

Objectives

After reading this chapter, you will understand:

- The value of indirect and direct evidence in a court of law.
- That eyewitness accounts have limitations.
- What physical evidence can and cannot prove in court.
- That the forensic scientist's main goal is to find a unique source for the evidence.

You will be able to:

- Explain the difference between indirect and direct evidence.
- Describe what is meant by physical evidence and give examples.
- Distinguish individual evidence from class evidence.
- Determine the significance of class evidence.



“You can observe a lot just by watching.”

—Yogi Berra, former New York Yankees catcher and sage



Evidence

Teacher Note

The TRCD for this chapter includes a PowerPoint presentation, which is an overview of the chapter. It can be used as introductory material or at the end as a review.

evidence: something that tends to establish or disprove a fact. Evidence can include documents, testimony, and other objects

testimonial evidence: what is said in court by a competent witness; also called direct evidence or *prima facie* evidence

physical evidence: tangible items that tend to prove some material fact; also called real evidence

Evidence can be divided into two general types:

1. **Testimonial evidence** is a statement made under oath. An example would be a witness pointing to someone in the courtroom and saying, “That’s the guy I saw robbing the grocery store.” This is also called direct evidence or *prima facie* evidence.
2. **Physical evidence** can be any object or material relevant in a crime. It can be any tangible thing, large or small. This is also called real evidence.

Classroom Activity

How accurate are eyewitness accounts? You can arrange an “intrusion” into the class by someone the students don’t know. Make an arrangement with the “intruder” before class to come in and make some kind of disturbance. Also, have a colleague call on the house phone or the teacher’s cell phone, interrupting class three times. Write the wrong date on the chalkboard before class, erase it during class, and replace it with another wrong date. During all of these staged intrusions, have a class discussion or activity on the different types of evidence that may be collected at several different types of crime scenes.

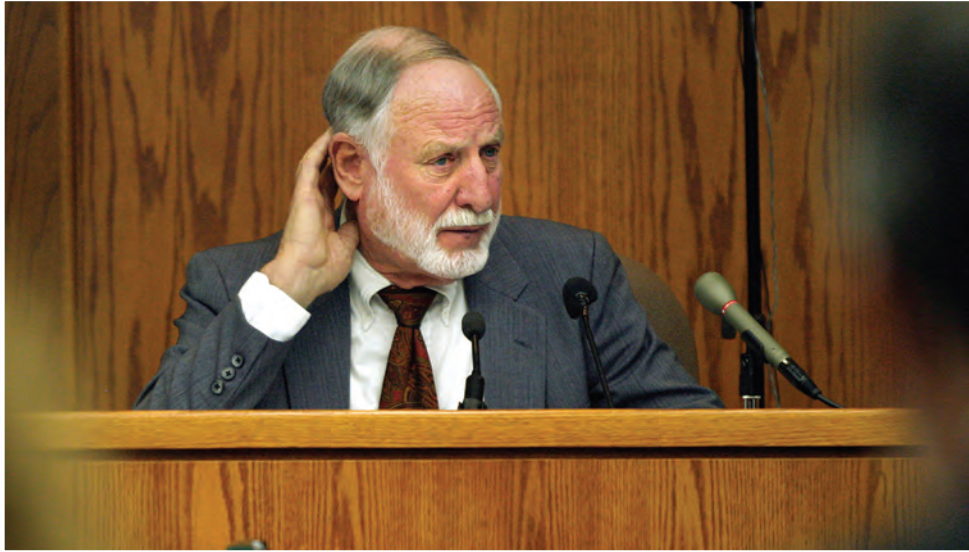
In a 1977 study of more than 2,000 lineups, of the 45 percent of potential offenders who were “recognized,” 82 percent were convicted. In 347 cases, where eyewitness testimony was the only evidence, 74 percent of defendants were convicted. Another report, in 1983, showed that jurors relied more on eyewitness testimony than on fingerprint evidence.

Testimonial or Direct Evidence

Eyewitness accounts can provide important evidence leading to the arrest of a criminal. Juries are heavily influenced by eyewitness identification. How accurate are eyewitnesses? What might influence their accuracy? Eyewitnesses can make perceptual errors for many reasons: The crime scene may have been too dark, the encounter may have been too brief, or the presence of a weapon may have diverted the eyewitness’s attention. The stress and fear involved in witnessing a crime may sharpen some people’s focus and confuse others. Errors in the memory process are also common. The time between the crime and questioning of the witness can affect what he or she remembers. New information can influence memory, as when, for example, viewing mug shots or being asked leading or suggestive questions. These kinds of new information can actually change the memory of a witness, even one who is trying to be fair and honest.

Police need to be careful in judging how reliable an eyewitness account might be. Important points to consider include:

- The type of crime and how the witness saw it. Research has found that witnesses are more accurate in remembering some characteristics, such as sex and hair color, than others, such as age, height, and specific race.



An expert witness testifying in court

A witness who is physically similar to the offender is more likely to give an accurate description.

- Victims of serious crimes sometimes have a more accurate memory over a long period of time because they tend to relive the event in their minds. The presence of a weapon or the threat of violence also influences recall because it may sharpen the witness's focus. Any type of stress tends to narrow the focus, closing out secondary information.
- Some types of witness are better at remembering than others. Children usually don't remember as well as adults do. How accurate a child witness's testimony is may depend on how he or she is interviewed. Because older adults may have poorer eyesight or hearing than do middle-aged or younger adults, their eyewitness accounts may be less accurate. Learning disabilities, mental disorders, alcohol or drugs, or head injury can all weaken memory and recall.
- Interviewing techniques or how information is retrieved can also make a difference in the accuracy of an eyewitness's story. Research has suggested that eyewitnesses are better at answering questions about what happened than they are at questions about the description of the offender. A witness's report about the offender's actions can be accurate even when there are few good details about what the offender looks like.
- Open-ended questions often get better answers. It may be better to ask the witness to describe what the offender was wearing than to ask what color the offender's shirt was. A careful choice of words can influence memory. Leading questions such as "Was the offender's shirt red?" can actually lessen accuracy. A confident witness is more likely to be accurate, although this isn't always true. Generally, if a witness claims to be "absolutely certain" about something, then it is likely to be true.

