

their analyses. Professionals also have ways of determining whether a person has tried to disguise his or her handwriting or to copy someone else's handwriting, known as a conscious writing effort. Many things can be done to minimize this conscious writing effort, such as the following: (1) a suspect should not be shown the questioned document; (2) a suspect should not be given any instructions about punctuation or spelling; and (3) the pen and paper should be similar to that of the questioned document.

TECHNOLOGY USED IN HANDWRITING ANALYSIS

Initial comparisons of documents are done with the naked eye, a handheld lens, or a microscope. However, even more advanced technology available today can assist the examiner with more technical aspects of the writing and document. Specialized equipment can reveal minor details about how a document was changed. For example, examination using an infrared spectroscope can determine if more than one kind of ink was used on the document. This is because of the way that different inks may absorb or reflect different wavelengths of light such as infrared.

Biometric Signature Pads

BIOLOGY The biometric pad, a new research tool, has been designed for identity authentication. The computerized pad recognizes your signature based on the speed, pressure, and rhythm of signing your name (Figure 10-5). Forgeries can be recognized by slight differences that are detected by the pad.

Computerized Analysis

Computerized analysis of handwriting samples has the advantage of being faster and more objective than analysis by an individual. For example, if the pen pressure is being reviewed, an examiner looking at the sample uses his or her subjective opinion. However, if the handwriting is first scanned into a computer, the pen pressure can be objectively analyzed by the shading in the pixels.

PSYCHOLOGY The Forensic Information System for Handwriting (FISH) is a computerized handwriting database used and maintained by the Secret Service (Figure 10-6).
MATHEMATICS Investigators scan in handwritten documents for a comparative analysis. Once the sample is scanned, it can be compared to other existing handwriting in the database. This system has verified that no two writers pen their words exactly the same, nor do they have the same combination of handwriting characteristics.

HANDWRITING EVIDENCE IN THE COURTROOM

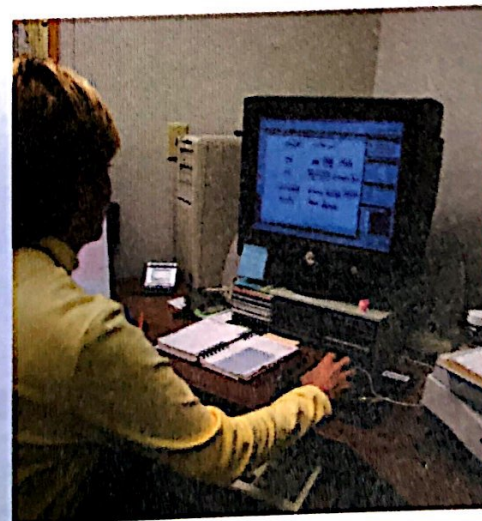
After handwriting samples are scientifically analyzed, the expert handwriting witness prepares a written report of the analysis to present to a jury. Both the defense and prosecuting attorneys ask the handwriting expert questions about the analyses. The expert witness demonstrates how document comparisons were made and how they were used to indicate the suspect's guilt or innocence. The expert witness validates comparisons by showing the jury

Figure 10-5. Advanced technology today, such as biometric signature pads, allows for more accurate analyses of handwriting samples, even at the grocery checkout line.



ePedi.i.d., Handwritten electronic capture device by Interlink Electronics, Inc.

Figure 10-6. The Forensic Information System for Handwriting (FISH) is a database of handwriting features that is categorical and quantifiable.



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examples of similarities or dissimilarities that led to the final conclusion. In court, the expert must be able to defend his or her findings, because the defense will likely hire their own document examiner to refute the prosecution's expert witness.

SHORTCOMINGS IN HANDWRITING ANALYSIS

Although an experienced document expert can detect many cases of forgery, some may be missed. One limitation is that the quality of the standards obtained often determines the quality of a comparison analysis, and good standards may be difficult to obtain. For example, analysis errors have occurred in history when the standard documents that experts used in their comparisons turned out to be forgeries as well. Another limitation is the effects of mood, age, drugs, fatigue, and illness on a person's handwriting.

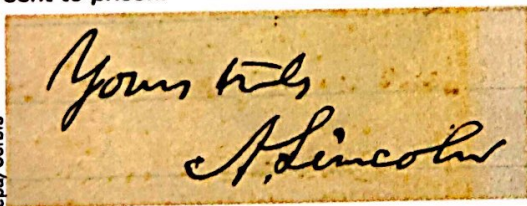
Because document analysis has become well accepted in forensics alongside other evidentiary types, programs have evolved to certify the training. The American Board of Forensic Document Examiners is one establishment that offers such a training program. Although it is still important that handwriting evidence be used in combination with other sources of evidence, handwriting analysis is considered a reproducible and peer-reviewed scientific process.

