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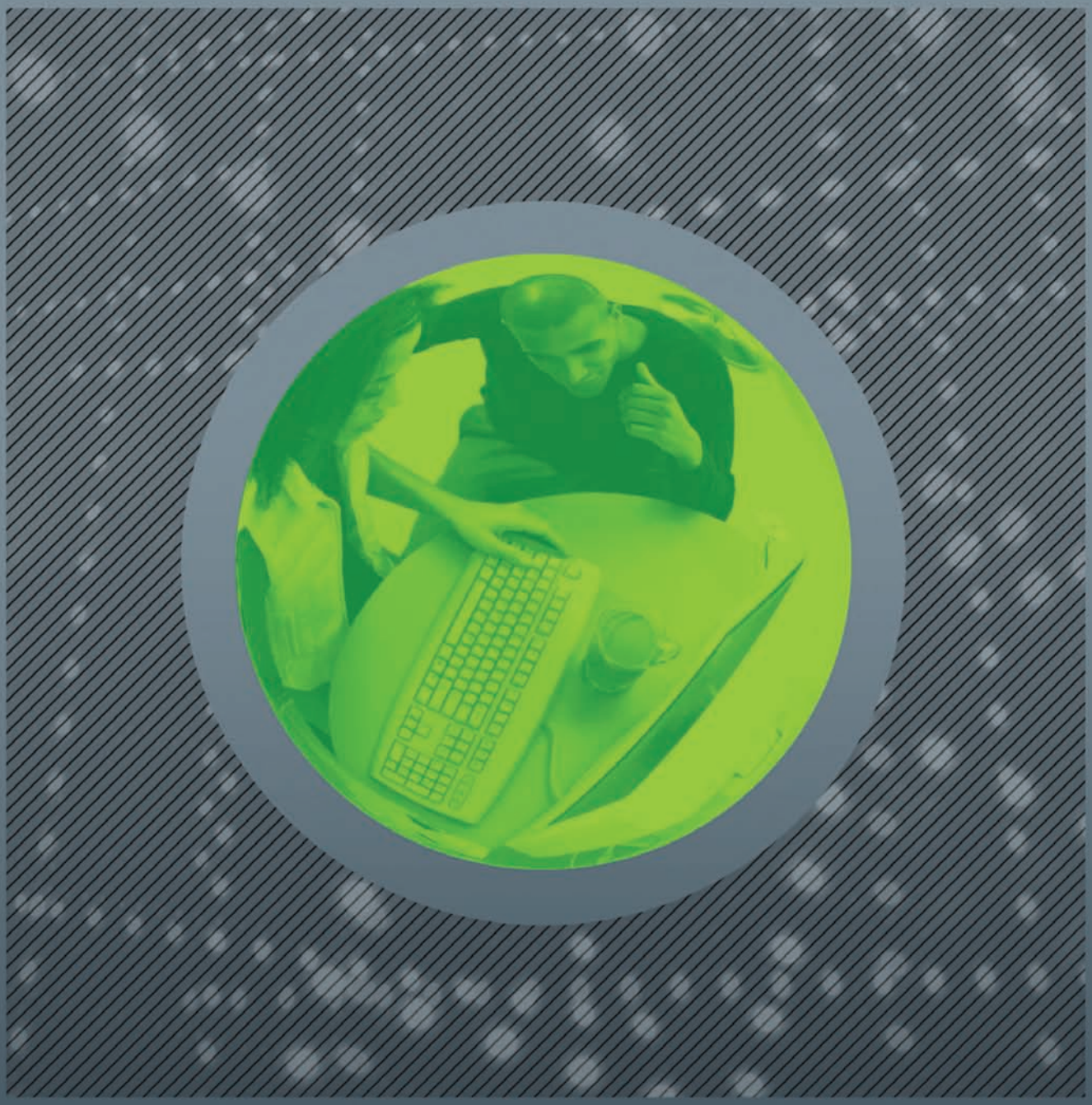

Forensic Science
From the Crime Scene to the Crime Lab
Richard Saferstein
Second Edition

ALWAYS LEARNING™

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be found at a crime scene. However, this example clearly demonstrates that a complex set of techniques and considerations are involved in studying each piece of evidence.