Classroom Activity, *continued*

Near the end of the class, ask students to clear their desks, take out a piece of paper, and answer the following questions:

- What time did the intruder come in?
- What did the intruder look like? Include height, weight, age, hair color, and hairstyle.
- Describe what the intruder was wearing.
- What did the intruder do?
- What conversation took place?
- At what times did the phone calls take place? How long did they last? What was said?
- What was the date on the board at the beginning of class?

After students have been given enough time to write down their answers, discuss this exercise as a class. Make comparisons. How accurate were the students' observations? How accurate would they be if they had to wait another day before they were asked? Have students write down what the person in front of them (or teacher, or person to the right, left, or behind) was wearing on the previous day. How many accounts are accurate?

Now ask the students to think about how accurate their observations would be if it were dark outside or if they were a fair distance away and witnessing a crime. Would a heightened state of anxiety make their observations more or less accurate? An extension of this activity would be to ask the question: Are there any studies or statistics on the accuracy of eyewitness accounts? A few days of research in the library or on the Web may answer this question.



Teacher Note

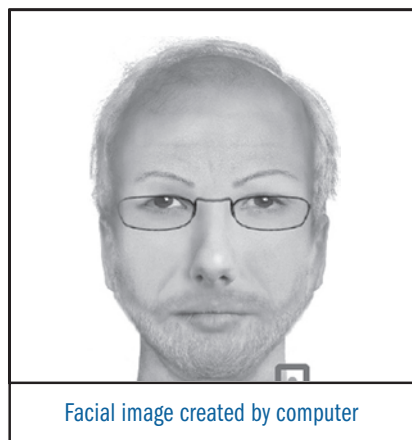
FACES 4.0 is a computer program that can be used to compose faces from thousands of features. Students love it, and it can be used to re-create a likeness of a suspect, or themselves. This demonstrates how difficult it is to describe subtle differences in facial features. It is available from its creator, IQ Biometrix (www.iqbiometrix.com), or from many other scientific supply firms, for example, Science Kit & Boreal Laboratories (www.sciencekit.com).

Dumb Crooks

Two Kentucky men tried to pull the front off a cash machine by running a chain from the machine to their pickup truck. Instead, they pulled the bumper off the truck. They panicked, fled, and left the chain still attached to the machine and their bumper (with the license plate still attached).

There are also other factors to think about when weighing an eyewitness account:

- Whether the witness already knew the accused, and what their relationship had been
- How much time passed between the offense and the identification
- Whether the witness had already identified (or failed to identify) the defendant
- Whether the witness had already identified someone else



Facial image created by computer

Most known cases of an innocent person being convicted happened because of a mistaken eyewitness identification.

Physical Evidence

The forensic scientist is most interested in physical evidence. It is the task of the forensic scientist to look at evidence and determine its identity and its origin. In identifying what a particular piece of evidence is, a scientist determines its physical and chemical properties. Physical properties, such as color, density, solubility, hardness, and refractive index, can often be observed or measured. Chemical properties can be observed when the object or substance changes its chemical composition. Often chemical properties are observed when the substance reacts with other chemicals. Examples of chemical changes or reactions are the formation of bubbles, color change, pH change, and the formation of a precipitate. Determining the origin of evidence almost always

Table 2.1: Common Types of Physical Evidence

drugs and toxic substances	resins, plastics	fingerprints
paints	explosive residues	hair
gunshot residues	serial numbers	tissues
firearms and ammunition	documents	pollen
impressions (shoe prints, bite marks, and the like)	fibers	wood material
petroleum products	soil	feathers
alcohols (especially ethanol)	glass	bones
rubber material	blood	tool marks
	body fluids	

involves a comparison of the substance or object itself with something similar or the same that has a known origin.

Physical evidence can be any material or object (see Table 2.1). It can take on almost any form: as large as a building, as fleeting as an odor, as small as a hair, or even submicroscopic, like DNA evidence. The variety of physical evidence is virtually unlimited, as is the uniqueness of the crime. Physical evidence is generally much more reliable than testimonial evidence.

Case 2.1 illustrates how some convictions are based solely on eyewitness accounts. Note how the defense did indeed challenge the accuracy of the eyewitness accounts, but the court accepted the testimony as fact.



2.1: Coral Eugene Watts

Confessed serial killer Coral Eugene Watts had served almost 20 years of a 60-year sentence when authorities began to worry about his possible release from prison. In 1982, Watts was convicted in Texas of burglary and intent to murder. Due to mandatory release laws and good behavior, an appeals court shortened his term to 25 years. He was scheduled to be released in May of 2006.

In a plea bargain agreement, Watts had confessed to killing 13 women and received immunity for 12 of them. Police had identified Watts as a suspect in the killings, but said that it was difficult to build a case against him because he had used different methods to kill, never sexually assaulted the women, and chose strangers. Authorities stated that they lacked evidence to support their suspicions. Watts killed within minutes of encountering his victims, leaving very little evidence behind. Due to this lack of evidence, police stated that obtaining

CASE STUDY



Watts, 2004

Watts's confession was the only way to close open murder cases and get answers for grieving relatives.

