspect through DNA typing will be of no value to the prosecutor if the stain was seized illegally.

Initial Actions and Scene Security

Police personnel are generally trained to "render aid and assistance" at a crime scene as their initial step, if this is applicable. Sometimes, however, protecting a victim, a police officer's partner, or the officer him- or herself from harm, in case a dangerous perpetrator is still around at the scene, is an even higher priority. Once the scene is deemed secure and injured persons have been assisted, initial responders' attention can turn to scene security. Rendering assistance may involve an EMS response. While taking care of injured victims is clearly the first priority, both police and EMS personnel should make an effort to do as little damage to the scene as possible. This could involve such actions as taking a single straight pathway in and out, not throwing bandage wrappers around at the scene, not cutting through obvious stab or gunshot

wound holes in clothing, and so on. These precautions do not waste any precious lifesaving time, and they can be very helpful in preserving scene integrity.

Establishing control and security at a scene may involve arresting suspects, detaining witnesses, removing people from the premises, maintaining crowd and vehicular traffic control, and so on, depending on the location and situation. **First responders** are generally on-site because they were called there, and their actions in establishing initial order and rendering aid and assistance are usually not legally questionable. As soon as the exigent emergency situation is resolved, however, police and investigators have to decide whether any subsequent activities are permissible without a warrant. The answer requires some knowledge of search and seizure law as applied to the particular situation.

first responder

The first police officer or investigator to arrive at and witness a crime scene, often a uniformed patrol officer.

First responders should notify their supervisors as soon as possible. Supervisors in turn must normally make the formal notification of the crime to the crime scene unit, the medical examiner, the prosecutor's office, and so on, in accordance with their training and the practices of the department.

If it is determined that investigators have the right to take control of the scene, a security perimeter should be established using tape, rope, or other barrier. The purpose of **crime scene security** is to keep out as many people as possible in order to preserve the integrity of the crime scene for detailed investigation. The extent to which a scene can be secured depends on where it is and the type of situation. In a residential setting, it should generally be possible to establish security. The more public an area is, the more difficult security may be. In some circumstances, such as on a busy street or highway, it may not actually be possible to truly secure an area, and investigators may have to work around the traffic and activity as best they can. It is well to remember that the initial security perimeter may have to be expanded, depending on what is found or what information is developed.

crime scene security

Limiting and controlling access to a crime scene and maintaining records of who was present.

Figure 3.1 shows a mnemonic designed by a police agency to help remind first and subsequent responders of their duties and responsibilities at a crime scene. The order of actions on the list is not necessarily the order in which they would be done at a scene.

Over the years, different authors have discussed various strategies about the best ways to keep people out of crime scenes who have no appropriate role there, and whose presence might introduce unwanted contamination. Anyone who must obey police directions can generally be prevented from entering scene security perimeters. But police and/or political superiors may be a more difficult problem. Collecting **elimination fingerprints** from anyone who enters a scene has been suggested as a potential deterrent. The prospect of having to provide a set of fingerprints to investigators might discourage someone from actually going into the scene. Today, collecting a buccal (inner cheek) swab from anyone entering a scene as a DNA profile elimination standard could also be in order and might provide additional disincentive. Taking a few initial photos or shooting a few minutes of initial video by one investigator to bring out and show authorized people is another potential strategy.

elimination fingerprints

A ten-print set of inked (or live-scanned) fingerprints from everyone who enters the secure crime scene area.

P roceed promptly and safely
R ender aid and assistance
E ffect preliminary notifications
L ocate witnesses
I nvestigate briefly and secure the scene
M aintain control
I nterview witnesses
N ote all conditions
A rrest suspects as appropriate
R eport fully and accurately
Y ield to continuing investigation

Figure 3.1
Mnemonic guide to preliminary steps at crime scenes.

First responders and/or follow-up investigators should gather the names and contact information of witnesses and others who may have information. They should also make notes about other potentially relevant matters, such as vehicles parked in the area, and so on.

It is worth noting here that some crimes can have more than one scene. For example, a victim might be assaulted at one location and forced into a vehicle, then taken to another location and assaulted further. In that event, there are scenes at both the locations, and the vehicle is another scene.

It is also worth distinguishing between a crime scene and what is often called a *dumpsite*. The crime scene is where the initial actions took place, and the majority of physical evidence is expected to be found there. A dumpsite usually refers to a secondary location where a body has been left, often well after and some distance from the criminal events. Less physical evidence may be expected at a dumpsite compared with that at an actual crime scene.

Steps in Scene Processing and Analysis

The steps in crime scene processing are briefly described here, then discussed in detail in separate sections, except for the final one which does not require further elaboration.

1. Scene Survey and Evidence Recognition

scene survey

A preliminary walk-through and look at the overall scene to try to establish the type of scene, note any transient physical evidence, and get a first impression of the relevant physical evidence.

evidence recognition

Determination of which physical evidence items and/or patterns are relevant to the case as opposed to being part of the scene background.

Once the scene is under control (as much as it is going to be), any injured persons have been properly cared for, and the area is safe, the first action is to conduct a quick **scene survey** with special attention paid to potentially transient evidence. Transient evidence refers to evidence that is easily destroyed or compromised. A footwear or tire impression that could easily be inadvertently driven on with a vehicle or stepped on by someone is one example. Another example is a pattern of objects at the scene that may be destroyed if people start moving things around. The second aspect of this survey is recognition of the potential evidence. **Evidence recognition** is the hardest thing to teach because it depends so much on experience and is least amenable to any prescribed protocol. There are always a lot of things at crime scenes. The objective is to figure out what is relevant to the investigation and what is background.

2. Scene Searches

scene search

A detailed, systematic search of a crime scene with the objective of noting every condition and every relevant item of physical evidence.

Several commonly used "formula" methods are used to conduct searches. They are discussed later. The **scene search** method chosen depends on the type of scene and how much area it covers. A large outdoor area thought to contain a shallow grave would not be searched the same way as a house, for example. The primary consideration is to be thorough. Crime scene processing is a onetime thing—many times there are no second chances. It is often said "two searches are better than one." The point is that investigators want to ensure that the scene has been completely searched before releasing it.

3. Documentation

documentation

Creation of a detailed, complete record of a crime scene, including notes, sketches, photographs, and possibly audio- or videotape.

The next step is **documentation.** Three or four different methods of documentation must be used to ensure a thorough record. The methods commonly used are notes, sketches, photographs, and video. Investigators should create a detailed record of the scene itself and of all relevant evidence that was recognized. A perfectly documented scene would enable someone to reconstruct (at least in their minds) every detail of the scene in proper perspective at some later time. One reason documentation is so important is that many patterns cannot be collected in the "bag and tag" sense but

only by documentation. Documentation is one of the key duties and responsibilities of crime scene investigators.

4. Evidence Collection and Preservation

Once the documentation steps have been completed, the physical evidence items recognized as relevant and appropriate for collection, packaging, and preservation can be placed into appropriate, properly labeled containers.

5. Release of the Scene

When investigators are satisfied that they have thoroughly documented the scene and associated evidence, and that they have recognized and collected where appropriate every relevant item, the scene can be released. Once a scene has been released, it is usually not possible to go back and collect anything else, because whatever it is, it may have gotten into the scene between the time of release and the time the scene is revisited. There is no longer a direct chain of custody from the original scene. Evidence found and/or collected after a scene is released could well be later ruled inadmissible by a court.

Scene Survey and Evidence Recognition

As noted, this step is the most dependent on the experience and training of the crime scene investigator. The ability to recognize potential evidence separates the most successful crime scene investigators from the crowd. Besides experience, the investigator should use a scientific approach and conduct a preliminary scene survey in order to recognize and identify the potential evidence. Figure 3.2 shows this logic. Analysis of the scene and formation of an initial working hypothesis of what happened is the first step. There may be a few alternate versions of the initial hypothesis. As observations are made and data are collected, the hypothesis should be revised and refined to incorporate all the data. The data also include witness statements and other investigative information, but investigators should gauge the reliability of this information in giving it weight in the formation and revision of the hypothesis.

It is important to keep an open mind as the investigation proceeds no matter how "open and shut" the case first seems. Problems that come up later in many cases occur because the investigators initially lock on to one theory of the case, and then have to turn reality wrong side out, because subsequent facts or findings fail to support the theory and it is considered too late to backtrack.

