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Editorial

We are fortunate to have research papers that have been submitted to me by my students of my Forensic Document Examination Interactive Training Program. All students who take my training are required to write a research paper. The previous issue of our journal and this issue of our journal contain some of these research papers.

You do not have to write a research paper to have an article published in our journal. I recommend that all members of IADE write articles. Not only does it enable members to share their knowledge and experience, one of the criteria of the expert witness field is being published. The first question I am asked when I meet an expert from another field is, "Are you published?" Writing for the journal adds to your credentials and demonstrates that you truly are an expert in your field.

I used to believe that anyone could write. If you could talk, you could write. However, writing differs from talking and is a skill that can be developed. If you do have difficulty writing, collaborate with one of your peers. I have edited many articles for publication and I have also had my peers review my books before they were published.

There are many topics to choose from when writing an article. You can submit a Case Study of one of your most interesting cases. You can ask your client if you may use his or her case in an article. Court cases are public record except for juvenile cases or any other case that is sealed.

Other topics can cover various aspects of document examination. You can write about various types of equipment used by document examiners. You can write about the process of solving various types of problems. You can conduct research and write a report about that. There is a need for research in various aspects of our work.

Right now, I have two articles for our next edition of our journal and I am looking for additional material. I had originally planned to publish two Journals a year but I have not been able to do so. I am committed to publishing one copy a year, however, if I have enough material, I would be able to publish two issues.

I also want to thank Frank Panepinto, CQDE, for editing the Journal for me.

Kathie Koppenhaver

THE HISTORY OF WRITING IMPLEMENTS

INTRODUCTION

Writing implements, ancient and modern, can be divided into two categories: those that scratch and those that stain. Using the first, inscriptions are engraved, carved or impressed with sharp instruments into, for example, stone, leaves, metal, ivory or wax or clay tablets.

The second category includes instruments that form written characters with color of some kind. In antiquity the reed (in Latin, *calamus*) was a common written tool in this category and was used on such material as the bark of trees, cloth, skins, papyrus and vellum.

From early man's cave paintings to the quill pen – how ink, paper and pens were all involved, the history of writing instruments by which humans have recorded and conveyed thoughts, feelings and grocery lists, is the history of civilization itself. This is how we know the story of 'us' by the drawing, signs and words we have recorded over time.

EARLIEST CAVE PAINTINGS

Nearly 350 caves have been discovered in France and Spain that contain art from prehistoric times.

19000-8000 BC

The cave paintings at Lascaux in France are some of the earliest records of art. The cave murals at Lascaux have been dated to the Solutrean-Magdalenian period (19,000–8,000 BCE), with the earliest art dating from 17,000 BCE.

No brushes have been found at Lascaux, thus one presumes that the paint was applied with moss or fur pads, or crude crayons made from solid lumps of pigment. Reeds and hollowed horns might also have been used as paint-sprayers.

Before 4000 BC

The first evidence of writing comes from Mesopotamia, where stylus-inscribed clay tablets were used in the third millennium BC, to record cruciform pictographs. Mesopotamia was an ancient region that existed primarily in what is now Iraq, and is recognized for its role in the development of the first literate societies. Mesopotamia thrived from the late 4th millennium BC to 323 BC when Alexander the Great conquered the region for the Greeks.

Early man scratched the surface of the moist clay tablet with a bronze or bone tool. The calamus, the stem of a reed sharpened to a point, or the pointed ends of bird feathers, were used for making characters in moist clay. The tablets were fired to dry them out. At Nineveh, 22,000 tablets were found, dating from the seventh century BC; this was the archive and library of the kings of Assyria, who had workshops of copyists and conservationists at their disposal.

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This presupposes a degree of organization with respect to books, consideration given to conservation and classification. The discovery of clay also made portable records possible. Early merchants used clay tokens with pictographs. These tokens date back to approximately 8,500 BC.

Around 4000 BC

One of the caveman's first inventions was a handy sharpened stone. The cave man scratched pictures with the sharpened-stone tool onto the walls of his cave dwelling. The cave drawings represented daily life such as the planting of crops, hunting victories or paintings of animals.

3000 BC Mesopotamia:



Images scratched into the clay with a calamus

Around 3000 BC

The Egyptians developed a form of writing with pictures. For writing on papyrus scrolls scribes used thin reed brushes or reed pens.

2000 BC

One of the oldest pieces of writing on papyrus known to us today is the Egyptian 'Prisse Papyrus' which dates back to 2000 BC.

20BC – 480 AD

The Romans have been developing a form of writing that they scribed into thin sheets of wax (on wooden tablets). Romans used a metal stylus. For short messages and at school, a Roman child was taught to write on the soft wax tablets using a pointed metal stylus. To use the tablet again, or rub out a mistake you smoothed the wax over with the blunt end of the stylus. For important letters the Romans used a metal pen dipped in ink. They wrote on thin pieces of wood or on specially prepared animal skins. Books did not have pages, they were written on scrolls made from pieces of animal skin glued together and then rolled up.

We know that Roman women wrote letters, because some of their letters have survived. One was found at Vindolanda, a fort near Hadrian's Wall in Northumberland. It is a birthday party invitation from Claudia Severa to her friend Sulpicia Lepidina and was written about AD 100.

With the fall of the Roman Empire, reeds of the right quality became less easily obtainable by their heaviest users in Christian Europe – the scribes producing the religious documents of the Church. One of them must have noted the similarity of the reed to the quill of a molted goose

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feather and learned to split and shape the feather's hollow end. The word '*pen*' comes from the Latin word '*penna*' meaning feather.

In Asia scribes used a bronze stylus. It was the Romans who created a reed-pen perfect for parchment and ink, from the hollow tubular stems of marsh grasses. These converted the stems were a primitive form of fountain pen.