The murders that Watts had confessed to occurred in Texas and Michigan; he had been implicated in at least 20 more murders. Law enforcement officials in Michigan, Texas, and Canada suspected Watts of slaying dozens of other women from the 1970s until his conviction in 1982. Watts had told officials that he would kill again if he ever got out of prison. Michigan and Texas officials opened cold cases to further investigate Watts for his earlier crimes, because he had already received immunity for the ones he had confessed to in 1982.

In Michigan, police had suspected Watts for years of the murder of Helen Dutcher but never had the evidence to charge him. They reopened the case, finding a previous witness. Joseph Foy had come forward at the time of the murder, saying that he had seen Watts murder Dutcher in his suburban backyard in 1979. Foy had reported the crime and described in detail the appearance of the perpetrator. A police sketch artist had made a drawing from Foy's description. Watts was brought to trial in Michigan in 2004. Three former victims who had survived attacks by Watts, as well as the detectives who took Watts's past confessions, testified at the trial. All testimony was allowed as evidence of a "pattern" of Watts's past behavior.

At the trial, the defense asked whether a witness could identify someone 85 feet away on a darkened night and whether Foy's memory would be accurate after 25 years. The court allowed the eyewitness testimony to be submitted.

The jury found Watts guilty of the first-degree murder of Helen Dutcher. In December of 2004, he was sentenced to life in prison in Michigan. Law enforcement officials continue to investigate Watts, who claimed he was responsible for at least 80 other murders from the 1970s until his conviction in 1982.

**CASE STUDY
CONTINUED**



Watts, 1979



Police sketch

2.2: Ronald Cotton

Ronald Cotton was wrongfully accused and convicted of a crime he did not commit, based partially on an eyewitness account that later proved to be inaccurate.

In July of 1984 an assailant broke into two apartments on separate occasions in Burlington, North Carolina. He cut phone wires, attacked and raped the women living there, searched through their belongings, and stole money. After

CASE STUDY

a photo identification by one of the victims, Ronald Cotton was arrested for the crimes. The prosecutor's evidence consisted of:

- Testimony by the other victim from a lineup
- A flashlight found in Cotton's home that resembled one the assailant used
- Rubber from Cotton's tennis shoe that was found to be consistent with rubber found at the crime scene
- The photo ID from the victim

It was not disclosed at the trial, but the second victim had picked another man out of the lineup. Cotton's attorney filed an appeal based on this information. At the second trial, the second victim had decided that Cotton was indeed the assailant. Also during the second trial, a prison inmate, Bobby Poole, confessed to fellow inmates that he was the one who had committed the crimes. The judge refused to have this information submitted into evidence.

At the conclusion of the second trial in November 1987, Cotton was convicted of both rapes and sentenced to life plus 54 years in prison.

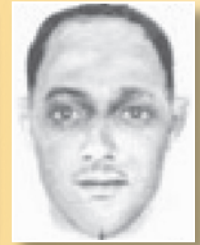
Cotton continued to claim that he was innocent and repeatedly asked for appeals. In 1994, Cotton got two new lawyers who filed a motion for DNA testing. The evidence samples from one of the victims were too degraded and did not give any information, but samples from the other were intact enough to be tested. The samples did not match Cotton, and so he was ruled out as the perpetrator. At the request of the defense, the DNA was submitted to the North Carolina convicted violent felon database; it matched that of the inmate Bobby Poole.

Cotton was released in 1995 after having spent almost 11 years in prison for a crime he did not commit. He was officially cleared of all charges and offered \$5,000 as compensation.

**CASE STUDY
CONTINUED**



Cotton



Police sketch



Poole

Jennifer Thompson, one of the witnesses, deeply regretted her mistake. She has since devoted her time to speaking out about her experiences and the dangers of relying on a single eyewitness account for evidence to convict. She has also become an outspoken activist opposing the death penalty.

The Innocence Project is a national organization dedicated to exonerating wrongfully convicted people through DNA evidence. Eyewitness misidentification is the single greatest cause of wrongful convictions nationwide, playing a role in 75 percent of convictions that are overturned through DNA testing, according to the Innocence Project. As of January 2008, the project has exonerated 212 people from 31 states who have served a total of nearly 2,500 years in prison.

Classroom Activity

Another fun activity is to have the class break up into groups of three to five students and perform a crime skit. The skits should be about five minutes long and include a crime, a setting, a victim, a perpetrator, and dialogue. An example may be: Two students are on their way to a football game, walking while discussing a movie they saw the night before. A third student confronts them and asks to borrow a dollar. As one student brings out her wallet, the third grabs it and runs away.

One class period may be spent writing the skits, assigning roles, gathering props, and rehearsing and timing the skits. At the next class, ask students to clear their desks and simply “witness” the crime skits. Later that hour or, better yet, the next day, ask students to answer the following questions about each skit:

Where did the crime take place? Describe the (imaginary) setting. Describe the victim. What was he or she wearing? Describe the perpetrator. What was he or she wearing? Re-create any dialogue that you remember.

indirect evidence: evidence providing only a basis for inference about the disputed fact

circumstantial evidence: evidence based on suggestion rather than personal knowledge or observation



GO TO www.scilinks.org
TOPIC **circumstantial evidence**
CODE **forensics2E40**

Not all evidence is permanent. For example, transient evidence is temporary; it is easily changed or lost. It is usually observed by the first officer on the scene and must be recorded at that time. Examples of transient evidence are:

- odors such as perfume, purification, gasoline, cigarette smoke
- temperature of a coffee pot, car hood, dead body, or water in a bathtub
- imprints and indentations such as footprints in sand, fingerprints in dust, teeth marks in perishable foods

Conditional evidence is produced by a specific action or event at the scene and must also be observed and recorded. Are the lights on or off? Is the garage door up or down? Are doors open or closed? Are windows locked or unlocked? What is the position of the body and the furniture?

Some evidence does not prove a fact and is called **indirect evidence**.