The scientific method	Crime scene analysis/ reconstruction
Data/observations	Data/observations/witness statements
Hypothesis	Hypothesis
Experiments	Testing hypothesis against the scene pattern information/ investigative information
Hypothesis testing	Further testing hypothesis against the lab and/or the medical examiner results
Theory	
More experiments	Possible experiments concerning evidence
More theory testing	Formation or origin
Best theory	Reconstruction (best theory)
Natural law	

Figure 3.2
Crime scene analysis and the scientific method.

working hypothesis
An initial theory about what may have happened in a case based on observation of the crime scene; properly formulated, can generate predictions about physical evidence that are testable during the investigation, laboratory, and medicolegal stages of analysis.

At the scene and in the early stages, the **working hypothesis** or theory should guide investigators as they look for evidence and a proper direction for the investigation. Investigators should continuously test emerging findings and facts and revise the working theory as necessary. It is important to realize that the final version of the theory cannot be formulated until investigators, the lab, and the medical examiner (if it is a death case) have all completed their work.

Sometimes, it is necessary to do some experiments to refine the theory to its final form. Blood spatter is one example of a pattern that investigators and/or forensic scientists may have to try to replicate before deciding what may have happened at a scene. Gunshot residue (powder residue) patterns are another. Note that doing an experiment and replicating the pattern does *not* show that the experimental protocol is *what actually happened* at the scene. It only shows that the patterns *could have* been formed in that way, and that the experimental protocol represents a reasonable, demonstrable, scientific basis for this element of the theory.

Scene Searches

As noted earlier, conducting searches can be done in several ways. Figure 3.3 shows four different methods: zone or quadrant, grid or strip, contracting and expanding circle, and double grid.

Zones and grids may be best for larger, outdoor areas. Strip searches can be used anywhere, but they are probably most effective when visibility is not too good, such as in an area with a lot of foliage. The contracting or expanding circle and spiral patterns are applicable to a few specific situations. The zone method is ideal for indoor or vehicle searches. You might say that the evidence drives what is sometimes called the "link" search method. For example, finding a dead body that has a gunshot wound suggests looking for a gun. If the thinking is that someone from outside the location came in, did the shooting, and left, you would next logically be looking for pathways of entry and egress. Thus, "link" searches are driven by the working hypothesis of what happened in the case. Investigators should keep in mind that there is a possibility the working hypothesis is wrong, however, and that would suggest doing a systematic search of the scene before releasing it to be sure not to miss anything.

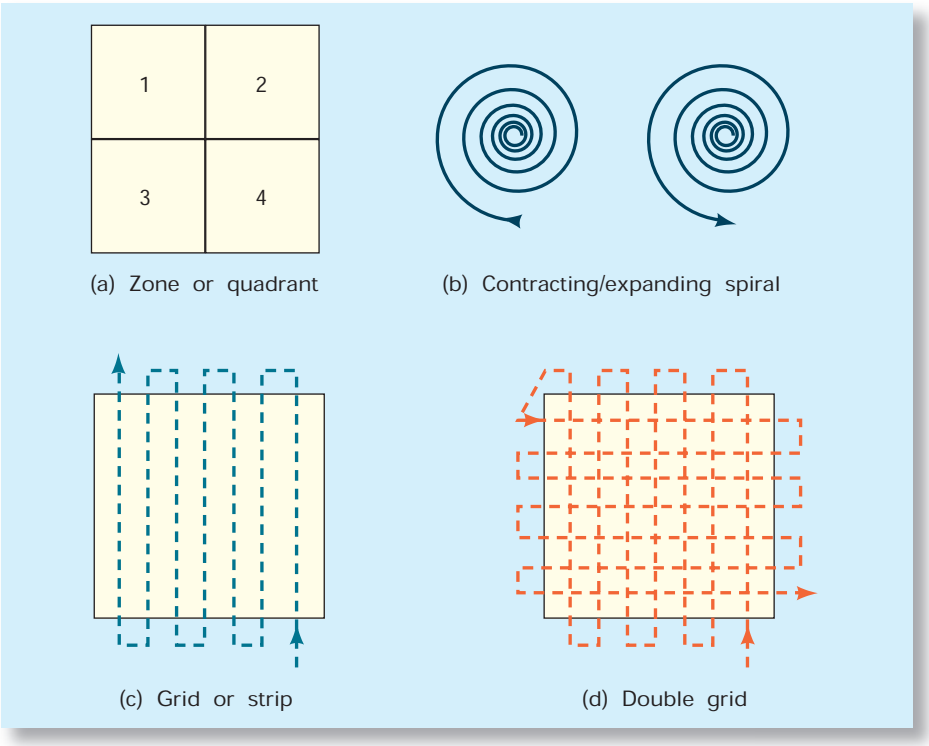


Figure 3.3
Four Common Search Patterns: A: Zone or Quadrant, B: Contracting or Expanding Spiral, C: Grid or Strip, D: Double Grid

Documentation

The classical methods for crime scene documentation include notes, sketches, and photography. They are all still necessary. Today, we can add audio recording as a potential means of taking some notes or recording information. And we can add video recording as an additional method of scene documentation. Note that video recording does not replace or serve the same purpose as still photography.

Every piece of documentation should include the following information: date, time, location, case number, person making the record, and, in the case of evidence items, a description of the item, and the item number assigned to it. In the case of sketches, there may be a sketcher and a measurer. Both names should be listed.

Notes

notes

Written or audiotaped records for documenting a crime scene that contain information such as initial conditions, names and contact information for witnesses, license plate numbers of vehicles in the vicinity, and that may be constructed to include scene security logs, photo logs, and evidence logs.

Notes are in part a way of documenting anything that cannot be photographed, sketched, or video recorded. It is important, however, to take notes about everything at the scene, including things that will be sketched, photographed, or videotaped. Investigators typically take too few, not too many, notes. Some of the crime scene "logs" discussed in the following may be considered notes. Usually, notes are written, but they can be taken using an audio recorder, too. Investigators should not consider photography, sketching, or videotaping a substitute for good note taking.

The importance of first responders making notes on initial scene conditions cannot be emphasized too strongly. Often, the initial responders are first on the scene and the only ones who observe it in close to its original condition. Little details can become important later. Are doors locked or unlocked, open or closed? Are windows open or closed? Are there any odors or other ephemeral features? First responders should make notes about the scene as soon as possible after they arrive while everything is still fresh in their memories.

Notes are often used as the basis for preparing a more formal written report later. All investigators should ensure that their notes support all the statements made in their final written report. Notes should be kept in bound notebooks and retained at least until the case has been fully adjudicated.

Several logs should be made at crime scenes, and these may be considered part of the notes, since they are written documents that record information. It is good practice to have a security log, showing who was at the scene and approximately when they came and went. Some authorities go so far as to suggest that people should sign in and out every time they enter the secured area. Others have suggested that a continuously running video record of the overall scene and the activities taking place within it (discussed later in this chapter) can serve as a security log. A photo log should be kept, and should, at a minimum, record what photos are taken. Some authorities have suggested keeping detailed records of the photographic settings used for each photo. Modern cameras used in fully automated mode render that sort of record keeping moot. The cameras can also be used manually, however, and then it would be possible to record all the camera settings. The most important thing is to have a good log of all the photos taken. Along with the photo log an evidence log should also be kept. A scene checklist should also be used to ensure that all major tasks are completed before the scene is released.

Sketches

sketches

Drawings of scenes with measurements or to scale, depicting the correct spatial relationships between scene fixed points and evidence items.

Sketches show the exact locations of all the buildings, streets, and permanent fixtures, as well as everything else that is at the scene, including the physical evidence that will be seized. Sketches provide information that photographs and video cannot because distortion of distances and locations caused by photographer/videographer location and perspective.

There are two general types of sketches: rough, or preliminary; and smooth, or finished. Figure 3.4A and B shows examples of each. Rough sketches are made

Figure 3.4A

Rough sketch made while at scene with important measurements and descriptive data.