DARK AGES - Various implements used for writing

As well as writing on parchment the Anglo-Saxons also used tablets filled with wax for notes and for planning the layout of large books. They wrote on the tables with a metal or bone stylus that had a pointed end and rubbed out the words with the flat end.

600-1800 AD QUILL PENS

To locate an exact period for the invention of the quill pen is impossible. It could hardly have been in use before the fourth century, probably not earlier than two centuries later. Some writers have assumed that it was employed by the Romans, but as no distinct mention is made of them by early classical authors we must accept the only information at hand.

There is a specific reference to a quill pen in the 7th century writings of the Spanish theologian St Isidore of Seville, who published one of the first encyclopedias; though pens fabricated from bird feathers probably date from much earlier. In any event, from about that time the quill pen, more flexible than the reed, became the pre-eminent writing instrument for most of the western world for over a thousand years.

The Europeans found that writing on parchment with a quill pen altered the style of their writing. At first, they used capital letters all the time, but later they developed faster styles with small letters. The writing instrument that dominated for the longest period in history (over one-thousand years) was the quill pen. Quill pens were the writing instrument from 600 to 1800 AD and were the principal writing instrument from the 6th to the 19th century. They went into decline after the invention of the metal pen.

The quill is a pen made from a bird feather. The strongest quills were those taken from living birds in the spring from the five outer left-wing feathers. The left wing was favored because the feathers curved outward when used by a right-handed writer. Goose feathers were most

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common; swan feathers were of a premium grade being scarcer and more expensive. For the finest work, raven or crow feathers were the best, and then came the feathers of the eagle, owl, hawk and turkey.

Quill pens tended to last for only a week before it was necessary to replace them. There were other disadvantages associated with their use, including a lengthy preparation time. The early European writing parchments made from animal skins, required much scraping and cleaning. A lead and a ruler made margins. To sharpen the quill, the writer needed a special knife (origins of the term "pen-knife".) Beneath the writer's high-top desk was a coal stove, used to dry the ink as fast as possible.

The hand-cut goose quill is, rarely, still used as a calligraphy tool, mainly because most paper is derived from wood pulp and wear down the quill quickly, but it is still the tool of choice for a few select professionals and does provide a sharp stroke, and more flexibility than a steel pen. The hollow shaft of the feather (*calamus*) acts as an ink reservoir and ink flows to the tip by capillary action.

Oh! Nature's noblest gift—my gray goose quill!
Slave of my thoughts, obedient to my will,
Torn from thy parent bird to form a pen,
That mighty instrument of little men!

BYRON.

PENCILS - 1500'S

The use of a pencil is one of the earliest forms of self-expression. The history of a pencil takes us back to the early 15th century. The use of graphite in pencils started with the discovery of a graphite mine in England, during the 1500s. Graphite is a form of carbon and was first discovered in the Seat Waite Valley on the side of the mountain Seat Waite Fell in Borrow Dale, near Keswick, England about 1564 by an unknown person. Shortly after this the first pencils were made in the same area.

Soon, people started using it for marking sheep, as the graphite was so pure and solid, that it was very easy to cut it into sticks. Later, they realized that the graphite sticks required some sort of case to make it stable. They used strings or sheepskin as a cover. Eventually, these cases were replaced by wood ones, which are still being used today.

Pencil lead was invented independently in France and Australia. The breakthrough in pencil technology came when French chemist Nicolas Conte developed and patented the process used to make pencils in 1705. A mixture of clay and graphite was fired before it was put in a wooden case. Pencils acquired their name from the old English word meaning 'brush'. [Middle English pencil, artist's brush, from Old French pincel, peincel, from Vulgar Latin *pēnicellus, alteration of Latin pēnicillus, diminutive of *pēniculus*.

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Modern pencils owe it all to an ancient Roman writing instrument called a stylus. Scribes used this thin metal rod to leave a light, but readable mark on papyrus (an early form of paper).

Other early styluses were made of lead, which is what we still call pencil cores even though they actually are made of non-toxic graphite.

1600's

It was the Germans who, in 1662, introduced the method of using a mixture of graphite powder in pencils. Even though the inner core of the pencils is made of graphite, people still call it lead. In reality, there is no trace of lead in pencils. Pencils have traveled a long way from the crude form used in the 1600s to the modern day mechanical ones. Contrary to conventional wooden pencils, these mechanical pencils lack the wooden case. The lead of this pencil is not attached to the case. Its mechanism makes it possible to extend the lead, as the tip of the pencil is worn away.

1775-1817

Jane Austen used quill pens to write her novels and in 1792 she used a crow quill to write a poem as a gift for a friend. The poem was written in tiny writing on a slip of paper and tucked into the pocket of a small needle-case.

PENS FROM 1800 TO PRESENT DAY - 1800-1850

For many people, the fountain pen is the most sophisticated pen to use. There is something pleasurable about writing with a pen that uses liquid ink. Indeed, when writing with a fountain pen, the nib seems to positively glide across the page with such effortless grace as to make the physical act of writing a joy.

Early 1800's: The first designs for pens that could hold their own ink was patented and a metal pen point was patented in 1803 but patent was not commercially exploited. John Schaffer received a British patent in 1819 for his half quill, half metal pen that he attempted to mass manufacture. Steel nibs came into common use in the 1830's. By the 19th century metal nibs had replaced quill pens. By 1850 quill pen usage was fading and the quality of the steel nibs had been improved by tipping them with hard alloys of Indium, Rhodium and Osmium.