The example of cartridge case ejection patterns also raises the specter that an attempt at reconstruction can fail. That is, the movement of the shooter, the number of shooters, and the number of bullets discharged will produce multiple cartridge cases in various locations, introducing complexities into the analysis. These complexities may not be as easy to resolve as they would in a reconstruction involving a single cartridge case. When such complexities arise, some investigators fall into the trap of reading too much into evidence that may not provide resolution. The fact is, reconstruction may not be able to answer all of the questions. The complexities of the analysis may overwhelm the reconstruction team and prevent them from coming up with plausible answers.

FORMING THEORIES FOR RECONSTRUCTION

The final steps of crime-scene reconstruction require the reconstruction team to bring together all the evidence and information to form plausible theories and a plausible sequence of individual events. Theories can suggest how a group of linked items was created by individual events at a crime scene.

Often the beginning and end of the sequence of events at a crime scene are obvious to the investigators. For example, a tool mark or a footwear impression can mark the site of forced entry into a house, beginning the sequence of events at the crime scene. Footwear impressions or tire impressions leading away from the house may show the exit of the suspect from the crime scene and thus the end of the sequence of events. However, the sequence and timeline of the remaining events may be much more difficult to determine. Sometimes the evidence that signifies the start or end of events provides clues to the missing events in the middle. For example, suppose an investigator finds bloody footwear imprints exiting a crime scene. Logic dictates that blood was present at the crime scene, and that it somehow became deposited on the shoes of an individual who subsequently left the crime scene. These clues can provide suggestions about where the reconstruction should focus its attention.

All available information and evidence must fit into the overall picture. When creating a crime-scene reconstruction, the team must focus on the issues at hand and use all the information that is not in dispute to create a framework in which to explore definitive events.

An **event timeline** will list each event or "moment" that occurred at a crime scene in various probable orders within a known or estimated time frame. Some reconstruction teams develop an event timeline chart (see Figure 2). Investigators should chart each sequence and include information on evidence to illustrate how each event could have occurred and the timeline in which they occurred. Once the various orders have been identified, each sequence should be tested against the evidence.

event timeline
The end product of crime-scene reconstruction that shows the possible sequence of occurrences at the crime scene and the known or estimated time period in which they took place.

Quick Review

- In order for physical or testimonial evidence to be used in reconstruction theories, the chain of custody of items and the integrity of testimonial evidence must be established.
- Individual items of evidence are first analyzed and tested separate from all other evidence; items should not be linked or grouped together during the initial phase of the investigation. Once all items have been evaluated this way, they may be coupled with other items of evidence that are clearly linked.