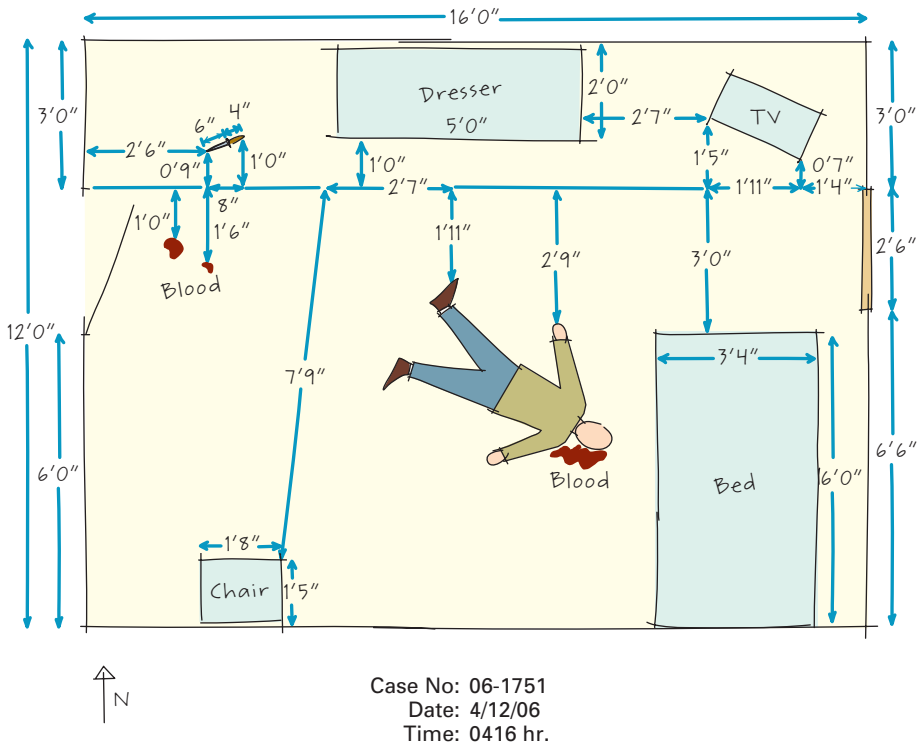
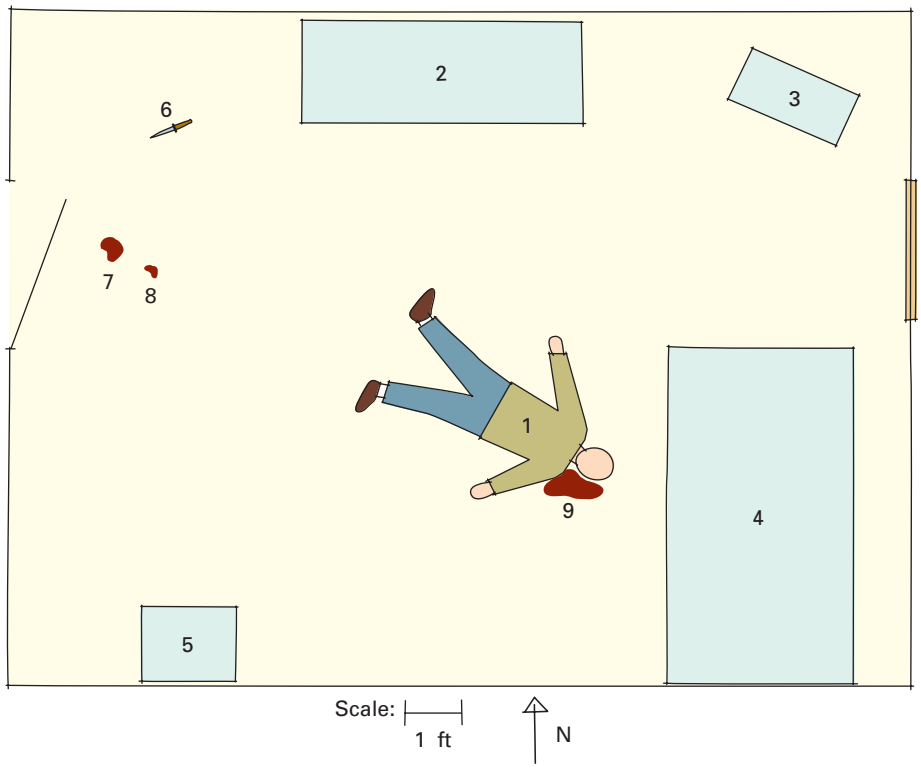


Figure 3.4B

Smooth sketch is a more refined sketch prepared later, containing the same information, but to a scale, and with nonessential features eliminated.



1	Body
2	Dresser
3	TV Set
4	Bed
5	Chair
6	Knife
7, 8, 9	Bloodstain

Case No: 06-1751
Date: 4/12/06
Time: 0416 hr.
Location: 150 W. Main St.
Sketcher: R. Johnson
Measurement: G White

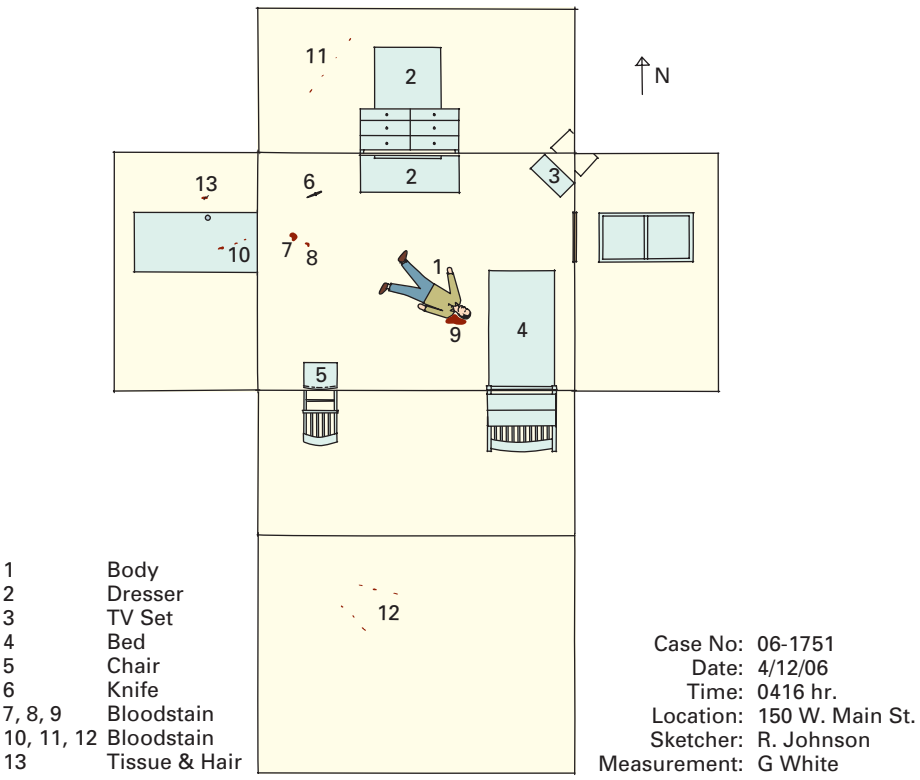


Figure 3.4C
Cross projection sketch, allowing features in a three-dimensional environment, such as a room, to be presented in a two-dimensional sketch.

at the scene, during processing. They are usually not to scale and contain measurements within the sketch. A smooth sketch is prepared later from the data contained in the rough sketch. Smooth sketches are drawn to scale. The scale should be indicated on the sketch. There are no measurements shown in the smooth sketch, because it is drawn to scale, and items or objects that are not relevant to the case are usually omitted.

Although we talk about crime scene sketches as if there were one sketch, in fact there will probably be a whole set of sketches, showing different scales and perspectives. One sketch might show the location of a house in relation to the street, for example. The next might show the whole house floor plan. Another could show a second story or basement floor plan. Another might show a floor plan of the garage. And there will be sketches that show the details for the rooms or areas in which most of the action occurred and/or in which most of the evidence seems to be located.

The type of sketch that can be used to show three-dimensional character and features, if necessary, is called a **cross-projection sketch,** and it is most easily envisioned using a rectangular room as the scene. Think of the room as a box. Then think of slitting open the seams of the box at its edges and folding it open to make a pattern of flat rectangles, each representing a wall, the floor or the ceiling. Figure 3.4C shows an example. This type of sketch could be used to show the location of bullet holes or blood patterns on walls or a ceiling, for example. Although many sketches will be "floor plans," it is sometimes necessary to sketch and record a vertical dimension, that is, how far from the floor something is. A blood pattern on a wall is one example.

cross-projection sketch
Sketch of a three-dimensional room or structure in two dimensions, by "collapsing" the walls and ceiling flat in the sketch.