Some physical evidence, however, may prove something, such as

possession of a controlled substance or driving under the influence when a driver’s blood has an alcohol level greater than 0.08 percent.

Circumstantial evidence implies a fact or event without actually proving it. The more circumstantial evidence there is, the greater weight it carries.

Probability and statistics come into play here. For example, suppose a blond hair is found in the hand of a murder victim with black hair. The hair evidence

is circumstantial because there are many people with blond hair. If the footprint of a size-eleven sneaker is found near the victim as well, that is also circumstantial evidence—many people have big feet and wear sneakers. However, the two observations together limit the pool of suspects.

What Is the Value of Physical Evidence?

Physical evidence is valuable for several reasons:

Examples of strange evidence examined by author (J.F.):

- chicken cacciatore (poison case)
- sparkler (product liability)
- itching powder
- beer (harmful contaminants)
- stepladder (personal injury)
- sparks from static electricity (fire)

- Physical evidence can prove that a crime has been committed and set the scene for the investigation; for example, gasoline found at the scene of a fire may prove arson.
- Physical evidence can back up witness testimony or prove it false; for example, a forensic scientist can test a bloodstain that a suspect claims is his own and not the victim’s.
- Physical evidence can link a suspect with a victim or with a crime scene; for example, a broken piece



Officer checking for possible stolen vehicle

Classroom Activity, *continued*

Describe any other participants.

Give any other information related to the crime.

A class discussion can follow, noting which scenes were most memorable and why. If a weapon was involved, did it influence the witness? If some groups have more participants, was it easier to remember details or more difficult? If any of the groups turned the lights off, how did that affect the details remembered?

This will help students to better understand the factors influencing the eyewitness accounts discussed in this section.

of headlight glass found in the cuff of a suspect's pants could place him at the scene of a hit-and-run accident.

- Physical evidence can determine the identity of people associated with a crime; for example, fingerprints, handwriting, or DNA might prove that a certain person was present at a crime scene.
- Physical evidence can allow investigators to reconstruct a crime; for example, blood spatter patterns may show where the suspect and victim were located relative to each other and may indicate what happened and in what order.

Police or crime scene investigators may collect physical evidence and submit it to the lab for testing by forensic scientists. The major role of the forensic scientist is to determine if there are links among the evidence, the victim, the crime scene, and the suspect. The physical and chemical characteristics of a substance or object may be identified, but it is most important to see whether the evidence collected is relevant to the crime. Most often, a **questioned or unknown sample (Q)** is compared to a **known sample (K)**. For example, the investigator finds paint of unknown origin on the bumper of a vehicle that is suspected to have been involved in a hit-and-run accident; it would

Perhaps the earliest recorded analysis of physical evidence took place when Archimedes (287–212 bc) was consulted by the Greek king, who suspected that some of his wealth was made of an alloy rather than pure gold.

questioned or unknown sample: material that has been collected from a known location but is of unknown origin

known sample: material that comes from a proven or known source



Document examiner using Electrostatic Detection Apparatus to develop written impressions

be compared to the paint from the victim's bicycle (known origin). A **control sample** generally refers to a material that is expected to respond in a particular way in testing. It is used to validate the method of testing by comparing test results to those of the questioned and known samples. In the above case, suppose no color change could be induced by heating hundreds of different paint samples, yet when the Q and K samples were heated, both changed to the same color. A control test of one or more similar paints should be run in order to verify the method and procedure. If the control paints did not change color, but the Q and K samples did, then there is a high probability that the Q and K paint samples originated from the same source; therefore, the car was involved in the hit and run.

The forensic scientist may then be part of a team using the physical evidence to reconstruct a crime. The team may include crime scene investigators, detectives or other law enforcement officials, medical examiners, and forensic scientists. In a murder investigation, the physical evidence

may be used to answer questions about what happened, how the victim was killed, whether there was more than one person involved, and when the crime happened. The reconstruction uses the physical evidence as well as witness accounts and statements by those involved in the case.

control sample: material that is similar to the questioned and known samples, and is used to validate the test method and procedure

Significance of Physical Evidence: Individual versus Class Evidence

The best evidence is anything that can be linked to a unique, single, specific source. This is called **individual evidence**. Examples are

individual evidence: material that can be related to a single source; individualization always involves a comparison

class evidence: material that can be associated only with a group of items that share properties or characteristics

fingerprints, handwriting, DNA patterns, and sometimes physical matches, such as a piece of broken glass that fits exactly to another, like a jigsaw puzzle piece. Unfortunately, most evidence is **class evidence**; this means that the object has characteristics common to a group of similar objects, but not to one single object. Take blue jeans, for example: Although we can go to some length toward individualization by classifying

them by maker, model, size, color shade, and surface treatment, there are still thousands of other pairs of jeans that are just the same. However, that need not be the end of it: If the jeans have been worn, they might have tears, stains, or even creases that individualize them.

A young person was seen leaving a high school parking lot after having been near a car with a broken window; the car's CD player was missing. The suspect was identified as having light brown hair and wearing a white shirt, blue jeans, and dark-colored athletic shoes. In a school of 1,600 students, how common are these characteristics?

How many students would be expected to be wearing a white shirt on any given day? Let's say that in your class of 33 students, seven are wearing a white shirt. How many students in the whole school are likely to be wearing a white shirt?

$$\frac{7 \text{ wearing a white shirt}}{33 \text{ students in class}} = 0.21, \text{ or } 21 \text{ percent}$$

Next question: How many students is 21 percent of the whole student body?

$$0.21 \times 1,600 = 340$$

So if your class is representative of the whole school, then you would expect 340 students to be wearing a white shirt today. Is this good evidence? Could you do better?