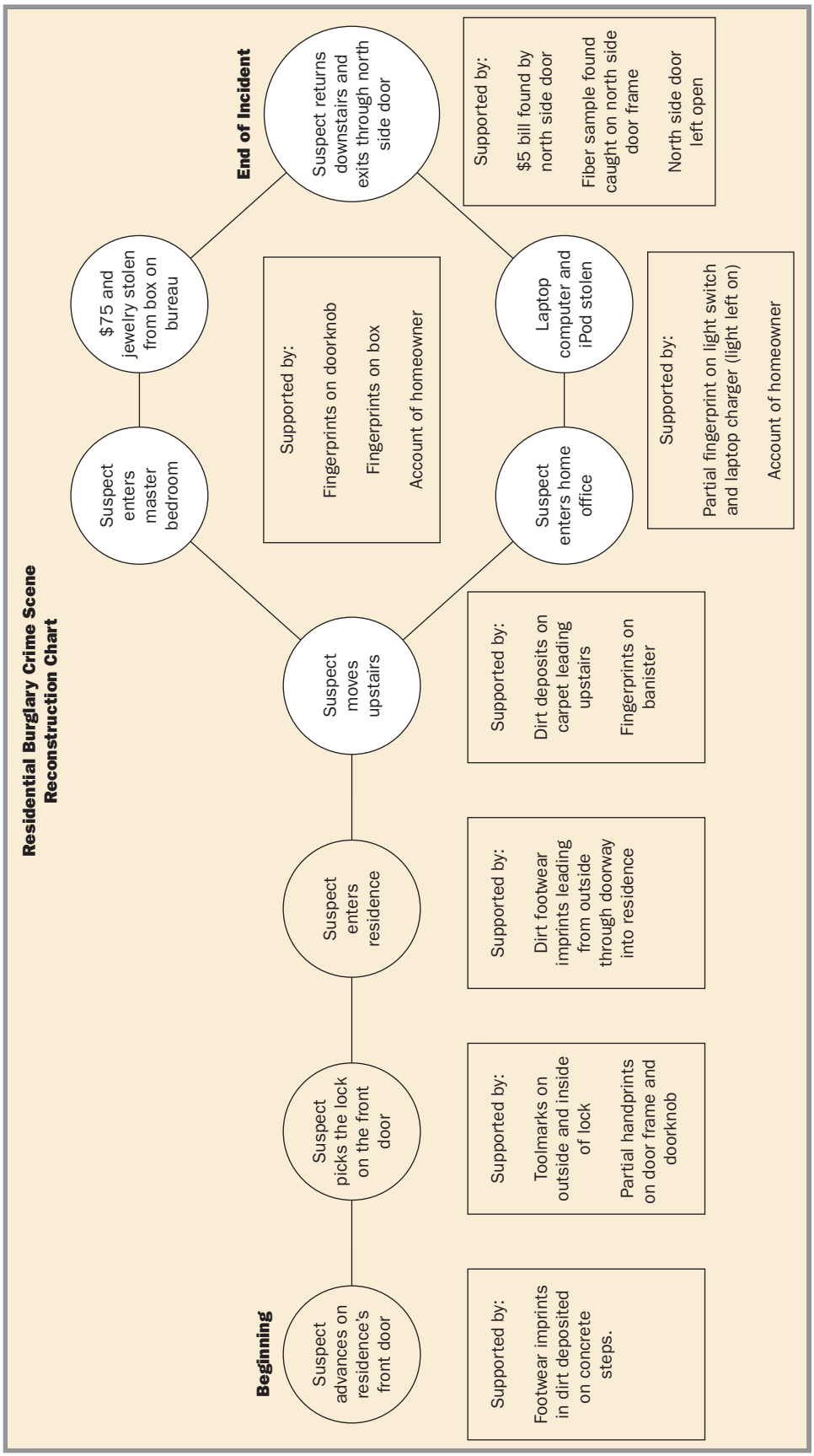

FIGURE 2 An example of an event timeline chart for a residential burglary. At one point two possible sequences of events are shown. Each event contains a list of evidence that supports the event's occurrence and sequence.

- Different categories or types of crime-scene evidence have to be studied with very specific techniques and considerations during the investigation. The kinds of evidence that may be found at a crime scene are highly diverse, and knowledge of techniques for processing each is needed to recover all pertinent information.
- The reconstruction team must bring together all the linked groups of evidence and information to form theories about how each group of linked items was created by individual events at a crime scene.

CHAPTER REVIEW

- Because crime-scene reconstruction develops a likely sequence of events at a crime scene with physical evidence, testimony, and reenactments, proper documentation and collection methods must be used for all types of evidence.
- Investigative personnel may bring some expectations or biases to reconstruction, and these can have a negative effect on the process. It is, therefore, very important for personnel to practice objectivity, or professional distance.
- The processes of deductive reasoning, inductive reasoning, and falsifiability are very important to the reconstruction process, but they must be differentiated and used properly.
- Investigators must be aware that the fallacies of bifurcation, generalization, and false linkage can impede a search for the truth. Avoiding these fallacies will help investigators maintain objectivity throughout the reconstruction.
- Crime-scene reconstruction is a team effort that requires the expertise of various professionals, depending on the kind of case.
- Information gathered from direct physical evidence provides a definite conclusion or direction, whereas circumstantial evidence provides a lead but no definite conclusion for reconstructing the crime.
- Testimonial evidence from eyewitnesses is sometimes highly subjective and heavily biased and must be used in reconstruction only if it is corroborated by physical evidence.
- Reenactments of events at a crime scene can be carried out by live personnel, mannequins, or computer-generated models.
- Evidence used in a crime-scene reconstruction must have a complete and valid chain of custody.
- In order for physical or testimonial evidence to be used in reconstruction theories, the chain of custody of items and the integrity of testimonial evidence must be established.
- Individual items of evidence are first analyzed and tested separate from all other evidence; items should not be linked or grouped together during the initial phase of the investigation. Once all items have been evaluated this way, they may be coupled with other items of evidence that are clearly linked.
- Different categories or types of crime-scene evidence have to be studied with very specific techniques and considerations during the investigation. The kinds of evidence that may be found at a crime scene are highly diverse, and knowledge of techniques for processing each is needed to recover all pertinent information.
- The reconstruction team must bring together all the linked groups of evidence and information to form theories about how each group of linked items was created by individual events at a crime scene.