To make a sketch, the dimensions of the scene have to be measured. In addition, methods have to be used to determine the exact location of objects and evidence items. Taking measurements that provide an exact location for objects can be done in three ways: the triangulation on two fixed points method; the

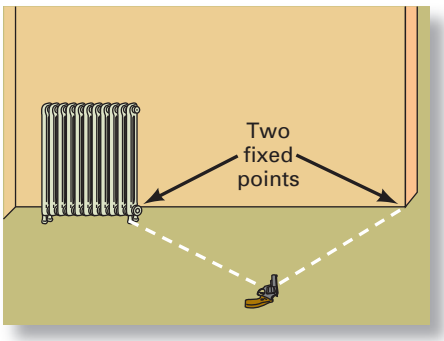


Figure 3.5A
Location of an item (gun) using fixed points in the scene (triangulation).

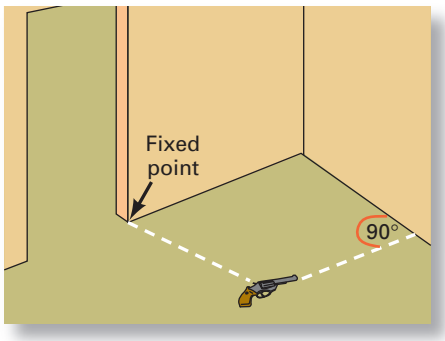


Figure 3.5B
Location of an item (gun) using a single fixed point and a 90-degree wall at the scene.

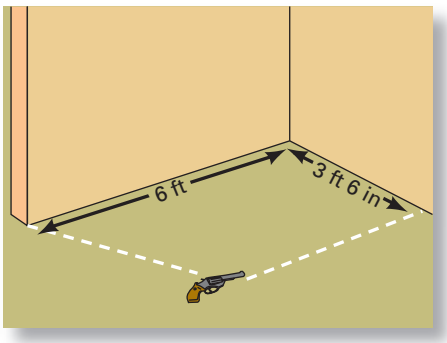


Figure 3.5C
Location of an item (gun) using measurements on an XY axis drawn in the scene sketch. This method depends on the presence of walls or other objects oriented 90 degrees to one another.

single fixed point with 90-degree walls method; and the XY axis method. Figure 3.5 shows how they all work.

The triangulation method may sometimes be the only useful method at an outdoor scene. The XY axis method requires that some fixed point be selected to represent the starting point (X = 0, Y = 0), and that the imaginary axes be oriented at 90 degrees to one another. Sketch preparers should be careful to select as fixed points objects or features that are not likely to move or disappear, in case reference has to be made to them later.

It isn't necessary to be an artist to make a good sketch. The point is to record the scene on a scale drawing. Various vendors sell templates to help sketch preparers draw objects, furniture, and so on into the sketch. When doing the finished sketch, the preparer should pick a scale that is logical for the area being sketched and for the level of detail that is necessary. The same scale will probably not be used for all the sketches in the series. For example, you might be able to show the street, the house and the driveway on one page with a scale like 1 inch = 25 feet. But in a sketch of a room whose real-life size is 8 × 12 feet containing a body and many items of evidence, you would be more likely to use a scale like 1 inch = 1 foot. Information that is not to scale may sometimes be included in a finished sketch if it is relevant.

Every sketch should show magnetic north on the drawing. A compass is an essential item in a crime scene processing kit. That way, all references to direction can be in absolute terms, rather than saying "left, right," and so on.

Some computer-based accident and crime scene sketch programs are now available to assist with producing accurate diagrams to scale. These require a bit of learning, but they can make sketching much easier. Hand notes should still be kept and used to verify the accuracy of the sketch produced. The cost of global positioning satellite (GPS) locators has also come down in recent years, and GPS could be useful in producing scene sketches with absolute location references.

Photography

crime scene photography

Technically proper photography of a crime scene for purposes of complete documentation.

Crime scene photography can be thought of as having two aspects: technical and forensic. The technical aspect has to do with a person's understanding of and skills in photography. The forensic aspect has to do with making good decisions about which pictures to take to accurately and appropriately capture the necessary details of the scene and physical evidence.

Technical Aspects Photographic equipment consists of **cameras, lenses,** and film. Today, the issue of digital versus analog cameras is also a factor. Digital photographic technology has improved so much in recent years that it may soon be the only type of photography commonly used. The strictly technical aspects of taking pictures can be divided into lighting, sharpness, and exposure.

camera

An analog or digital device equipped with a lens and capable of recording images on film or an electronic storage medium.

lens

An optical component of a camera that focuses light onto the recording medium (film or digital recorder); "standard" lenses with a 50 mm focal length provide a "normal eyeball" view of the subject, "wide angle" lenses provide more peripheral views, and "telephoto" lenses provide closer but narrower views.

Many different types of cameras have been used in crime scene photography. For practical purposes, cameras can be divided up into five categories: "point and shoot," instant Polaroid, 35 mm, 4 × 5, and digital. All of them except digital cameras use film as the recording medium.

Traditionally, the value of "point and shoot" and instant Polaroid cameras is ease of use. Anyone can take pictures with them with no training or photographic knowledge. An additional advantage of Polaroid cameras is the instant results. If the picture doesn't come out as expected, you know it immediately and can take another one. Digital cameras also offer the advantage of instant results. The 35 mm camera has been by far the most versatile available. The "35 mm" in the name refers to the size of image on the film. These cameras come in a wide range of models, with many lenses available, and a range of possible features. For years, the 35 mm was the camera of choice for general crime scene photography work. Most 35 mm cameras have microchips in them that allow them to be set fully automatic, shutter-preferred, f-stop preferred, or fully manual. Each operational mode has its value under different photographic conditions. The main point is that these cameras allow the photographer maximum control over the conditions. Some knowledge of photography—beyond the thumbnail sketch we are providing here—is necessary to make the most efficient use of any modern camera. A few scene photographers have used large format (4 × 5) cameras. Their advantage in crime scene photography is in photographing larger-size patterns or items of evidence. Because the film is larger, the image size on the film is larger, and there is less "compression" and loss of detail going from life-size to negative (and back again when the negative is printed). Better digital cameras resemble 35 mm cameras, although the image capture device is significantly smaller in most cases. Higher-end digital cameras, with interchangeable lenses, offer the greatest versatility, and their prices continue to come down. Many digital cameras offer significantly better performance than Polaroid or "point and shoot" cameras. In the last few years, digital photography has improved so dramatically that the choice between traditional film (analog) and digital cameras and images is now more a matter of preference.

Resolution is a major factor in digital photography. It is generally stated in megapixels. The higher the number, the higher the theoretical resolution (and probably, the more expensive the camera). Individual image resolution is generally stated in a "A × B" pixel format, where A and B are pixel numbers. The higher the numbers, the greater the resolution and the larger the image. Higher-resolution images can be printed in larger and larger sizes without loss of clarity. At the higher numbers there is less "compression." There are also various formats for digital images, such as .gif, .jpg, and .tif. Digital photographers need to understand these formats in terms of how much they "compress" the original image (with a potential for loss of detail), how large they are, and so on. Computer programs like Adobe Photoshop can convert digital images from one format to another, as well as adjusting many properties and parameters of the image.

Digital images are typically stored in the camera on some sort of card that slides into a slot. These cards come in different total capacities, usually stated in megabytes (mb). The more images or the larger the images one wants to store at a time, the larger the capacity of the card should be. Images from the card can be downloaded to a computer with a card reader or directly from the camera by way of a cable. Generally, digital images are fairly large and occupy quite a bit of disk or storage space. This factor has to be considered if many digital images must be stored for long periods. Another important consideration with crime scene images is backup provisions, in case something happens to the original images. Some people have suggested that the integrity of digital images will tend to be suspect because they

can be manipulated using computer programs such as Photoshop. However, digital image and photography experts have made great strides in developing methods to ensure that the images are original and to detect images that have been tampered with. Use of these strategies is very important in digital crime scene photography, because any manipulation of an image could potentially be viewed as an attempt to misrepresent evidence. There may be circumstances, however, where computer-based manipulation of an image—for example, to improve the contrast between a footwear impression and the background—would not really be any different from using traditional photographic techniques to do the same thing. The important factor in such a situation would be honesty about what was or was not done.