Peregrine Williamson. In 1809, the first patent was issued in the U.S. for a metallic writing pen to Peregrine Williamson a jeweler of Baltimore, Maryland. The patent title occurs in summary lists in published books that exist after the fire that consumed all the records at the Patent Office on 15 Dec 1836. Williamson's pens were made of steel rolled from wire, a sort of steel quill that would never need cutting to sharpen the nib, the material costing seven shillings a pound. Five shillings each was paid the workman for making them; this was afterward reduced to thirty-six shillings per gross, which price was continued for several years. His first attempt did not write well for want of flexibility but that was solved by adding two

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more slits parallel to the main one. He then had a product that eventually sold so well it kept him and a journeyman employed full-time in a profitable business.

There are references to steel pens being used in Britain before this patent as Samuel Harrison, an Englishman, made a steel pen for Dr. Priestly in 1780.

1831

John Jacob Parker patented the first self-filling fountain pen in 1831. However, early fountain pen models were plagued by ink spills and other failures that left them impractical and hard to sell. The oldest known fountain pen that has survived today was designed by a Frenchman named M. Bion dated 1702.

1884

Lewis Edson Waterman, a New York insurance broker, invented the first workable fountain pen. The fountain pen became the predominant writing instrument for the next sixty years. During this time, four fountain pen manufacturers dominated the market: Parker, Sheaffer, Waterman and Wahl-Eversharp. Writing instruments designed to carry their own supply of ink had existed in principle only for over one hundred years before Waterman's patent. Lewis Waterman patented the first practical fountain pen in 1884.

1888-1916

First ball-point pen was patented in 1888. When George Parker established the Parker Pen Company in 1888 in Janesville, Wisconsin, it was with the determination to make "a better pen." Parker was a telegraphy teacher but sold pens part time to earn extra money. Apparently, the pens he sold required constant repair, so Parker resolved to improve them. He went on to create a dynasty of market leaders among fountain pens.

Parker patented his first fountain pen in 1889. In 1894, the company patented the Lucky Curve, a system whereby ink was returned to the reservoir by capillary action and ink leakage was greatly reduced. Parker introduced the Gold Filigree Lucky Curve Pens in 1900.

The principle of the ball pen actually dates from the late 19th Century when patents were taken out by John Loud in 1888 for a product to mark leather and in 1916 by Van Vechten Riesberg. However, neither of these patents were exploited commercially.

1938

Invention of ballpoint pen by two Hungarian inventors, Laszlo Biro and George Biro. The brothers both worked on the pen and applied for patents in 1938 and 1940. The newly formed Eterpen Company in Argentina commercialized the Biro pen. The press hailed the success of this writing tool because it could write for a year without re-filling. In the summer of 1943 the first commercial models were made. The rights to Lazlo's patent were bought by the British

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Government.

The ball pen is more rugged than the fountain pen which may be why sales rocketed during World War II when the Military needed robust writing implements to survive the battlefield environment.

May 1945

Eversharp Co. teams up with Eberhard-Faber to acquire the exclusive rights to Biro pens in Argentina. The pen was re-branded Eversharp CA. The CA translated as Capillary Action.

June 1945

Less than a month after Eversharp/Eberhard closed the deal with Eterpen, Chicago businessman, Milton Reynolds visits Buenos Aires. While in a store he sees the Biro pen and recognizes the pen's sales potential and purchases a few pens as samples. He returns to America and builds the Reynolds International Pen Company, ignoring Eversharp's patent rights.

October 1945

Reynolds copies the product in four months and sells the product, the ball point pen, as Reynold's Rocket at Gimbel's department store in New York. The pen was sold as 'The first pen to write underwater and was smear proof'. This must have been an unsatisfied demand as some 10,000 were sold at the launch at the department store on October 29, 1945. Nevertheless, Eversharp's pen did not live up to its own advertisements as Reynolds' pens leaked, skipped and often failed to write. A high volume of pen returns by unsatisfied customers occurred for both Eversharp and Reynolds. The ballpoint pen fad ended.

December 1945

Great Britain was not far behind with the first ball-point pens available to the public at Christmas by the Miles-Martin Pen Company. The ball point pens became popular. Biro pens were used by the British Air Force in W.W.II and they worked.

1950-1953

First inexpensive ball point pens were available when the French Baron, called Bich, developed the industrial process for manufacturing ball point pens. He drops the 'h' and starts selling pens under the name of BIC. As ballpoint pens have become unpopular, fountain pens are popular again. Reynolds folds.

1954

Parker Pens introduce its first ball point pen, the Jotter. The Jotter wrote five times longer than the Eversharp or Reynolds pens. It had a variety of point sizes, a rotating cartridge and large capacity ink refills and, best of all, it worked well. It became immediately popular.

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1957

Parker introduces the tungsten carbide textured ball bearing in their ballpoint pens.

1960's

It was invented fiber, or felt tipped pen (Tokyo Stationery Company, Japan). Papermate's Flair was among the first felt-tipped pens to hit the U.S. market in the 1960's and it has been the leader ever since. Following their initial success with felt-tips, manufacturers branched out with a variety of fiber-tipped instruments, including newly popular highlighters.

1980's-1900s

Roller Ball Pens. The introduction of the roller ball pen had been made in the early 1980's. Unlike the thick ink used in a conventional ball point, roller ball pens employ a mobile ball and liquid ink to produce a smoother line. Technological advances achieved during the late 1980's and early 1990's have greatly improved the roller ball's overall performance.

1990's

Rubberized writing instruments are commonly used by pen companies, to reduce the grip.

1997 onwards

Ring Pens' mass production (GRANDEE Corp). This pen is designed to write without gripping the pens with three fingers.

Today

There is strong competition among pen manufactures and a variety of fountain pens, ballpoint pens and roller ball pens, pencils and crayons are all used today, with manufactures constantly trying to improve the quality of their products. The highly popular modern version of Laszlo Biro's pen, the BIC Crystal, is still sold in large numbers and Biro is still the generic name used for the ballpoint in most of the world.

OTHER WRITING IMPLEMENTS

Stick forms of chalk, crayons and charcoal are other types of writing instruments.