FORGERY

As discussed previously, forgery is the process used by criminals to make, alter, or falsify a person's signature or another aspect of a document with the intent to deceive another. Forged documents might include checks,

employment records, legal agreements, licenses, and wills. When a material gain, such as money, accompanies a forgery, it is called **fraudulence**. Generally, the primary purpose of forging something is to profit from the fake or alteration. For example, Martin Coneely was a fraudulent forger in the United States in the 1900s. In 1937, after selling a forged Abraham Lincoln letter (Figure 10-7), Coneely was arrested and spent three years in prison. Ironically, his forgeries are collector's items today.

Figure 10-7. Martin Coneely forged Lincoln's writing and signature, but was caught and sent to prison.



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CHECK FORGERY

Americans write more than 70 billion checks a year. Approximately \$27 million in illegitimate checks are cashed each day. Criminals can alter or acquire checks in many ways, including:

- Ordering someone else's checks from a deposit slip
- Directly altering a check
- Intercepting someone's check, altering it, and cashing it
- Creating forged checks from scratch

PREVENTING CHECK FORGERY

Reformed master forger Frank Abagnale once said that the best way to deal with fraud is to prevent it from happening in the first place. How do com-

panies protect themselves against forgeries? Several techniques are used to protect businesses, banks, and the public from forged and altered checks, as shown in Figure 10-8. However, these are all aspects of the paper, and they require someone to be knowledgeable about these security features and willing to look for them. In their attempt to prevent check fraud, many banks hope to eventually eliminate checks altogether. In fact, many banks and credit unions encourage the use of their debit and check cards for this very reason.

Figure 10-8. Methods used to prevent check forgery.

Print checks on chemically sensitive paper
Use a large font size that requires more ink and makes alterations more difficult
Use high-resolution borders on the checks that are difficult to copy
Print checks in multiple color patterns
Embed fibers in checks that glow under different types of lights
Use chemical-wash detection systems that change color when a check is altered

LITERARY FORGERY

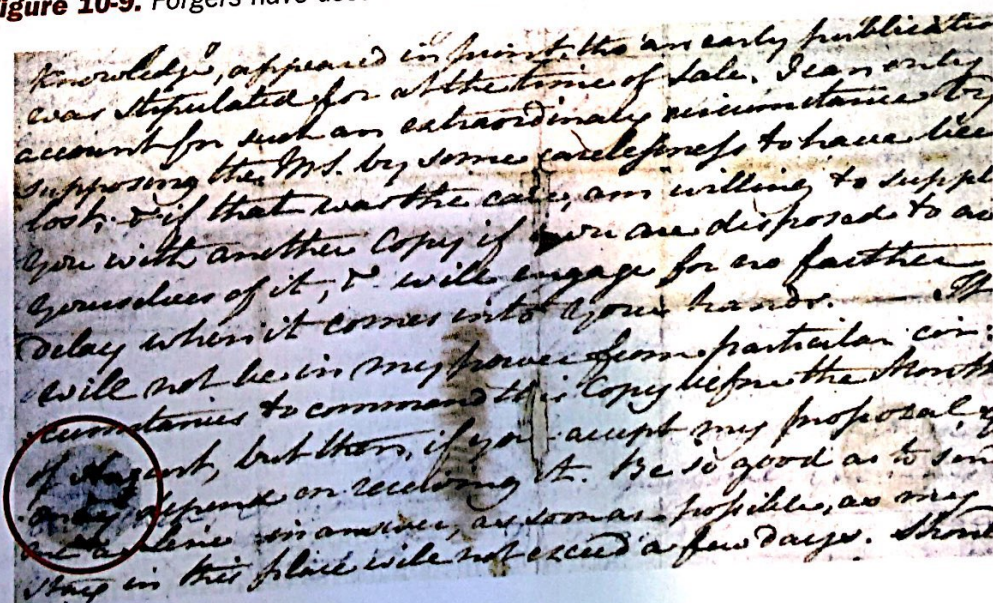
Literary forgery refers to forgery of a piece of writing, such as an historic letter or manuscript. Letters written by famous people are often valuable, especially if the writer was an important world figure, developed a famous theory, or was a notable writer. For example, a letter written by Adolf Hitler, Albert Einstein, or Charles Darwin would be treasured because it might provide insight into the thinking of the writer.

The best literary forgers try to duplicate the original document, so the materials used are similar to those used in the original document. They do this by collecting old paper or old books, from which they can cut out properly aged paper for their forgeries. Because the process of papermaking has changed, it is essential for forgers to use aged paper to pass the microscopic examination tests. Inks have also changed; so intelligent forgers

must mix their own inks from material that would have been used at the time. Watermarks impressed in the paper when it was made also help to age a piece of paper as shown in Figure 10-9. Handwriting tools and styles of penmanship popular at the time of the printing are also considered.