As noted earlier, lighting, sharpness, and exposure are the key technical elements in taking good photographs. They are equally important.

For crime scene photography, front lighting is virtually always preferred. Back and side lighting are generally reserved for special situations. That is one of the reasons we suggest using flash all the time. In low-light situations, the flash should provide adequate illumination for a good image. Even in daylight, shadows can be a problem (such as taking a picture of something in the shade under a tree). The flash tends to "fill" in the shadow and correctly illuminate the subject of the photo (hence the term "fill flash"). Backlighting is almost always a problem. In extreme situations, like having to try and take a photo looking into a setting sun, you may have to wait until the sun has set to get the picture. One important exception to the "front lighting is best" rule is in photographing three-dimensional impression markings (indentations), such as footwear or tire impressions in soft earth (Chapter 5). Here, side lighting (usually with a flash unit) provides the best image, because a slight amount of shadow illuminates the pattern detail. A series of exposures with the flash at different angles is generally recommended. Photographing reflective surfaces also requires special lighting techniques.

Sharpness of a photographic image is a function of two factors: having the camera properly focused, and holding the camera still while the lens is open. Many automatic cameras have autofocus; that is, with normal objects and conditions, they can focus without operator intervention. But if problems occur, the autofocus may have to be turned off, allowing manual focusing. The second factor is holding still. This factor becomes important when exposure times are slower. Under those circumstances, it is recommended to use a tripod.

Exposure is the most complicated element, because it is a function of two parameters that are separately adjustable on nonautomatic cameras: the f-stop, and the exposure time. The **f-stop,** or f-number, indicates the amount of light that will be allowed to reach the film or image capture device by controlling the **lens opening.** The exposure time is the amount of time the lens is open and is usually expressed in fractions of a second. The larger the lens opening, the smaller the exposure time can be to admit the same quantity of light. One other factor that has to be considered, however, is called **depth of field.** Depth of field is greater as the f-number is greater (i.e., as the lens is closed down more and more). You can think of depth of field as a range of distances from the lens where everything will be in focus. Narrow depth of field might mean that only objects between 6 and 12 feet will be focused, whereas wider depth of field might have almost everything in view in focus. How much depth of field is needed for a picture depends on what is being photographed and what needs to be in focus. A picture depicting an overall view of an outdoor crime scene should have a lot of depth of field—everything should be in focus. Depth of field may be less important in photographing a bloody footwear imprint on a flat surface. The photographer has to choose the f-number partly out of consideration for depth of field.

f-stop/lens opening

A selectable parameter on a camera that defines the amount of light entering the lens.

depth of field

A photographic term describing the distance behind and in front of the subject that is in focus; inversely related to lens opening.

Forensic Aspects The forensic aspects of crime scene photography have mainly to do with selecting the correct subjects and objects to photograph in order to do a good job of documenting the information contained in the scene. This will vary for different types of evidence and from scene to scene, but there are some guidelines to follow.

Figure 3.6A
Highway crime scene showing a vehicle and a body (overall shot).

Figure 3.6B
Same scene as in figure 3.6A but closer to the vehicle and body (intermediate distance photo).

Figure 3.6C
Same scene as in figures 3.6A and B, but close-up to show auto license plate. Other close-up shots are also possible.

It is generally good practice to photograph the overall scene and subscenes proceeding from the bigger to the smaller—overall, midrange, close-up, as is often said (Figure 3.6). Sometimes, even aerial photos of an overall scene, taken from an aircraft or from atop a cherry picker, are needed. In some less extreme situations, use of a stepladder can improve the perspective.

Once the overall scene and subscenes (such as smaller areas, rooms, etc.) are photographed, the evidence must be photographed. First, the evidence items that have been identified for collection and packaging should be photographed in their original location (Figure 3.7). A label or number plates or markers may be placed next to an item at a scene.

The photographer should take a picture with and without this marker (the one without the marker is to document the item in place before any possible tampering takes place). These photographs, along with the sketches, should permit the original location of any seized item to be reconstructed accurately. It is very important to

Figure 3.7
Expended cartridge case in car on driver's side with evidence number marker.

have good photographs of patterns that will not or cannot be collected or otherwise preserved. These may be "crime scene" patterns (Chapter 4), or they may be imprints or impressions that will not or cannot be actually collected. For patterns like tire tracks, footwear impressions, and so on, the photographer should take care that the film plane of the camera is parallel to the plane of the floor or ground. A tripod should be used for these kinds of shots. Multiple photos and bracketed shots are a good idea for these evidence items to ensure that there is a good picture.

There are a few other guidelines. For most evidence photos a scale (ruler) should be included in the picture—to show the size of the item and, in some cases, to show how far it is off the floor or ground (Figure 3.8). It is again good practice to take a photo of an item without the scale and another one with the scale. Using flash, which we recommend, tends to "wash out" the numbers and markings on white scales. Scales that are gray, yellow, and so on, are available to avoid this problem.

As we've already mentioned, the date, time, location, photographer, and so on should be noted, and, with film, investigators must keep track of the separate rolls. One strategy for "labeling" rolls of film is to use the first frame to take a picture of a paper or chalkboard containing the basic data and a label like "roll 1," "roll 2," and so on. This strategy could be followed with digital images, too, as long as all the images are ultimately kept in one "location," such as on one CD-ROM.

Video Recording

Video recording of crime scenes has been feasible for a number of years since the technology became affordable. Several different types of video cameras are available, mainly differing according to what type of media they use (VHS, 8 mm, etc., or digital).

videography
The use of a video recording device, in this context, to document a crime scene.

Videography has several potential roles in crime scene documentation. It can be used as a stationary "monitor" of all the people and activities at the scene, acting as a sort of activity and security log. More often, a scene is video recorded as another means of documentation. This type of video can be used to show others who weren't there the overall layout of the scene, evidence locations, patterns, and so on. "Others" could be forensic scientists at the laboratory, pattern analysts, and sometimes the jury at a trial.

Some considerations in crime scene video recording include whether to narrate, whether to have the date/time stamp turned on in the image, and how much video to take.

Figure 3.8A
Fired bullet on ground near tire with evidence number marker.

Figure 3.8B
Fired bullet on ground near tire with scale in place.

Some authorities suggest no narration and not having a live microphone during video recording. Their primary argument is that the microphones are too sensitive and pick up comments and remarks that may later seem inappropriate or insensitive. The argument for narration is that it orients the viewer and helps in understanding the video record. The narration should be slow and monotonic. References to direction should be absolute (north, south, etc.).

If the date/time stamp is on, it should be adjusted to be correct. The clock should also be synchronized with other watches at the scene so that all recorded times will be consistent.

How much video is taken depends on the primary purpose. If it is used as a silent "monitor," there may be many hours of tape. As a straight scene documentation device, one to several hours of tape may be shot. The longer the camera must be held, the more the videographer may need a tripod or monopod to help steady the camcorder.

Generally, the "overall, midrange, close-up" formula can be followed with video, just as it is with still photography. The videographer should avoid rapid camera movement and excessive zooming in and out, because these things detract from the quality and usefulness of the video record.

Rapidly advancing recording techniques may mean that "virtual reality" holographic scenes captured forever may become routine.

Duty to Preserve

In connection with the products of crime scene documentation (notes, audiotape, sketches, photographs, videotape, digital video or images, etc.), it is important for investigators to realize that there is generally a **duty to preserve** these materials and recordings for a long time. How long depends on the individual jurisdiction, but at a minimum most jurisdictions want the materials preserved until the "case has been adjudicated." If this means the first trial that yields a verdict, the time could amount to a few years. If it means until all the appeals in the case are exhausted, the time could exceed the investigator's life span. The courts have fairly consistently taken the position that the original documentation should be preserved for examination by defendant's counsel and/or experts, and for later reexaminations of the case on appeal. Another important reason for preserving documentation and records is the increasing revisitation and reinvestigation of cases by cold case units.

Thus, there must generally be arrangements for storage and archiving of various crime scene work products.

duty to preserve

An obligation imposed by courts on law enforcement agencies and personnel to preserve certain audio and video recordings for a specified length of time.

Evidence Collection and Preservation

After scene and evidence documentation is complete, **evidence collection and preservation** is the next step in crime scene processing.