CONCLUSION

Those of us involved in our own personal arms race of computers, operating systems and software might hanker for the simpler technology of Jane Austen's time (1775 – 1817). The quill pen she used was made from easily obtainable materials and required only the simplest of equipment in its manufacture.

After very briefly touching the surface on the research of writing implements through time, it is somewhat surprising to discover that we have not advanced so very far, the pencil being very similar in design today as it was in earlier times, and pens are not so dissimilar in shape,

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being long and narrow with a pointed end, to those of the shape of the quill pen or the design of early seventeenth century pens.

All dates have been cross-checked, and are as accurate as possible.

Margaret Webb completed her training through the Forensic Document Examination Interactive Training Program in 2010. This article is her research paper that she submitted as part of the course.

A BRIEF HISTORY OF DOCUMENT EXAMINATION

The art of forgery is as old as the alphabet. The crime of forgery has been practiced since ancient times in every country where writing existed and paper was used for financial transactions. Laws against forgery can be traced to 80 BC when the Romans prohibited the falsification of documents that transferred land to heirs. Forgery was prevalent in Europe in the Middle Ages. Gradually laws were passed to prohibit forgeries in every developed country, but it was difficult to identify some of the highly skilled forgeries.

While forgery had its foundation in ancient times, expert testimony in court cases was limited until the late 1800's. Only a witness who had knowledge of the writing or had witnessed the writing was allowed to identify handwriting. There were no document examiners at that time. The jury had to decide if the handwriting was genuine or not.

In 1562 a statute was passed in England during the reign of Queen Elizabeth I that prohibited forgery of publicly recorded officially sealed documents affecting the title to land. An expansion of the forgery laws was passed in 1726 making a false endorsement on an unsealed private document a capital crime punishable by death. Pillory, fines and imprisonment were the penalties in cases not subject to capital punishment.

The United States Federal Government passed an Act for the punishment of people committing forgery in 1823. It prohibits false-making, forgery or the alteration of any writing for the purpose of obtaining or receiving any sum of money from the US Government.

The American Law Institute's Model Penal Code of 1962 simplified and defined the elements of forgery and became the standard for defining the crime of forgery. The following elements must be present to support a charge of forgery: falsely creating or passing a check with a fraudulent or fictitious signature (false making) which imposes a legal liability with the intent to prejudice, damage, or defraud. The victim or a witness must be able to identify the forger. The author of the spurious check and the person who attempts to pass it are both guilty of forgery although the person passing the check is usually charged with uttering which is an attempt to pass a forged document.

First Significant Case

The first significant case in this country was tried in Massachusetts in 1867. It involved traced signatures of Sylvia Ann Howland. Bankers, tellers, professors of penmanship and photographers and engravers were the only experts allowed to testify.

Early Examiners

One of the earliest handwriting experts was Daniel Ames who was a skilled penman. He wrote *Ames on Forgery* in 1900. Ames had a private practice from 1861 to 1909.

John Tyrrell was a pioneer in document photography. He was a document examiner with the Northwestern Mutual Life Insurance Company for 45 years and had a private practice from 1896 to 1955. He was one of the experts who testified in the Lindbergh Kidnapping Case.

Albert S. Osborn, known as the "Father of Document Examination" wrote *Questioned Documents*, the first practical book on the subject. This book was originally published in 1910 and republished in 1929. Osborn was the first to scientifically demonstrate that an opinion is no stronger than the reasons given to support it. He advocated the need for full explanation of an opinion on direct testimony. (Bradford & Bradford p. 13). Osborn was in private practice from 1887-1946. His son and grandson took over the business when he retired. Albert Osborn was one of the founders of the American Society of Questioned Document Examiners in 1942.

Handwriting Examiners

In the early years, professional handwriting examiners came strictly from the private sector. The first two government examiners were Dr. William Souder of the National Bureau of Standards, Department of Commerce and Bert C. Farrar of the Treasury Department. The first scientific police laboratory was established in 1930. The FBI opened their laboratory in 1932 with one document examiner. The Post Office followed with their laboratory in 1940.

In 1938, Clarence D. Lee, co-author of *Classification and Identification of Handwriting* joined the Institute of Applied Science which was a correspondence school offering training in various identification studies such as fingerprint identification and questioned documents. Lee wrote the document course for the school. Many handwriting examiners got their start through this correspondence school. This school is no longer in business.

Chauncey McGovern, a handwriting expert in San Francisco, awakened the public to the field of document examination with an article entitled, "Indistinct Pen-Writing Made Clear by the Camera" for Camera Craft Magazine. In a speech at the 1922 International Association of Identification Conference, McGovern said, "No matter what the handwriting expert sees, or imagines he sees in disputed writings, it is not of the least value unless he can make photographs which the judge and jury can see clearly and understand distinctly."

Well-known Cases Involving Forged Documents

Lindbergh Kidnapping Case

The Lindbergh Kidnapping Case and the testimony of Albert S. Osborn and seven other document examiners identifying Bruno Richard Hauptman as the writer of the kidnap notes publicized the field of document examination. However, in comparing the questioned writing with the known, many document examiners disagree that Hauptman wrote the kidnap notes.

In 1947 the Saturday Evening Post ran a series of articles entitled "Hot Documents" featuring Clark Sellers, a Los Angeles document examiner. The article described many cases that were

solved through handwriting examination. This series introduced the field of document examination to the public.

The Lindbergh Case popularized handwriting expertise. It was the beginning of modern experts in the field of handwriting identification. Since that time there have been several well-known forgery cases.

Howard Hughes' Forged Autobiography

In 1971 Clifford Irving convinced his publishers at McGraw-Hill that he had been authorized by Howard Hughes to write his autobiography. He produced forged letters from Howard Hughes to himself requesting Clifford Irving's assistance in writing his autobiography. Irving even fabricated a contract between himself and Howard Hughes to divide the money from the book. He did extensive research on Howard Hughes in order to make his book appear to be authentic.