How many students would be wearing blue jeans? In your class, you count 12 wearing blue jeans.

$$\frac{12 \text{ wearing blue jeans}}{33 \text{ students in class}} = 0.36, \text{ or } 36 \text{ percent}$$

Procedure Notes

This activity can be done as a whole class. Modify the numbers to reflect your class and your school. Look around at your students and decide what characteristics you want to emphasize, for instance, Nike shoes, gray sweatshirt, blond hair, or glasses. Ask the class if they feel they are representative of the whole school.

Procedure Notes

Have students list class characteristics that they could use to describe students in their school. Then determine how many such characteristics would be needed to narrow a suspect down to one or two students. Usually with four or five class characteristics, the number of suspects can be narrowed down to one or two students in the whole school!



Activity 2.1, *continued*

How many students in the school would be expected to be wearing blue jeans?

$$0.36 \times 1,600 = 580 \text{ students}$$

Is this good evidence? Why not ask how many students in the school are likely to be wearing a white shirt *and* blue jeans?

$$0.21 \times 0.36 = 0.076, \text{ or } 7.6 \text{ percent}$$

Now multiply this by the number of students in school:

$$0.076 \times 1,600 = 120 \text{ students}$$

We have narrowed the field quite a bit by looking at just two general pieces of class evidence.

Now determine how many students would be likely to have light brown hair. In your class you count five students with light brown hair:

$$\frac{5 \text{ with light brown hair}}{33 \text{ students}} = 0.15, \text{ or } 15 \text{ percent}$$

How many students in school would be likely to have light brown hair?

$$0.15 \times 1,600 = 240 \text{ students}$$

How many students would be likely to be wearing a white shirt *and* blue jeans *and* to have light brown hair?

$$0.21 \times 0.36 \times 0.15 \times 1,600 = 0.011, \text{ or } 1.1 \text{ percent}$$

So to determine how many students in the whole student body meet all those descriptors:

$$0.011 \times 1,600 = 18 \text{ students}$$

Statistically, you have narrowed the field of 1,600 possible suspects to just 18. Now let's calculate how four pieces of class evidence could affect the probability of nailing the suspect. If four students in your class are wearing dark-colored athletic shoes, then:

$$\frac{4 \text{ with dark-colored athletic shoes}}{33 \text{ students}} = 0.12, \text{ or } 12 \text{ percent}$$

How many students in school would be likely to be wearing dark-colored athletic shoes?

$$0.012 \times 1,600 = 190 \text{ students}$$



Procedure Notes to Activity 2.2

Activity 2.2 serves to illustrate the distinction between class and individual evidence, and the circumstances whereby class evidence may be individualized. It is helpful to have stereomicroscopes available for use when necessary. The 12 activities described can be discussed in class. The teacher can also collect material and set up stations with different items for the students to examine and assess. Examples could include:

1. A piece of twine or rope cut from its parent. (Class)
2. Small glass fragments compared to a large bottom or top section of a bottle (so they cannot be fitted together). (Class)
3. A bank robbery note and the pad it came from. (Class, unless the tear pattern can be matched or indented writing recognized)
4. Three or more soda pop tabs compared to an empty can without the tab. (Class, probably)
5. A piece of paper, one of four carefully cut from a single piece and compared to the others. (Class, probably)
6. As above, but tear the pieces and compare. (Individual)
7. A section of newspaper compared to the other sections. (Class)

How many students in school are likely to be wearing a white shirt *and* blue jeans, *and* to have light brown hair, *and* to be wearing dark-colored athletic shoes?

$$0.21 \times 0.36 \times 0.15 \times 0.12 \times 1,600 = 2 \text{ students!}$$

A way to increase the probative value of class evidence is to find as many different types of objects as possible with which to link the suspect to the crime or the victim. (*Probative* means supplying proof or evidence.) So, soil and red paint on the jeans would each alone belong to a large class of material; but both occurring together might greatly increase the probability of linking those jeans with a certain crime, even though the evidence is still circumstantial.

You can see how the probative value continues to grow by simply considering class evidence. This type of statistical analysis is termed “the product rule,” and it works only for independent events or observations. For example, if students were encouraged to wear the school colors of blue and white, then wearing blue jeans and a white shirt would be related and not independent.

Is class evidence useful? Yes, if there is a significant amount for a given case. It is also very useful in eliminating or exonerating certain suspects. For example, if a bloodstain is found to be type O, the most common type, people with type A, B, or AB can all be eliminated as possibilities.

In the preliminary hearings of the O. J. Simpson case, the prosecution gave evidence that blood found at the crime scene had been tested by conventional blood grouping methods and matched Simpson’s blood. One in 400 people share these blood characteristics. The defense argued that given the population of Los Angeles, this number of people would fill an entire football stadium; therefore, the blood evidence was useless. Is this true? If the blood evidence were the only evidence the prosecution had had, the reasoning may have been correct. But if there were other types of class evidence implicating Simpson, should the significance of the blood evidence have been considered?

In the next activity, you will examine the concepts of class and individual evidence with a series of comparisons.



O.J. Simpson

Procedure Notes, *continued*

8. Cut a piece of duct tape and compare it to the parent roll (and/or a different roll), or tear off a piece. (Probably class if cut; individual if torn)
9. Pull a few strands of yarn from a sweater or fabric and compare them to the parent (if not obviously damaged) or a similar item. (Class)
10. Enlarge an inked fingerprint and compare it to several other prints. (Individual)
11. Break a hefty stick in two. Dab some “blood” on the one from the assault scene and compare it with the other end that was found in the suspect’s woodpile. (Class, unless the break can be fitted together)
12. Tear a page from a book and crumple it up; place the closed book beside it. (Individual)

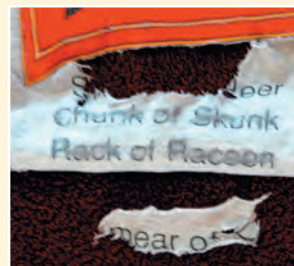
Your imagination is the limit in setting this up. The local junkyard may be a good place to visit and collect a number of samples to use in class.