Generally, physical evidence is collected and preserved because it will be submitted to a forensic science laboratory for analysis, but some physical items may be collected for other reasons. An example might be suspected stolen property. As noted elsewhere, some patterns may not be physically "collectible," so adequate documentation and/or preservation is particularly critical.

At death scenes, the medical examiner or coroner generally takes charge of bodies and some of the items associated with the body (clothing, etc.). Investigators should follow departmental procedures in notifying the medical examiner of a suspicious death and abide by accepted protocols in obtaining evidence associated with bodies. Often, detectives may attend the autopsy to see if the medical examiner can determine a tentative cause and manner of death, and to provide the medical examiner with additional information about the scene. Final determinations may require completion of the investigation, microscopic tissue examination, completion of toxicology tests, and so on. Clothing and other items associated with the body are generally turned over to investigators by the medical examiner for submission to a

evidence collection and preservation

The actual seizing and packaging of physical evidence items for submission to a forensic science laboratory in a manner that ensures integrity of the evidence, and/or documenting scene patterns that cannot be physically collected.

forensic science laboratory. In some cases, a sexual assault evidence kit may be taken postmortem, as well as trace evidence collected from the body and sent to a forensic science laboratory for analysis.

Collection Methods

Several methods can be used to collect physical evidence at scenes. The first, and the one that we recommend whenever possible, is to collect the evidentiary item intact. Collection of intact items is possible with many items and objects. Sometimes, such as with evidence on floors, walls, or other immovable things, it may not be realistic to collect the entire item intact. In those cases, investigators have to use sampling methods—that is, a sample of the evidence must be removed from the item on which it is located (often called the "substratum"; plural, "substrata"). These **evidence collection techniques** include:

evidence collection techniques

Methods used to collect evidence when the intact item or item containing the evidence cannot be seized; usually includes using forceps or tape lifts at scenes; shaking, scraping, and vacuuming may be done in the laboratory or as last resorts.

- Use of forceps
- Tape lifting
- Shaking
- Scraping
- Vacuuming

Forceps and tape lifts, and occasionally, vacuuming may be used in the field (i.e., at a scene) under appropriate circumstances. But it is not advisable to shake or scrape items outside the laboratory, because traces of evidence could easily be lost. In connection with blood/physiological fluid stains, cutting, swabbing, or scraping can be used, as explained in detail in Chapter 9.

If investigators use forceps, they should be sure that the forceps are clean, and, if necessary, new forceps should be used for each evidence sampling to avoid any contamination. The word *sampling* implies that there are many items or a lot of evidence, and that the investigator is going to collect a representative sample. The key word is *representative*, and this activity may require some experience and judgment. Sometimes, all the evidence may be collected, as in the case of one or a few fibers or hairs. In other cases, sampling will be necessary, as in the case of a medium-velocity blood spatter pattern. The evidence pattern or deposit pattern may help guide investigators in their sampling.

Tape lifting can be a useful method for collecting evidence. It has the advantage of being thorough. But investigators should understand that the tape can sometimes cause problems for laboratory personnel trying to remove the evidence from the tape for examination.

Shaking and scraping are different versions of the same thing and generally apply to trace or materials evidence on clothing, or other similar items that can be processed in this way. This method should be used in the laboratory by forensic science personnel.

Vacuuming should be considered a last resort. Here, a vacuum cleaner hose is fitted with an in-line filter device in which the filter can be readily replaced and the system can be cleaned thoroughly in between uses. The principal drawback of vacuuming is that it collects every bit of trace and material ever deposited on the item, much of which probably has nothing to do with the case. A trace evidence examiner is then required to sort through hundreds of items on the vacuum filter to try and figure out what may be relevant.

It is good practice to thoroughly document the location of any evidence on an object or item before any collection technique is employed.

Numbering and Evidence Description Methods

Items collected at scenes or in the laboratory are generally given numbers and brief descriptions on the packaging and in the evidence log. There is no universal rule for numbering evidence. Each investigator or department should develop a thorough and

consistent protocol, and stick with it. Obviously, the numbers and descriptions on the packaging should match those on the evidence log. It is best to use a numbering system acceptable to the forensic laboratory that will receive the evidence, thereby avoiding the lab having to renumber the items.

Signs or markers may be placed next to evidence items at scenes to help document their original locations. The number on the sign or marker must also match the number used on the packaging and in the log.

The identity of many items being collected at scenes is obvious, such as "beer bottle," "knife," "pair of shorts," and so on. In those cases, investigators should just use the name of the item as a description. It is wise to avoid adjectives that impugn value to an item in an evidence description—thus, "yellow metal ring" rather than "gold ring." With some items, investigators may not actually know the identity, such as with a suspected dried bloodstain. In those cases, descriptions like "bloodlike substance" or "reddish-brown stains" can be used to avoid being challenged in court about how the investigator "identified" the material or substance.

Evidence packaging should include the number and description of the item, as well as the case number, date, time, and name of the collector.

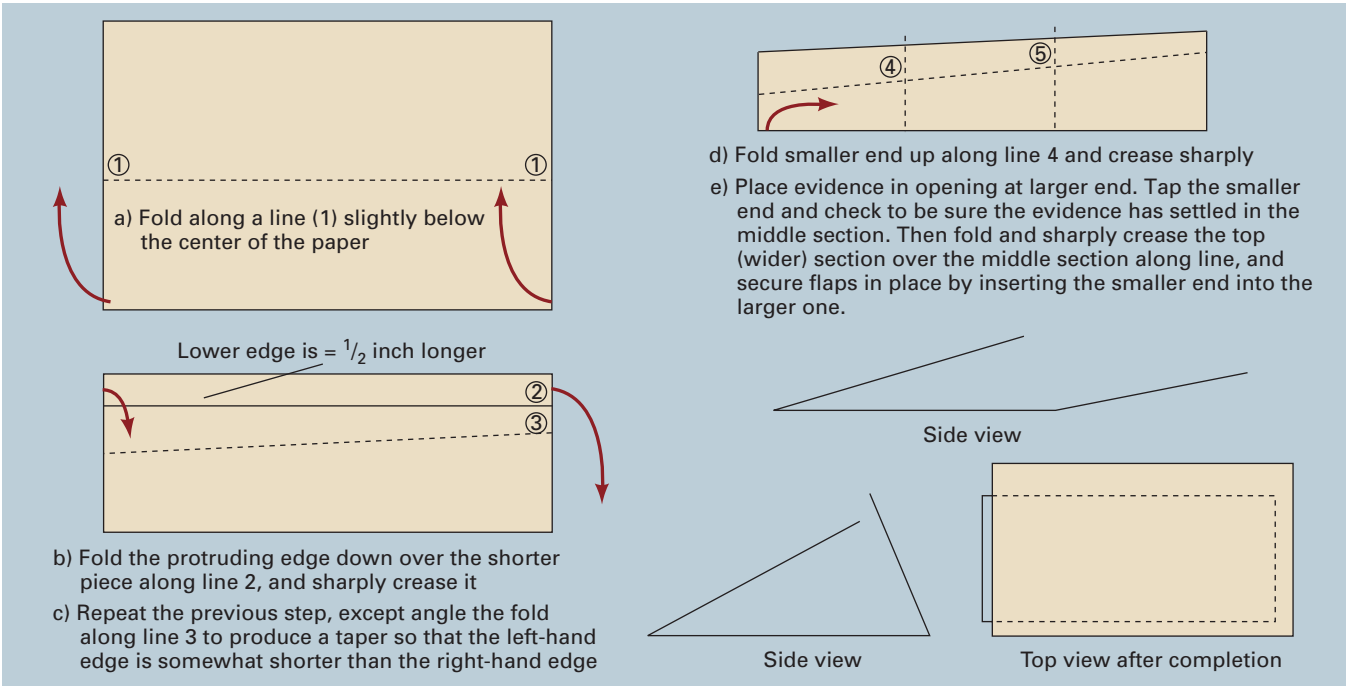
Packaging Options

Most evidence packaging is common sense, but there are a few principles to be followed. The majority of evidence items will be packaged in paper containers or evidence bags. The size of the container should be proportional to the size of the evidentiary item.

For most small items, particles, and objects, we recommend a "druggist fold" package as the primary container. A *druggist fold* is nothing more than a way to fold a piece of square or rectangular paper, so that it forms a leakproof container for particle- or powder-type material. It can also be used as a primary container for fibers or hairs. Figure 3.9 shows the making of druggist fold step-by-step.