Life Magazine purchased the rights to run excerpts of the Howard Hughes Autobiography for \$250,000. To verify the authenticity of the letters from Howard Hughes they hired the firm of Osborn, Osborn, and Osborn who compared samples of Hughes' known writing with the Irving forgeries. He and four other experts testified that the letters written by Hughes were genuine. Paul Osborn wrote, "*The evidence that all of the writing submitted was done by the one individual is, in our opinion, irresistible, unanswerable and overwhelming.*"¹

Clifford Irving was counting on the fact that Howard Hughes would not come forward and denounce his work. However, Howard Hughes did state publicly that he had not authorized Clifford Irving to write his autobiography. Irving was arrested and served jail time for his forgery. His wife who had cashed the checks from McGraw-Hill also served time in jail.

Clifford Irving admitted forging the autobiography and claims that he had intended to return the money to McGraw-Hill. A comparison of Clifford Irving and Howard Hughes' handwriting revealed many similarities between the two writers.

¹ ["Forgery, Hitler's Diaries Join the Long List of Famous Frauds," Time Magazine, May 16, 1983, p 42.](#)

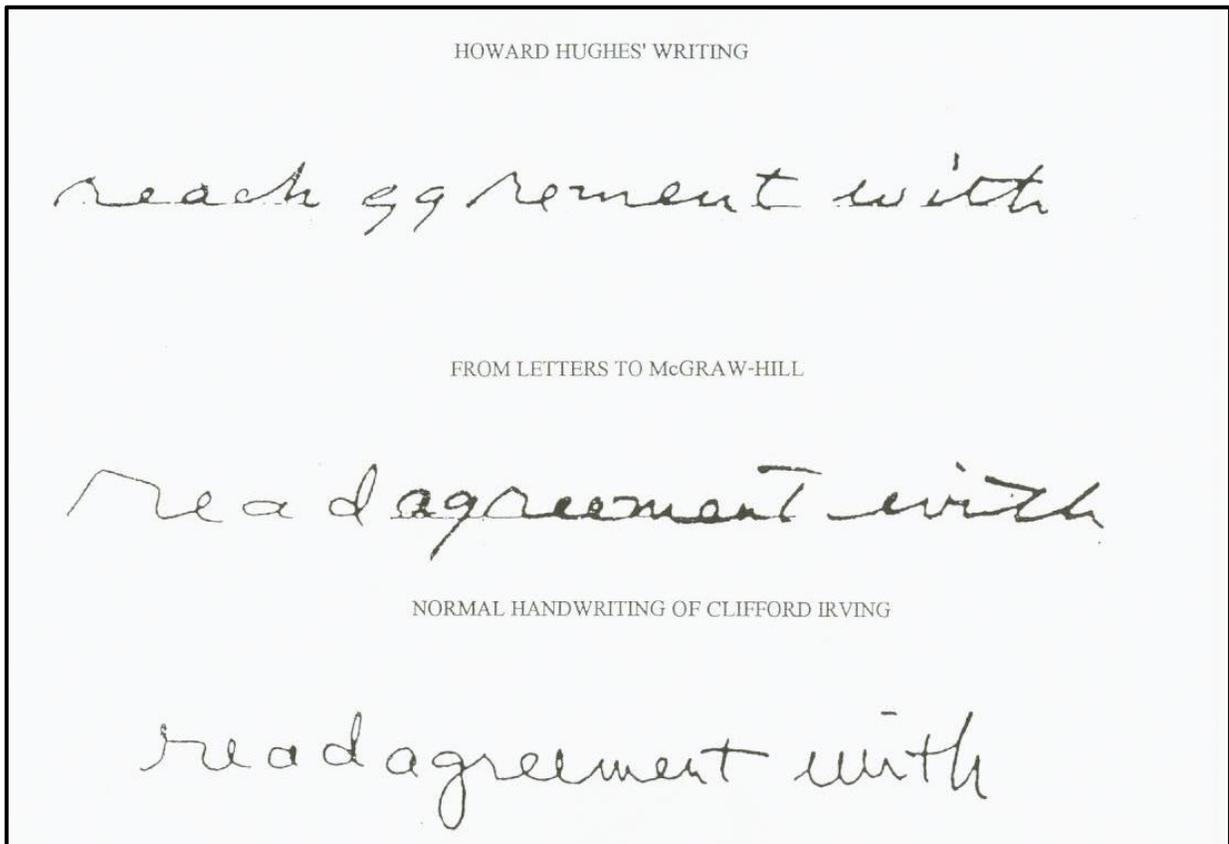


Figure 1

Konrad Kujau

On October 20, 1979, Konrad Kujau informed some friends at a party that 27 Hitler Diaries had been discovered in a crashed plane in East Germany. He boasted that he had contacts who could smuggle the diaries out of East Germany.

Like Irving, Kujau researched his subject with books and newspapers in order to make his diaries appear genuine. For two years he spent his days writing furiously in his studio in order to complete the 27 diaries supposedly written by Hitler from 1933 to 1945. He doctored them with tea stains and bashed the finished volumes around to age them. He contacted a journalist for the Stern Publishing Company, Gerd Heidemann, who believed that the journals were genuine. The Stern Publishing Company did not investigate the origin of the diaries because they wanted to keep the fact of the diaries private until they were published.

A story was concocted to guarantee complete secrecy for the project. It was believed that the lives of the East German smugglers would be endangered if any information of the diaries' existence

leaked out. It was therefore agreed that they would not consult a handwriting expert, a forensic scientist or a historian until all 27 of the diaries were recovered.