KEY TERMS

circumstantial evidence
crime-scene reconstruction
deductive reasoning
direct physical evidence
event timeline
falsifiability
inductive reasoning
objectivity
reenactment
testimonial evidence

REVIEW QUESTIONS

1. _____ is the method used to develop a likely sequence of events at a crime scene by the observation and evaluation of physical evidence and statements made by individuals involved with the incident.
2. Reconstructing the circumstances of a crime scene is a team effort that may include the help of law enforcement personnel, medical examiners, and _____.
3. To avoid letting personal beliefs or biases affect the conclusions reached through observations, crime-scene reconstruction teams must practice _____.
4. True or False: Expectations or biases can have a positive effect on the process of reconstruction by leading to correct analysis or interpretation of the information provided by the evidence. _____
5. True or False: Members of the crime-scene reconstruction team should design the examination and theory formation process to prove a theory or hypothesis that they believe to be true. _____
6. _____ reasoning is being used when a given fact or finding leads to a conclusion that is probable but not definitive. _____ reasoning is being used when a given fact or finding leads to a definitive conclusion.
7. Inductive reasoning is used to analyze _____ that provides a lead but no definite conclusion.
8. Another way to avoid bias is to test the _____ of all theories of how a crime occurred and all plausible alternatives against the evidence.
9. The inherent fallacy of _____ exists when investigators or attorneys try to apply a simple "yes or no" answer to a complex question.
10. True or False: Generalizing about aspects of evidence is always helpful to an investigation. _____
11. When a link is prematurely assumed between two or more objects of evidence, this is the fallacy of _____.
12. True or False: The biggest limitation to crime-scene reconstruction is the fact that what is left behind at a crime scene is often much less than is needed to create a full timeline of events that occurred in the past. _____
13. _____ left behind at the crime scene is helpful in reconstruction to support or contradict accounts given by witnesses and/or suspects.
14. The analysis of _____ employs deductive reasoning and provides a definite conclusion or direction.
15. Eyewitness accounts, called _____, are sometimes highly subjective and heavily biased because people may lie or misinterpret the facts.
16. The re-creation of events at a crime scene, called a _____, may be performed by live personnel, mannequins, or computer-generated models.
17. For an item of physical evidence to be used in a reconstruction, it must have a confirmed and intact _____.
18. True or False: Each item of evidence should first be analyzed and tested separate from all other evidence to avoid false linkage of evidence. _____
19. True or False: The kinds of evidence that may be found at a crime scene are few, and similar categories or types of crime-scene evidence have to be studied with similar techniques and considerations. _____
20. Once all evidence has been evaluated, the reconstruction team must bring together all the evidence and information to form plausible _____.
21. True or False: The beginning and end of the sequence of events at a crime scene are usually obvious to the investigators and may suggest what events occurred in between. _____
22. A(n) _____ created for the reconstruction defines each event that occurred at a crime scene in various probable orders within a known or estimated time frame.

APPLICATION AND CRITICAL THINKING

1. Which logical fallacy is described in each of the following situations?
   a) An investigator finds a body wrapped in a bloody sheet and assumes that all the blood came from the victim.
   b) An officer investigating a hit-and-run accident spots a car with a dented bumper near the scene and assumes it was involved.
   c) The district attorney asks an investigator whether highly suggestive circumstantial evidence leads to a particular conclusion.
2. While investigating a murder scene, police gather evidence that includes a dead body riddled with stab wounds, fingerprints on a bloody knife found near the body, and a ticket stub from a theater several miles away from the scene. Investigators determine that the knife belonged to the victim, but matched the prints on the knife to an acquaintance of the victim. When questioned, the acquaintance claims he was at the movies at the time of the murder—the same movie shown on the stub found at the scene. What direct physical evidence connects the acquaintance to the crime scene? What circumstantial evidence connects him to the scene? What can you conclude about the acquaintance's involvement solely from direct physical evidence and deductive reasoning? What might you conclude considering circumstantial evidence and inductive reasoning as well?

Fingerprints

Time & Life Pictures/Getty Images

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

- **Identify the common ridge characteristics of a fingerprint.**
- **List the three major fingerprint patterns and their respective subclasses.**
- **Distinguish visible, plastic, and latent fingerprints.**
- **Describe the concept of an automated fingerprint identification system (AFIS).**
- **List the techniques for developing latent fingerprints on porous and nonporous objects.**
- **Describe the proper procedures for preserving a developed latent fingerprint.**

JAMES EARL RAY: CONSPIRATOR OR LONE GUNMAN?