Using stereomicroscopes can be fun for the students. Most students have used a microscope before but haven’t had time to explore and enjoy the wonders of the microworld. Give them some time to look at their fingernails, scars, jewelry, a piece of clothing, and the like. The objective is to allow students time to discover how the stereomicroscope works. By the end of the year, students will know which type of microscope (compound or low-power stereo), which type of lighting (transmitted, reflected, or both), and what magnification to use for optimum results in various situations. The microscope is the forensic scientist’s best friend.

Answers

1. Tear a piece of cloth from a T-shirt. Set the piece out with the shirt and add another piece of the same color and type of fabric from a different source. Students should be able to individualize one piece, while identifying the other as class evidence. Ask them whether the color makes a difference. White is a more common color for a T-shirt, so a red shirt, for example, would have more probative value. Even better than color would be a matching imprint.
2. The gun is class evidence unless it was one of a kind and specifically linked to its owner (who happened to be, say, John Wilkes Booth).
3. Break a bottle so that the pieces are large enough to fit together as individual evidence, like pieces in a jigsaw puzzle. Wrap the bottle in layers of newspaper before using a hammer or pipe.
4. Even if the victim had blond hair, the hair is class evidence.
5. Fingerprints on the handle would specifically identify the culprit. Blood analysis could tie it to the victim.
6. Millions of tires are manufactured with the same imprint. What may make a tire unique is the wear pattern coupled with imperfections or damage (cuts, nails, pebbles in a groove, etc.).

1. A torn T-shirt was found in the backseat of a suspect's car. A piece of torn cloth was found at the scene of the crime. Can it be individualized to the T-shirt? Explain.



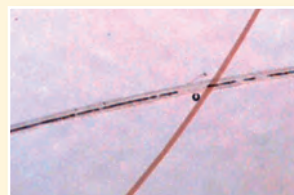
2. A pistol was found in a theatre where a man was shot. A suspect known to have owned a Derringer like this one was apprehended. Would this gun be considered individual or class evidence?



3. Pieces of a broken bottle were found at the scene of an assault. The bottom of a bottle was found in a suspect's car. Can the pieces of the bottle be uniquely associated (individualized) with what was found in the suspect's car? Explain.



4. Some blond hairs were found on the gloves of a suspected kidnapper who has brown hair. Would they be considered class or individual evidence?



5. A bloody knife has been found in the backyard of a murder suspect. Under what circumstances could it be individualized? Or will it remain class evidence?



6. Are tire impressions such as these individual or class evidence? Explain.



Activity 2.2, continued

7. Can it be determined whether these bullets were fired from the same gun? How can bullets be individualized to a gun? Explain.
8. Some powder was found in a plastic bag in a suspect's pocket. Some similar powder was found on the victim. Can the first powder be individualized to the second powder? Explain. If the two powders were determined to be chemically identical, does that prove they came from the same source?
9. A pair of latex gloves was found at the scene of a robbery. A box of the same brand of latex gloves was found at a suspect's home. Can the gloves be individualized to the box? Explain.
10. A cigarette butt was found at the scene of a crime. Is it individual evidence? Explain.
11. A match was found at the scene of a suspicious house fire. A suspect was found carrying a book of matches, several of which were missing. Is the single match class or individual evidence? Explain.



Answers, continued

7. If you know a hunter, policeman, or proprietor of a local shooting range, collect several spent bullets and shell casings of the same caliber. Bullets can be individualized by striations on the outside, and spent shell casings can be individualized, to some degree, by the firing pin marks.
8. Use baking soda or some other powder; place some in a baggie and another sample in a vial. Even though the two samples are the same powder chemically, there is nothing unusual about them, and there is no way to prove that the powder in the vial came from the same source as the powder in the bag. It is, therefore, class evidence.
9. Take two latex gloves out of a box and set them next to the box. There is no way to individualize the gloves to that particular box.
10. No, because it could have come from any cigarette package.
11. Without the matchbook, the single match is class evidence. But by comparing the match's characteristics (such as dimensions, color, head, composition, tear pattern, and the like) with those from the suspect's matchbook and perhaps a dozen randomly collected matchbooks, it could be individualized. This is a good experiment to do with the stereomicroscope.

Answers, continued

12. Soil composition and characteristics vary considerably, even in small areas. If everything matched and it could be shown that there were no other similar samples wherever the suspect had been, perhaps it could be individualized enough to provide strong evidence. Better would be a matched impression with a shoe print from the scene. That would put the suspect there, but not necessarily in the house.

Activity 2.2, continued

12. A suspect in a B & E (breaking and entering) had shoes that were caked with soil. Is the soil class evidence, or could it be considered individual evidence? Explain.



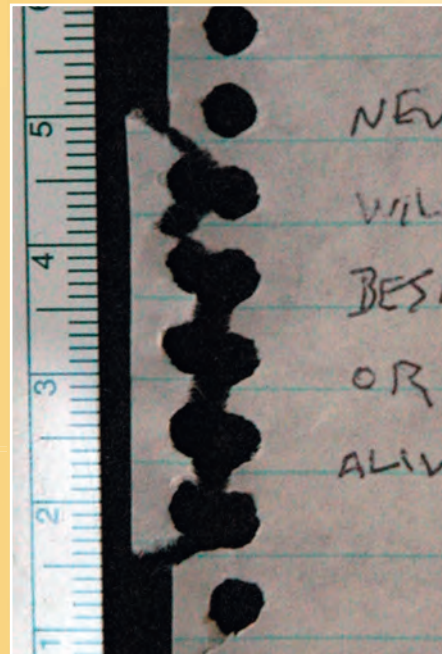
2.3: Fracture Match

A note was found by a student in the math lab at a community college. It was written in blue ballpoint ink on a piece of lined paper torn from a spiral notebook; it stated that there was a bomb hidden in the building. The student quickly turned the note over to the authorities, who evacuated the building.