Altogether Kujau forged and sold 62 Hitler diaries. Kujau made many mistakes in creating his forged diaries. First, he used ordinary school notebooks which could not have been available during the correct time period. These notebooks contained pages made of paper which was a poor-quality mixture of coniferous wood, grass and foliage, laced with a chemical paper whitener that came into existence in 1955. Hitler would have used diaries of higher value. The binding of the books also contained polyester threads and the glue contained chemicals not available until after World War II. The diaries had been stained with tea to give them the appearance of age.

The red threads attached to the seals on the covers contained viscose and polyester, plastics not available in Hitler's era. While the labels on the covers were typed on an Adler Klein II Typewriter manufactured between 1924 and 1934, the typing was sequential. There was no evidence of wear to the typeface which would occur over a seven-year period.

There were four different varieties of ink used in the diaries which did not match any of the inks known to be in existence during World War II. West German artists' shops carried the inks used in the forged diaries. Scientists measured the evaporation of the chloride from the inks to determine their age and concluded that the inks were one to two years old.

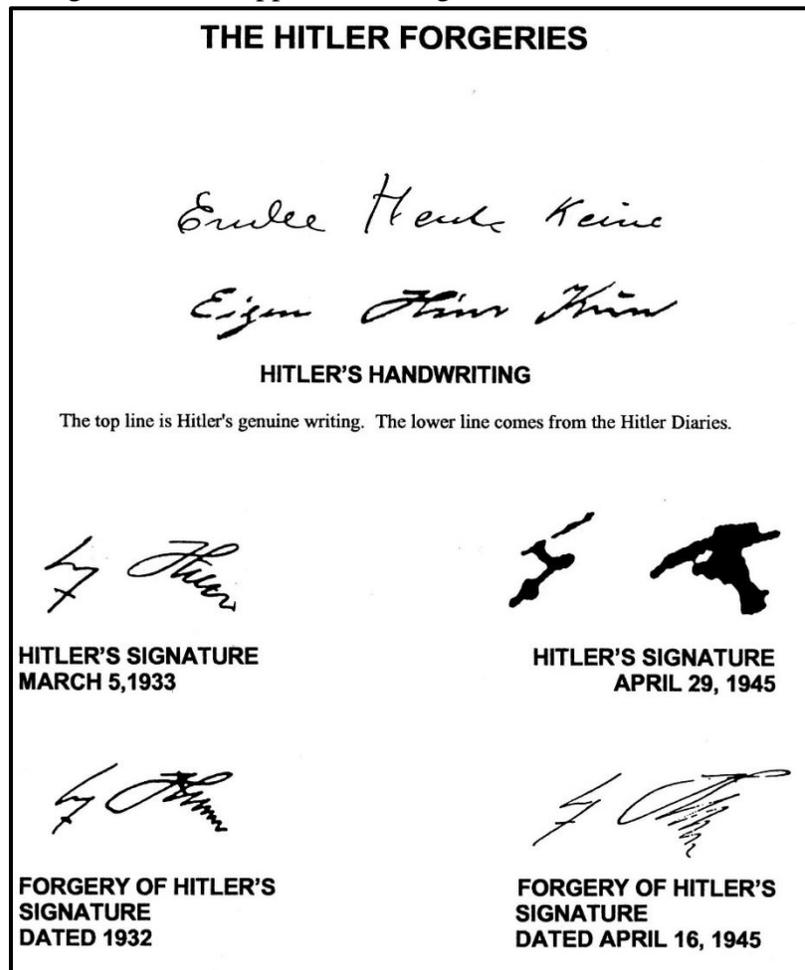


Figure 2

Kujau spent time in jail for his forgeries. He continued to create fake signatures of Adolph Hitler and sold them as fakes.

Ordway Hilton authenticated the Hitler Diaries. He assumed that the comparison documents were genuine but they were also created by Kujau. However, an examination of the original diaries revealed the problems with the documents.

Mark Hofmann

Mark Hofmann identified himself as a rare autograph dealer who "discovered" many rare documents, particularly Mormon memorabilia. His letter allegedly written by Joseph Smith described how a white salamander had revealed the hiding place of the Book of the Mormons, thus it became known as "*The Salamander Letter*."

Mark Hofmann spent considerable time researching the Mormon religion at Utah State University basing many of his forgeries on this research. He stole pages from old books so that he had paper from the proper time period on which to create his forgeries. His years of research enabled him to fool the experts, including the FBI, for 5 years.

Hofmann's customers placed orders for the documents they wanted to collect and never questioned his ability to deliver what would be hard-to-find or non-existent documents.

When the experts examined the Hitler diaries in their forensic laboratories, they were able to prove the fraudulent nature of the diaries based on analysis of the paper and ink. But Hofmann used paper from the right period and an ink formula that matched the correct composition used during the time period when the documents would have been created.

The experts authenticated Mark Hofmann's forgeries based on the paper and the ink. The ink had been artificially aged by the use of heat and chemicals. Heating a document in an oven ages the paper and ink but it ages the paper approximately ten times as fast as the ink. Ironing the document with an iron will yield similar results.

Microscopic examination of the documents is a basic procedure in most document cases. The microscopic examination of the Hofmann documents revealed an alligatoring effect in the ink. This effect was seen only in the Hofmann forgeries. It occurred by treating iron-gall ink with hydrogen peroxide and ammonium hydroxide to artificially age the ink.

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BOOKS OF INTEREST TO DOCUMENT EXAMINERS

The following books cover the stories of modern-day forgers. Some are no longer in print, such as Clifford Irving's book. All are interesting reading. These books are part of my bibliography.

BOOKS RELATING TO THE LINDBERGH KIDNAPPING

This was the first case in which document examiners played an important part.