Any piece of paper can be used for a druggist fold, and the size should be determined by the quantity of evidentiary material to be packaged. The use of

Figure 3.9 **The Steps in the Preparation of a Druggist Fold to Contain Loose Trace Evidence.**



laboratory weighing paper for evidence collection is recommended, however, if it is available and the right size. This paper tends to resist having particles and powders stick to it or absorb into it. Otherwise, any clean white paper can be used. Although the druggist fold is intended not to leak, small evidentiary items like powders, particles, or fibers may work their way out as the package is handled and transported. Accordingly, the druggist fold should not be used as the *only* container of the evidence. The druggist fold containing the evidence should be placed in an appropriate *secondary* container to ensure that the evidence will not be lost. For blood or physiological fluid evidence, the secondary container must be paper and must not be airtight (see Chapter 9). For nonbiological evidence (see Chapter 13), the secondary container could be a plastic Ziploc bag.

Plastic Ziploc bags are suitable for many types of solid evidence items. The only major exception is biological evidence, which should be packaged in paper containers after thorough drying to avoid putrefaction and degradation. Plastic containers have the advantage that the contents can be seen without opening the container. Packaging is usually sealed at the scene with tamperproof evidence tape and not opened again until a laboratory examiner does so. We suggest that lab examiners open the package at a different location, preserving the original seal, if possible. The lab examiner can then reseal the package with tamperproof tape. This way, both seals are intact when the packaged item is presented in court.

Paper containers do have the disadvantage that you can't see into the container. There are paper containers on the market that have cellophane "windows." Paper containers must always be used with biological evidence.

A few other types of containers are used in special situations. With fire debris thought to contain ignitable liquid residues (see Chapter 11), clean paint cans with tight-sealing lids are used as containers. Liquids should be packaged in glass vials of appropriate size. Sometimes, boxes are used to contain weapons, multiple fragments of broken glass, and so on. Investigators should be certain that firearms are rendered safe before packaging. If a firearm or other weapon is found in water, it is recommended that it be left in the same water, that is, placed in a suitable container and covered with the water, for transport and submission to the lab. If items are fragile, steps should be taken to ensure that additional breakage does not occur during handling and transport.

Proper Controls and Comparison Standards

controls

In general, required to ensure that a laboratory test is working properly or to permit a proper comparison; the major types important in forensic investigations are blank, known, and alibi known.

Controls are very important in forensic testing. Without the appropriate control, it may not be possible to do an examination or to draw any useful conclusions. Investigators are generally responsible for seeing to it that controls are collected and submitted to the laboratory. The required controls differ to some extent depending on the type of evidence.

There are generally four different types of control and comparison standards that might be important in forensic testing of evidence: knowns, alibi knowns, and blank controls, and substratum (background) comparison specimens. Some of these specimens must be collected at the scene or in connection with evidence collection and processing. Investigators need to know which ones are required for which types of evidence. Traditionally, the substratum (or background) comparison standard has been called a "control." Strictly speaking, however, it is not a control, because a control is a specimen with a completely known or defined history. Thus, it is better called a comparison specimen. Remember, as noted earlier, one may not be able to return to a scene after its release, so the collection of all required control and comparison specimens the first time through is critical.

Known (Exemplar, Reference) Controls Many types of forensic tests discussed in this book involve comparisons between a questioned (evidentiary) specimen and a known specimen (whose origin is known with certainty). The known (which

may also be called the exemplar, or the reference) is essential for the comparison. Examples are known blood (or a buccal swabbing) from a person (for comparison with DNA types from evidentiary blood or body fluid specimens), known fibers from a carpet (for comparison with evidentiary fibers from a suspect's clothes), and known paint from an automobile suspected in a hit-and-run case (for comparison with a paint smear transferred onto a bicycle). Depending on the type of case and type of evidence, the known may be submitted along with the questioned specimen, or at a different time.

Alibi (Alternative) Known Control An alibi (alternative) known is the same as a known control, but from a different source. Police might suspect, for example, that soil on a suspect's shoes is from an assault scene. Soil from that scene would therefore be the known control. But the suspect says the soil came from cutting through a muddy field nearby. Soil from that field would then be an alibi known in the case.

Blank Control A blank control refers to a specimen known to be free of the item or substance being tested. Scientists use blank controls as negative controls (generally along with positive controls) to be sure tests and test chemicals are working properly. Investigators usually do not have to worry about blank controls.

Substratum Comparison Specimen The term *substratum* refers to the underlying material or surface on which evidence is found or has been deposited. The term *substrate* is sometimes used for the same purpose, but for technical reasons is less desirable.

comparison specimens

In general, required to ensure that laboratory test results will permit a proper comparison; for certain evidence, substratum comparison specimens are necessary.

As noted earlier, this specimen has in the past been termed a "control." But strictly speaking, it is not a control, because its history is not known. With most blood and physiological fluid evidence (Chapter 9), arson accelerants (Chapter 11), and various types of materials or "trace" evidence (Chapter 13), investigators must remember to collect a sample of the substratum separately from the evidence in order to permit the analyst to interpret the scientific tests and make comparisons properly.

Typically, the substratum comparison specimen is subjected to the same testing as the evidence (which is on the substratum already) to make sure it is the evidence giving the test result, and not the underlying surface material.

Generally speaking, when intact items that have blood or other biological stains on them are collected, an unstained portion of the item can be used as a substratum comparison specimen. If investigators cannot submit an item with biological stains intact, and must use one of the sampling methods discussed previously, then they must take care to collect substratum comparison specimens.

Laboratory Submission

For evidence items that are to be submitted to a forensic laboratory, generally a specified "evidence submission request form" of some kind must be completed. The form has basic case information, date and time of incident, name(s) of victim(s) and suspect(s), type of incident, name and contact information for the submitting agency and investigator(s), and a list of items submitted. There may be space for a brief description of the case facts. Investigators are often required to specify what examinations or tests they want done on each submitted item.

If investigators and the laboratory that receives the evidence can agree on a numbering system, the lab submission sheet may become a de facto "evidence log." This saves the lab from having to renumber all the items and reduces the possibility of clerical errors when many items are submitted.

In major cases involving many seized items that require laboratory analysis, meetings between the investigative team and the laboratory team are recommended.

Crime Scene Analysis and Reconstructions

As discussed, crime scene analysis involves theory building and ultimately reconciling all the scene and investigative information to attempt to arrive at a "best theory" or reconstruction of what happened in the case.

Laboratory Analysis and Comparisons of Evidence

Laboratory personnel conduct analysis and comparisons of all the relevant evidence submitted in cases. This analysis can take considerable time and can involve multiple sections of the laboratory. Analysis of specific types of evidence is discussed in the chapters that follow.

Investigators should appreciate that many laboratories are underresourced for their caseloads and, as a result, have backlogs. It may be useful to discuss the facts of the case with a criminalist. This strategy can help focus on the most important items of evidence, and on the most relevant testing, and help avoid testing and analysis that has no clear purpose in the specific case. Good judgments, good choices, and good decisions in the examination of evidence from cases are key features of good criminalistics. The ability to make these choices and decisions wisely usually requires experience and insight, but it distinguishes forensic scientists from other laboratory scientists. Effective communication between crime scene and laboratory personnel is also an important factor in the process.

Medical Examiner's Reports in Death Cases

In death cases, there will be a report from the medical examiner, often detailing the findings at an autopsy. Toxicological analysis of blood and possibly organs and other fluids from the decedent are typically incorporated into the pathologist's report.

The medical examiner or coroner has the legal authority to rule the circumstances of a death: homicide, suicide, accidental, natural, undetermined. A cause of death is also stated when it can be determined. Final determinations may be delayed until the results of the investigation are complete and the toxicology is complete.

Reconstruction: Putting It All Together

reconstruction
Formulation of a "best theory" of a set of events in a case based on consideration of all the available evidence and information.

Conducting a **reconstruction** requires that all the data in the case be available. Thus, the final reconstruction cannot be completed until the laboratory report, the medical examiner's report, and all the investigative reports have been completed.

You can think of a reconstruction as forming the "best theory" of events in the case. This best theory will derive from hypotheses that have been formulated along the way and refined as more data become available. Remember that the best theory has to be able to explain all the data. If a theory is developed too quickly, later facts can make it look untenable.