Documents are sometimes chemically treated to make them look older. Chemicals may be added to the paper to age both

Figure 10-9. Forgers have used watermarks in the past to help age a document.



Digging Deeper

with Forensic Science e-Collection

Do research on some of the early Shakespeare forgeries in 1875 by Englishman William Henry Ireland using the Gale Forensic Sciences eCollection on school.cengage.com/forensicscience. William Henry Ireland claimed that he had acquired an authentic handwritten manuscript of Shakespeare's known as the play *Kynge Leare*. Cite some of the evidence discovered by scholarly investigators that showed that this and other documents presented by William were only imitations. Discuss how William obtained the antique paper and ink to create the supposedly old manuscript. Find out how William evaluated the credibility of the paper and writings he produced.

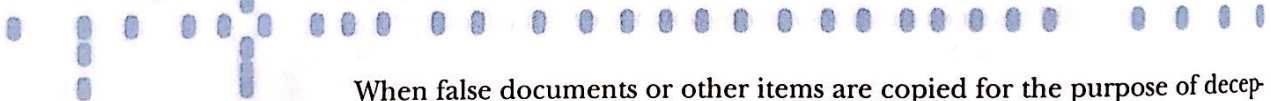


Figure 10-10. An injured Mark Hofmann is arrested for murder.



the paper and the ink. In the early 1980s, Mark Hofmann, a document dealer and master forger, created several hundred forged documents using this method. Besides forging documents, Hofmann also forged coins and banknotes. One of Hofmann's most significant forgeries was his creation of 116 pages of a supposedly lost Mormon document. He sold this document for a fortune to a Mormon collector. Hofmann also forged works attributed to Emily Dickinson, Abraham Lincoln, and Mark Twain. In 1985 Hofmann devised a plan to forge another collection of Mormon documents. Unable to produce the forgeries in time, he used a bomb to buy time and escape detection. His bombs killed an innocent Mormon business leader, Steven Christensen, and Kathy Sheets, wife of Christensen's business partner, Gary Sheets. A third bomb exploded unexpectedly in Hofmann's car, severely injuring him and attracting police attention. Hofmann was tried and convicted of forgery and murder and is currently serving his life sentence. Figure 10-10 shows Hofmann after his arrest, holding his injured hands.

COUNTERFEITING



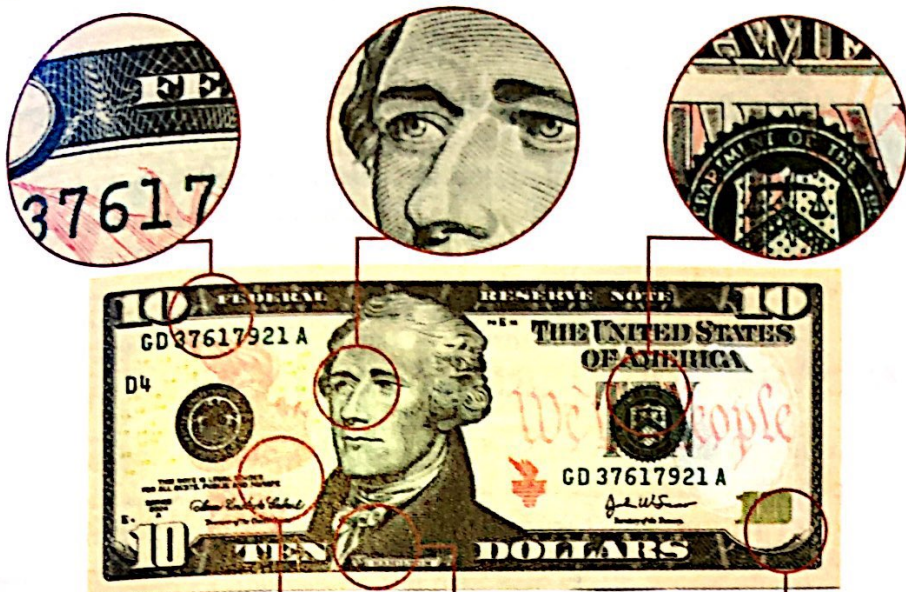
U.S. law enforcement agencies forecast that companies lose approximately \$400 billion to \$450 billion annually to counterfeiters.

When false documents or other items are copied for the purpose of deception, it is called **counterfeiting**. Travelers' checks, certain bonds, and currency are among the most often counterfeited items. Other examples of counterfeited items include coins, food stamps, postage stamps, and paper money. Counterfeiting of money is one of the oldest crimes. Under U.S. law, counterfeiting is a federal felony punishable with up to 15 years in prison. The U.S. Secret Service is the federal agency in charge of investigating counterfeit U.S. currency.