Kennedy, Ludov, *The Airman and the Carpenter*

Scaduto, Anthony, *Scapegoat*

Waller, George, *Kidnap; the Story of the Lindbergh Case*

BOOKS RELATING TO THE HOWARD HUGHES FORGED AUTOBIOGRAPHY

Fay and Stephen, *Hoax, The Clifford Irving Affair*

Irving, Clifford, *Hoax, What Really Happened*

BOOKS RELATING TO THE MORMON FORGERIES

Lindsay, Robert, *The Gathering of Saints*

Sillitoe, Linda, and Allen Roberts, *Salamander, the Story of the Mormon Forgery Murders*

Naifeh, Steven and Gregory White Smith, *The Mormon Murders*

Worrall, Simon, *The Poet and the Murderer, A True Story of Literary Crime and the Art of Forgery*

BOOKS RELATING TO THE HITLER DIARIES

Hamilton, Charles, *The Hitler Diaries*

Harris, Robert, *Selling Hitler*

BOOK ABOUT THE RIPPER DIARY

Cornwell, Patricia, *Portrait of a Killer, Jack the Ripper, Case Closed*

Harrison, Shirley, *The Jack the Ripper Diary*

THE VISUAL DETECTION OF HANDEDNESS FROM HANDWRITING ALONE

1. Introduction

In legal cases where handwriting or a signature are disputed there are occasions when the determination of the handedness of a writer could be crucial to deciding whether or not a certain accused individual created the writing, especially as there is a far smaller percentage of left-handed writers compared to right handers.

In 1958 William R Harrison wrote in his book *Suspect Documents*ⁱ “While it is true that many who habitually use the left hand adopt a most peculiar writing position which might have some effect upon the writing, the author has to confess that this feat is beyond his powers, for he has been unable to discover any consistent feature of a handwriting which would infallibly indicate which hand was used.”

However, in 1994 Tom Davies BA, BLitt (Oxford)ⁱⁱ, a professor at Birmingham University and a forensic document examiner clearly differed from Harrison’s opinion.

He wrote “Why do I study handwriting? Because it is interesting, and there is a great deal of work to do, and because it is important. People regularly go to prison on the basis of handwriting analysis, so it is necessary to know as much about it as possible. This seems obvious. It is not universally accepted, however. In 1982 we were given a research grant of about £10,000 to attempt to produce a statistically based description of the characteristics of left handed handwriting. Which we duly did. However, I incautiously issued, under the promptings of the University Press Office, a modest press-release describing the project. This caused a remarkable uproar. Some of the less scrupulous newspapers (the worst offender was *The Daily Telegraph*) took up our project as a clear example of totally useless, utterly academic research. The Home Office was besieged with letters. An MP was narrowly prevented from asking questions in the House. I was amazed.”

In answer I can offer another anecdote. Some years ago, a man whom the newspapers called the Black Panther kidnapped a young girl. He sent out ransom notes. There was an enormous man-hunt, costing over a million hours of police time. He murdered her, eventually: she was found hanged, on a steel rope, in a sewer. When the murderer was finally caught, he was found to be left-handed. Had this been deduced from the handwriting of the notes, the number of possible suspects would have been cut by 90%. But this could not happen, because the Home Office had not yet given Birmingham University a grant to do the necessary research. The need for handwriting experts, and the need for research in handwriting, is obvious.”

2. The Percentage of Left Handers to Right Handers

Studies have shown that the number of left-handers compared to right-handers in the world averages about ten to eleven per cent.

According to S. Corenⁱⁱⁱ, approximately 9 out of 10 people are right-handed, a proportion that appears to have been stable over thousands of years and across all examined cultures. Handedness is usually assessed by having individuals answer a series of questions about preferred manual behaviors, whereas anthropologists have determined the incidence of handedness in ancient cultures by examining artefacts; the shape of a flint axe, for example, indicating whether it was made by a right- or left-handed individual. Handedness in antiquity has also been assessed by examining the incidence of figures in artistic representations who are using one hand or the other. Based on this evidence, our species appears always to have been mainly right-handed^{iv}.

A large-scale historical study of handwriting down the ages by academics at University College London (UCL) has found that the proportion of left-handers has gone up from 3% among those born more than 100 years ago to 11% today.

In 1990 D. Rubin^v believed that environmental factors including social conditioning and training had an effect on handedness. Chris McManus^{vi}, professor of psychology at UCL, said the surge in left-handedness may be due to a reduction in attempts to coerce naturally left-handed children into using their right hands.

Although left-handers currently form about 11% of the population, only about 3% of those born in 1900 were left-handed, a more than three-fold difference which requires explanation. Whether the difference results from social pressure for left-handers to become right-handed, artefacts resulting from response biases that can occur when questionnaires are used, or perhaps a greater mortality of left-handers is still controversial. Left-sided arm-waving, as observed in documentary films made between 1900 and 1906, and which correlates with left-handedness, occurs less often in 391 individuals born in the Victorian period, than in a modern control group. Left arm waving was also more frequent in the older individuals in the Victorian sample, an age effect that excludes any explanation in terms of increased mortality of left-handers. Since Victorian social pressure to wave with the right arm also seems highly unlikely, and there can be no response bias, the most likely interpretation is of a falling rate of left-handedness in the nineteenth century, with a true increase in left handedness during the twentieth century.

McManus's team have reinforced the theory that left-handedness is growing by analyzing recently discovered film shot in about 1900 which shows that only 16% of those living at the beginning of the 20th century used their left arms to wave, compared with about 24% of people

today. The 800 reels of footage of Edwardian England were taken by Sagar Mitchell and James Kenyon.^{vii}

Various research papers list the number of left handers as being 10% of the population^{viii}, with less than 1% being comfortable writing with either hand. In his survey of 1992, Nigel Bradley of the University of Westminster also found that 10% of the population was left-handed with slightly more men being left-handed than women.^{ix}

Recently in The Sunday Times John Elliott reported that a large scale historical study of handwriting down the ages had found that the proportion of left-handers had gone up to 3% since a hundred years ago, and the percentage of left handers now was 11%.^x

However, back in 1961 M.M. Clarke^{xi} put forward the idea that no-one is exclusively right-handed or left-handed because there are degrees of handedness and therefore it is not possible to divide the population in this way. Tests to prove lateral dominance proved to be somewhat inadequate^{xii} because of the high frequency of mixed and inconsistent patterns in the writing of normal children.