It being a pleasant summer evening, a lot of students hung around waiting for the bomb squad. A campus police officer walking through the crowd noted a student with a math book and a spiral notebook. On a whim, the officer struck up a conversation with the student and asked if she might look at the student's notebook. The notes and equations before the blank pages were written in blue ballpoint ink, and at least one page had been torn out, leaving scraps of paper stuck behind the spirals. The officer felt that this was enough cause for her to seize the notebook as evidence. Later, at the crime lab, a comparison of all the scraps of paper caught in the spirals yielded one that matched the bomb threat note.

This is an illustration of individual evidence. By matching up the tear pattern, it could be seen that the note came from the student's notebook and no other notebook but hers. The combination of a lucky set of circumstances and an astute officer caught the culprit. Oh, there was no bomb—the student was bored and hated math.

CASE STUDY



Matching pattern

2.4: Richard Crafts

Richard Crafts was convicted of the murder of his wife, Helle, in 1986. It was one of the first cases where a person was convicted of murder without a body to prove that the crime had taken place. The case was built on forensic evidence and astute investigative work.

Richard and Helle had had a tumultuous marriage, with accusations of infidelity on both sides. Helle had filed papers for divorce. November 18, 1986, was the last time Helle was seen or heard from. Her family and friends became alarmed; she had told one of them, “If anything happens to me, don’t think it was an accident.” This spurred her friends to encourage the police to investigate Richard as her possible murderer.

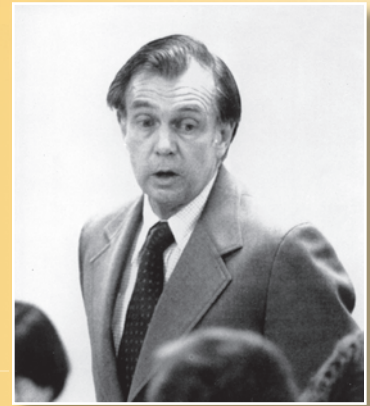
The investigation turned up several interesting points. The nanny had found a stain on the master bedroom carpet, which Richard had replaced on November 22. Police discovered that Richard had purchased new bedding and a freezer and rented a wood chipper days before Helle disappeared. When a truck driver came forward and told police that he had seen someone chipping something into the Housatonic River in the middle of the night during a snowstorm, police began to piece together the events that led to Helle’s death.

Investigators went to the river where the truck driver had seen the wood chipper and began to search for evidence. They found a chain saw from which someone had attempted to file off the serial number; the serial number had been warranted to Richard Crafts. Human tissue, hair, and a blue fiber matching Helle’s robe were found embedded in the teeth of the chain saw. Searchers also found 2,660 strands of hair, 59 slivers of human bone, two tooth caps, five droplets of blood, two fingernails, part of a finger, and three ounces of human tissue.

Investigators pieced together a scenario: Richard killed Helle in their bedroom with some sort of blunt object, leaving bloodstains on the carpet, bedding, and the towels used to clean up. He then put her body in a freezer to make it easier to dismember her with the chain saw. He rented a wood chipper to dispose of her body completely in the Housatonic River, and then disassembled the chain saw and threw it into the river.

After literally thousands of forensic tests, the tissue evidence was found to be consistent with Helle, and some was even determined to be positively Helle’s. Even though the amount of evidence was not much, estimated to be roughly one one-thousandth of a human body, it was enough to provide material for more than fifty thousand forensic tests. Without forensic science, it is doubtful that Richard Crafts would have been convicted and sentenced to 50 years of imprisonment for the murder of Helle Crafts.

CASE STUDY



Richard Crafts at trial



Wood chipper

Here is a case where thousands of hours were also expended to bring a killer to justice. What often is not stressed is the amount of “old-fashioned” police work involved in following leads, interviewing, and writing reports, all culminating in time spent in court at the trial. Note in two of the four Case Studies presented in this chapter how lucky coincidences led to the perpetrator. What were they?

Answer

- (1) An astute policewoman noting the spiral notebook and investigating;
- (2) A truck driver happened to be at the right place at the right time to observe the use of a wood chipper in the dead of night.

Answers

1. Testimonial evidence is what is said in court by a competent witness. Physical evidence consists of tangible items that tend to prove some material fact.
2. Possible factors are the nature of the offense and situation, the age of the witness, the length of time between the offense and the testimony, interviewing techniques, the witness's prior relationship with the accused, and any earlier identification of other suspects by the witness.
3. any material or object that can be related to the crime, including hair, blood, fibers, poisons, fingerprints, soil, glass, and drugs (see Table 2.1 on page 37)
4. Circumstantial evidence implies a fact or event but does not prove it, while physical evidence may prove a fact. Physical evidence is specifically relevant to the crime.
5. Some examples may be odors that evaporate, temperatures that cool, or prints that blow away in the wind or are obliterated by rain.
6. Examples may be: A body may be moved, the lights may be switched off, the windows may be closed. It is conditional because it is caused by an event or condition at the scene.
7. Physical evidence is generally more reliable due to the fallibility of eyewitness accounts.
8. evidence that does not necessarily prove a fact but implies a fact or provides a basis for its inference
9. eyewitness accounts
10. He was scheduled to get out of prison, and they knew he was responsible for many more crimes. They did not want him to get out and commit more.

Checkpoint Questions

Answer the following questions. Keep the answers in your notebook, to be turned in to your teacher at the end of the unit.