Since his arrest in 1968 for the assassination of Dr. Martin Luther King Jr., endless speculation has swirled around the motives and connections of James Earl Ray. Ray was a career criminal who was serving time for armed robbery when he escaped from the Missouri State Prison almost one year before the assassination. On April 3, 1968, Ray arrived in Memphis, Tennessee. The next day he rented a room at Bessie Brewer's Rooming House, across the street from the Lorraine Motel, where Dr. King was staying.

At 6:00 p.m., Dr. King left his second-story motel room and stepped onto the balcony. As King turned toward his room, a shot rang out, striking the civil rights activist. Nothing could be done to revive him, and Dr. King was pronounced dead at 7:05 p.m. The assailant ran on foot from Bessie Brewer's, stopping to leave a blanket-covered package in front of a nearby building, and then drove off in a white Mustang. The package contained a high-powered rifle equipped with a scope, a radio, some clothes, a pair of binoculars, a couple of beer cans, and a receipt for the binoculars. Almost a week after the shooting, the white Mustang was found abandoned in Atlanta, Georgia.

Fingerprints later identified as James Earl Ray's were found in the Mustang, on the rifle, on the binoculars, and on a beer can. In 1969, Ray entered a guilty plea in return for a sentence of ninety-nine years. Although a variety of conspiracy theories surround this crime, it is an indisputable fact that a fingerprint on the rifle that killed Martin Luther King Jr. was from the hands of James Earl Ray.

History of Fingerprinting

portrait parlé
A verbal description of a perpetrator's physical characteristics and dress provided by an eyewitness.

anthropometry
A system of identification of individuals by measurement of parts of the body, developed by Alphonse Bertillon.

Since the beginnings of criminal investigation, police have sought an infallible means of human identification. The first systematic attempt at personal identification was devised and introduced by a French police expert, Alphonse Bertillon, in 1883. The Bertillon system relied on a detailed description (**portrait parlé**) of the subject, combined with full-length and profile photographs and a system of precise body measurements known as **anthropometry**.

The use of anthropometry as a method of identification rested on the premise that the dimensions of the human bone system remain fixed from age 20 until death. Skeleton sizes were thought to be so extremely diverse that no two individuals could have exactly the same measurements. Bertillon recommended the routine taking of eleven measurements of the human anatomy, including height, reach, width of head, and length of the left foot.

For two decades, this system was considered the most accurate method of identification. But in the early years of the twentieth century, police began to appreciate and accept a system of identification based on the classification of finger ridge patterns known as *fingerprints*. Today, the fingerprint is the pillar of modern criminal identification.

EARLY USE OF FINGERPRINTS

In China fingerprints were used as far back as three thousand years ago to sign legal documents. Whether this practice was performed as a ceremonial custom or as a means of proving personal identity remains a point of conjecture; the answer is lost to history. The examples of fingerprinting in ancient history are ambiguous, and the few prints that remain did not in fact contribute to the development of fingerprinting techniques as we know them today.

Several years before Bertillon began work on his system, William Herschel, an English civil servant stationed in India, started requiring Indian citizens to sign contracts with the imprint of their right hand, which was pressed against a stamp pad for the purpose. The motives for Herschel's requirement remain unclear: He may have envisioned fingerprinting as a means of personal identification, or he may have been adapting for his purposes the Hindu custom that a trace of bodily contact is more binding than a signature on a contract. In any case, he did not publish anything about his activities until after Henry Fauld, a Scottish physician working in a hospital in Japan, published his own views on the potential application of fingerprinting to personal identification.

In 1880, Fauld suggested that skin ridge patterns could be important for the identification of criminals. He told about a thief who left his fingerprint on a whitewashed wall, and how in comparing these prints with those of a suspect, he found that they were quite different. A few days later, another suspect was found whose fingerprints compared with those on the wall. When confronted with this evidence, the individual confessed to the crime.

Fauld was convinced that fingerprints furnished infallible proof of identification. He even offered to set up, at his own expense, a fingerprint bureau at Scotland Yard to test the practicality of the method. But his offer was rejected in favor of the Bertillon system. This decision was reversed less than two decades later.

EARLY CLASSIFICATION OF FINGERPRINTS

The extensive research into fingerprinting conducted by another Englishman, Francis Galton, finally made police agencies aware of its potential application. In 1892, Galton published his classic textbook *Finger Prints,* the first book of