COUNTERFEIT CURRENCY

In the past, with access to a scanner and color printer, it was not very difficult to create counterfeit currency. Scanning could pick up the intricate lines and details found on currency. The Secret Service, with the aid of technology, has added features to paper currency that, when scanned, prevent the currency from being copied. If the currency was successfully scanned, a counterfeiter would still encounter difficulty printing it. The most sophisticated printers cannot reproduce this microscopic detail, because of the built-in security features of money (Figures 10-11 and 10-12). Counterfeit

Figure 10-11. Different parts of paper money contain tiny, intricate lines and details that cannot scan well.



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Figure 10-12. As you can see here, the tiny, intricate lines and details on paper money do not always print well in counterfeit bills.



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Did You Know?

In 2004, a woman tried to buy more than \$1,000 worth of items at Wal-Mart using a fake \$1 million bill. The U.S. Treasury does not make a \$1 million bill, so she was sent to jail.

money also feels different because real money is printed on special paper. In fact, the number-one way that people suspect fakes and scrutinize money is because it doesn't feel right. The paper itself is therefore the number-one security feature.

The government continues to change the design of paper money to make currency more difficult to copy and to prevent counterfeiting. The new series of currency changes began with a revision to the \$20 bill on October 9, 2003, followed by the \$50 bill on September 28, 2004, and the \$10 bill on March 2, 2006. More recently, the U.S. government announced that a redesigned \$5 note should be released in early 2008. In Activity 10-3 you will make observations about the newly designed bills.

DETECTING COUNTERFEIT CURRENCY



It is relatively easy to detect counterfeit currency. Counterfeit-detecting pens are inexpensive special pens and markers containing the element iodine. When they come in contact with a counterfeit bill, the paper marked with the pen will change to a bluish-black color. The color change is caused by a chemical reaction involving starch, a compound found in regular printer paper. By contrast, real currency does not contain starch. Many currencies are also printed on paper containing a fiber. When real money is marked with the counterfeit-detecting pen, the pen will leave a pale yellow color on the bill, which fades within a very short time. Figure 10-13 shows features found in real currency.

Pen manufacturers claim the counterfeit-detecting pen is 98% effective. However, the U.S. government does not concede this level of effectiveness and uses additional criteria for judging whether currency is counterfeit. These criteria are important, because some counterfeiters actually bleach small bills to provide the correct paper for use. For example, a counterfeiter might bleach a \$1 bill for reprinting into a \$50 or \$100 denomination. This bill will pass the counterfeit-pen test, but not some of the other safety measures found on real currency. Furthermore, there is currently a global movement to change to polymer money, a type of plastic money. Plastic money is much more difficult to counterfeit and less expensive to print.

Figure 10-13. Features found in real currency: making counterfeiting money difficult.



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Number	Some Features Found in Real Currency
1	Portrait stands out from the background and appears raised off the paper.
2	There is minute microprinting on the security threads, as well as around the portrait.
3	Serial number is evenly spaced and the same color as the Treasury seal.
4	Check Letter and Quadrant Number
5,6	Federal Reserve seal (5) no sharp points, and Treasury seal (6) with clear, sharp sawtooth points
7	Clear red and blue fibers are woven throughout the bill. Security thread is evident, consisting of a thin, embedded vertical line or strip with the denomination of the bill written in it.
8	Federal Reserve Number and Letter
9	Series
10	Check Letter and Face Plate Number
11	Watermark appears on the right side of the portrait of the bill in the light.
12	When a new series bill is tilted, the number in the lower right-hand corner makes a color shift from copper to green resulting from color-shifting ink.
13	Clear, distinct background details and lines
14	Clear, distinct border edge

SUMMARY

- Fraudulence is attempting to get financial or other gain from forgery.
- Handwriting analysis is the examination of questioned documents compared with exemplars by document experts to establish the authenticity and/or authorship of the documents.
- Document experts use scientific tools and protocols to compare handwriting characteristics of a questionable document to those of an exemplar to help identify authors and detect any alterations, erasures, and obliterations.
- Certain aspects of a person's handwriting style, such as letter form, line form, and formatting, can be analyzed to ascertain authenticity or authorship.
- Handwriting analysis has become an important tool, especially for forensic examiners. Handwriting experts help financial, legal, and governmental institutions, as well as the general public, detect and prevent forgery, counterfeiting, and other fraudulent crimes.
- Technological advances, such as the biometric signature pad and the use of the infrared spectroscope, have greatly enhanced the detection of forged documents.
- Countries continue to refine methods to protect their currency from counterfeiters.