1. Explain the difference between testimonial evidence and physical evidence.
2. List three factors that may affect the memory of an eyewitness in recounting a crime.
3. List five types of physical evidence.
4. How is circumstantial evidence different from physical evidence?
5. Give three examples of transient evidence and explain why it may be transient.
6. Give three examples of conditional evidence and explain why it is conditional.
7. Which is generally more reliable, physical evidence or testimonial evidence?
8. What is meant by indirect evidence?
9. What significant type of evidence was used to convict Coral Eugene Watts?
10. Why did prosecutors want to reopen his case after so many years?

11. What is the significance of the Ronald Cotton case?

12. State the difference between class and individual evidence.

13. Can class evidence be used to link a suspect with certainty to a victim or crime? Can individual evidence?

14. Explain how class evidence may be useful.

15. What is direct evidence?

16. Where is physical evidence found and collected?

17. Why is physical evidence important? What can it prove?

18. What is meant by a control sample?

19. How can class evidence be used to narrow a field of suspects?

20. Explain how individualized evidence can have probative value.

21. Explain how class evidence can have probative value.

22. What is the significance of the Richard Crafts case?

Answers, *continued*

- 11.** The case illustrates the fallibility of eyewitness accounts.
- 12.** Individualized evidence has a common origin, while class evidence only shares common characteristics.
- 13.** Class evidence cannot, but individual evidence can.
- 14.** It can exonerate suspects who are from a different group. For example, if type A blood is left at a crime scene, people with types O, AB, and B may be eliminated as the source. Class evidence may be useful when there are different types of evidence or there is a lot of it.
- 15.** Also known as testimonial evidence, direct evidence is statements taken under oath, as in the case of an eyewitness account.
- 16.** Evidence is collected from the crime scene, while controls are collected from the victim, suspects, or other known sources.
- 17.** It can prove that a crime has been committed; establish key elements of a crime; back up testimony or contradict it; link a suspect with a victim or crime scene; establish the identity of people associated with a crime; or allow reconstruction of the events of a crime.
- 18.** In forensic science, a control sample is one whose origin is known. It is collected from the victim or suspects for comparison with the unknown or questioned crime scene evidence. In a laboratory context, a control is often a sample used to test a method, and a standard is a known sample.
- 19.** The probabilities can be multiplied together to provide stronger evidence.
- 20.** Individual evidence can prove something that is material to a crime. Fingerprints are considered to have high probative value because they can belong to only one person.
- 21.** Class evidence does not generally prove a fact, except in cases where it exonerates or eliminates individuals.
- 22.** Student answers will vary, ranging from conviction for murder without a body to the extraordinary number of forensic tests.

Project: Both Sides of the Issue; Public Information on Registered Sex Offenders

Suggested Assignment

This is an optional project for students to research and present both sides of an issue. Look for students to be able to critically assess the merits of each side. This project may be interjected at any point in the chapter.

Recently, many states have passed statutes about community notification whenever a sex offender is scheduled to be released from prison or moves into a community. This brings up the question of which right should take priority, the right of the individual to privacy or the right of society to know (freedom of information).

Write a paper analyzing the arguments on both sides of the issue of registering sex offenders and publishing their names. So you can understand both sides of the issue and learn how to identify and defend the side you disagree with, structure your paper in the following way:

TITLE: Should the names of registered sex offenders be available to the public?

AUTHOR: Your name

INTRODUCTION: Write one or two paragraphs briefly explaining how the names of registered sex offenders may be published, according to the law, and why the issue is controversial.

PRO SIDE: Write one sentence stating that names of registered offenders should be published.

SUPPORT: Write a short statement about society's right to know. Write at least three paragraphs supporting the statement, using at least three sources.

CON SIDE: Write one sentence stating that no list of registered sex offenders should be published.

SUPPORT: Write a short statement explaining why the rights of the individual should take priority, especially regarding privacy. Write at least three paragraphs supporting the statement, using three sources.

PERSONAL OPINION: Write your views and conclusions based on the arguments you have already presented. You must support one side or the other.

WORKS CITED: List references for all sources you used.

Additional Projects

1. Can tabs from a soda pop can be matched to the parent can? To what degree? To a particular brand? To a particular can? How would you set up a research project to answer such questions? What characteristics of the tab and parent would you look at? Check with your teacher and carry out the project, using the scientific method of approach.
2. Suppose a hate note was written in fingernail polish on, say, a mirror or car window. Would it be possible to match the polish to its source? What characteristics of the polish could be used for the comparison? Set up a research project.
3. Glitter is becoming prevalent in many areas of our lives. If glitter were left at a scene of a crime, how might it be traced to its source?
4. Rope is often used in the course of a violent crime. What are the qualities of a rope that could be used to compare one piece with another?

References

Books and Articles

- Buckhout, R. "Eyewitness Testimony," *Scientific American*, 231 (June 1974), pp. 23–31.
- Evans, C. *Casebook of Forensic Detection*. New York: John Wiley, 1996.
- Ragle, Larry. *Crime Scene*. New York: Avon Books, 2002.
- Saferstein, Richard. *Criminalistics: An Introduction to Forensic Science, College Edition* (9th ed.). Englewood Cliffs, NJ: Prentice Hall, 2006.
- Siegel, Jay A. *Forensic Science: The Basics*. Boca Raton, FL: CRC Press, 2007.

Films

- The List Murders* can be ordered from www.films.com/Home.aspx (identification of a murderer after 19 years). DVD, VHS.

Websites

- www.crf-usa.org/bria/brial33.html#how; eyewitness reliability
- www.crimeandclues.com/testimony.htm; testimonial evidence
- www.pbs.org/wgbh/pages/frontline/shows/dna/cotton/summary.html; excellent interactive site illustrating the difficulty in identifying people. Very detailed look at the Cotton-Poole case.