In these times, especially if a case is even potentially high profile or "media worthy," there is often considerable pressure on investigators, police officials, and prosecutors to offer too much speculation too early in the case. It is generally better to wait for all the data before formulating a final theory of the case.

It is also important to realize that there are three types of reconstructions: complete, partial, and limited. There is rarely enough reliable data to actually discover every detail about what happened. Thus, reconstructions must be restricted to those facts that the data support, and scientists and others must understand the limitations of any reconstruction.

As noted earlier, experiments are sometimes done to try to duplicate some event that is hypothesized as part of a case reconstruction. Experiments are perhaps most common in cases involving blood spatter patterns or distance determinations from gunshot residue patterns. It is important to understand, though, that experimental duplication of a scene pattern does *not* prove that events at the scene happened exactly as in the experiment. It only shows that the theory is scientifically reasonable and that events *could have* happened in that way.

Finally, reconstructions do not always have to involve a big series of events or a lot of complexity. Some reconstructions are quite simple and have to do with one item or one event in a case. For instance, a contact transfer blood pattern on the knee of a pair of pants shows that the wearer knelt in blood (we might even know whose blood, based on DNA testing). That might be an important factor in the overall case.

Reconstruction versus Reenactment

Sometimes, efforts are made to reenact the events of a case after the fact. This exercise can involve computer animations, or even go so far as to employ actual actors and videotape or film.

It is important to understand, as we have tried to make clear in the foregoing section, that reconstructions are almost never complete in space and time and detail. Thus, a **reenactment** is by definition speculative and usually only partially supported by reliable physical evidence analysis.

Scientific criminal investigators should be appropriately cynical about reenactments of past events supposedly based on witness statements, and they should not be drawn into participating in this kind of activity without a full understanding of the limitations and potential to mislead. It is critical to consider *all* the available evidence, including the results from the forensic laboratory, in developing any reconstruction or reenactment.

reenactment

A hypothetical rendition of a set of events at a crime scene partially based on a reconstruction theory, but with all the "blanks" filled in to make a smooth, continuous story.

Digital Evidence and Forensic Computer Science

A rapidly emerging subdiscipline in the forensic sciences has to do with "digital evidence" and the valuable information it can provide to investigations. Digital evidence includes computers of any type (desktop, laptop, palmtop, handheld, etc.), phone answering devices, cell phone logs within the device, pagers, and so on. Many devices in our everyday lives record and retain digital records of various types, and these can be valuable in many investigations. More and more, larger departments are training investigators to be specialists in recognizing, handling, and deciphering the information on computers and digital devices. The digital devices must be looked upon as part of the crime scene, or as valuable separate evidence, and must be processed with the same care.

Gleaning investigative information from computers can be looked at as a sort of two-tier process. Investigators can be trained to extract readily decipherable information from someone's computer, such as looking at their files or their browser history of Web sites visited. If information is password protected, or has been "deleted," it may still be extractable, but the knowledge and techniques required are more complicated and require computer scientists.

Still another aspect of this area involves criminals who use computers and the Internet to commit various crimes, ranging from trying to lure children into chat rooms or even to actual face-to-face meetings, to every imaginable sort of financial fraud and victimization. Some larger departments, and some federal agencies, have trained special investigators to actively pursue the perpetrators of these activities. There is also no doubt that computers, the Web, and cellular devices can and have figured in terrorist activities.

Summary

Crime scene investigation includes processing and analysis. They are not the same thing. There are guidelines for processing, but they must be adapted to different scenes. Analysis follows the scientific method: formulating a hypothesis, and using data from the scene, lab, medical examiner, and investigation to refine it.

Scenes can be classified in various ways, but none is perfect. It is important whether a scene is on public or private property, and it is essential for investigators to know whether they have a right to be at a scene and process it without obtaining a search warrant.

First responders should protect themselves from harm, render aid and assistance as necessary, and then establish security. The initial perimeter of a scene may have to be extended as new information becomes available. A crime scene is a location at which a criminal event happened. A dumpsite is the location of a body, or perhaps a vehicle. Dumpsites typically have less evidence.

Steps in crime scene processing include an initial survey, thorough search, documentation, evidence collection, evidence submittal to a laboratory as appropriate, and release of the scene. During the initial survey, hypothesis formulation should begin. The hypothesis will help guide further steps. There are systematic methods for searching scenes, but the most important thing is to be thorough. Documentation of a scene is accomplished by notes, sketches, photography, and sometimes video. All are necessary. There should also be security logs, photo logs, and evidence logs. Sketches made at a scene are "rough." They are later revised to scale as "smooth." Several techniques are available for locating the position of evidence within a sketch. Crime scene photographers must be technically competent. The most important technical things to consider are lighting, sharpness, and exposure and depth of field. But crime scene photography is primarily documentation. Overall, mid-range, and close-up is the usual order of taking photos. Taking photos with and without scales or evidence markers is recommended. Scales must be readable. Video can act as a security log. It can also provide a method for documenting scene patterns for experts to examine later. And it may be played in court if there is a trial. Courts in many jurisdictions have specified that law enforcement must preserve audio- and videotapes until cases are fully adjudicated, including appeals.

There are several methods of collecting evidence. The best one is collecting the intact item with no tampering or sampling. If that is not possible, sampling with forceps or sticky tape may be considered. Vacuuming is a last resort method, and scraping should not generally be done in the field. Evidence items must be named and numbered in a consistent way. Biological and trace items can often be collected in a druggist fold. Biological evidence must be packaged in paper containers (nonairtight). Evidence should be sealed by the collector and be marked with the date, case number, name of collector, and name and number of the item.

Important control and comparison specimens for evidence items are known, alibi known, blank, and substratum. Investigators must be aware of what these are and when they need to be collected and submitted along with the evidence.

Major cases can involve evidence that is not submitted to the lab, laboratory analysis of submitted items, medical examiner's reports on victims in death cases, and all the scene documentation and investigative information. It may be possible to partially reconstruct the events from all this information. Reconstruction is the "best theory" of what happened. It is often incomplete, and because it is a theory, cannot be proven. Reconstruction is not the same as reenactment.

Digital and computer evidence has become more important in investigations in recent years. This may involve extracting data from actual computers, but it can also involve pagers, cell phones, PDAs, phone answering devices, and other appliances that record information.

Key Terms

first responders (p. 63)
crime scene security (p. 63)
elimination fingerprints (p. 63)
scene survey (p. 64)
evidence recognition (p. 64)
scene search (p. 64)
documentation (p. 64)
working hypothesis (p. 66)
notes (p. 67)
sketches (p. 67)
cross-projection sketch (p. 69)
crime scene photography (p. 70)
camera (p. 71)
lens (p. 71)
f-stop/lens opening (p. 72)
depth of field (p. 72)
videography (p. 74)
duty to preserve (p. 75)
evidence collection and preservation (p. 75)
evidence collection techniques (p. 76)
controls (p. 78)
comparison specimens (p. 79)
reconstruction (p. 80)
reenactment (p. 81)

Review Questions—Short Answer

1. What is crime scene processing versus crime scene analysis?
2. What are some types of crime scenes? What are the implications of the different types of scenes for crime scene investigators?
3. Describe the steps in crime scene processing and analysis.
4. What are the purposes of the initial scene survey?

5. What are some types of scene searches and to what kinds of scenes are they applicable?
6. What are the main kinds of scene documentation, and why is each necessary?
7. What are some ways of locating evidence items on a sketch?
8. What are the important principles of crime scene photography?
9. List and briefly discuss some methods for collecting physical evidence from scenes.
10. What are the main types of controls that must be available and/or used for the lab to be able to properly test physical evidence?

Fill-in-the-Blank & Multiple Choice

1. Photographs of crime scenes must include overall views, midrange shots, and _____, to properly record the details of the scene and object.
2. The rough sketch that is usually prepared at a crime scene is used to
   a. help identify the victim.
   b. reduce the number of photos.
   c. precisely locate evidence.
   d. help visualize the scene.
3. All unauthorized individuals should be _____ a crime scene during its processing.
4. The three most common, and classical, methods for documenting a crime scene are (1) _____, (2) _____, and (3) _____.
5. The best method for collecting evidence items from a scene is
   a. tape lifting
   b. submit intact the item that contains the evidence
   c. vacuuming
   d. using sterile forceps

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