3. Aims & Objectives

The aim of this research is to establish whether a sample of handwriting can be determined to be written by a left-handed or right-handed writer with absolute certainty from the close visual study of the direction of pen movements and significant letter shapes in the handwriting.

4. Materials and Methods

For the purposes of this research a number of writers would be asked to copy out an identical paragraph. A relatively simple paragraph from a popular children's book was selected for this purpose, to avoid complex spellings. The particular paragraph was also carefully selected because it contained all the letters of the alphabet with the exception of the letter X.

The samples received were labelled with an L for a left-hander and R for a right-hander and given a sequential number.

Each handwriting sample was carefully examined under magnification for specific signs of left-handedness. Any lack of these signs was deemed to be similar to right-handed execution. Therefore, the right-handed samples were also scrutinized for specific signs of left-handedness, and any absence of these signs deemed to be a sign of right-handed execution. Any anomalies in both sets of writing examples were also noted.

The different signs found in the left-handed samples and the right-handed samples were then calculated as percentage occurrences and expressed in graphs.

5. Criteria

In her research paper on Left Hand and Opposite Hand Writing Features by Jacqueline A. Joseph^{xiii} CDE, the author compiled a researched list of eleven elements that were indicative of left-handed writings or right-handed writings written with the unaccustomed left-hand. The purpose of her research paper was to assist questions of common authorship of documents, and whether a writer by changing hands could sufficiently disguise their writing to avoid detection.

The compiled list of traits has therefore been used as an initial guideline in this research as follows:

Traits having significance indicating a person is a left-handed writer:

1. Crossing of the lowercase “t” from right to left.
2. Leftward drag of elongated i-dots.
3. Long initial stroke of letters at the beginning of a word which may proceed either in an upward or downward direction
4. Hooks and curves at the beginning of some small and capital letters with start in a leftward direction
5. Prominent eyelets in the beginning part of the small “a, d and g”, representing an initial underhand motion
6. Overhand motion in forming lower case v (made with retrace or eyelet at bottom) and the lowercase “h” (eyelet formed where loop and hump are joined).
7. Tenting of lower case “h, l and t”: and tenting of the upper part of capital “I and j”.
8. Open lower part of the final lowercase “g and y” with the ending stroke curving to the left; also, triangular or v-shaped lower parts of those letters.
9. Absence of terminal endings of such letters as lower case “d, l, and t”, as well as lower case “h, m, and n”, with slight pen drags to the left.
10. The terminal of the lowercase “s” with an absence of a retraced bottom coupled with a leftward extension of the closing part
11. Similar to the lowercase s, the lowercase “f and k” as well as capital “G”, also are found to have considerable leftward extension in their closings

5.1 In addition, close examination of the burr striations^{xiv} of the biro or pen on the paper were scrutinized under x9 magnification. The burr striations and their path along the written word offer visual clues as to which direction the letter was formed. This in turn can provide a valuable clue as to the direction of circular pen-strokes, as shown in the lines left by the uneven edges of the biro rollerball, known as burr striations. This is evident particularly on the letter “O” which is usually formed by a right hander in an anti-clockwise direction, but can on occasion appear formed in a clockwise direction.

In cases where the volunteer writers had used felt tip pens or other writing implements where the striations were not visible it was not possible to take this element into account.

6. Subjects

Nineteen of the handwriting samples submitted were written by left-handers and forty-six by right-handers giving a total of 65 samples for study. Handedness was classified by self-report. The form was either given out directly and handed back, or sent out by email, printed out, completed by the subject and returned by post.

The majority of the samples were written by British educated citizens, but also include samples from writers who are Dutch, French, Italian, Hungarian and also a Dutch-born Israeli. The age range of the volunteers ranged from under 15 years to over 90 years.

Some interesting comments emerged from the participants. One writer was adamant that it was his belief that everyone had mixed handedness because he himself wrote on paper in a disconnected style with his left-hand, yet played sports right-footed and right-handed, and wrote in a connected style on the blackboard with his right hand. Many of the left-handers were emotionally expressive of the iniquity and difficulties of belonging to a largely overlooked minority in a right-handed society. Some right-handed writers had deliberately formed letters in opposition to the normally prescribed connective directions to differentiate themselves stylistically.

7. Findings

In the writing of the left handers there were many samples where there was no indication that the writings were written with the left hand. As can be seen from the graphs (8.5) a significant percentage had significant movements in their writing which indicated that they might be left-handed.

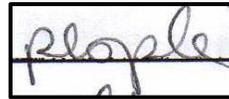
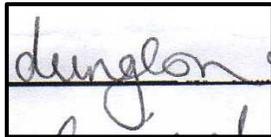
7.1 The slant of all of the writings, both right handed and left handed, varied and therefore support the research by Reed Hayes, a Document Examiner in Hawaii, who wrote^{xv} “It is possible for a lefthander to achieve a fluid, rightward motion by adjusting body position and paper, so there is little evidence to support the popular notion that left-handers’ writing typically slants leftward.”

7.2 Of the criteria elements used (See Point 3 above) there was no great correlation between traits only typical of left-handers, as many of the traits were also found in the right-handed samples as well. However, it should be noted that the criteria traits were based on the handwriting style of US citizens, and some of the flourishes taught in the American handwriting styles are sometimes less common in European scripts.

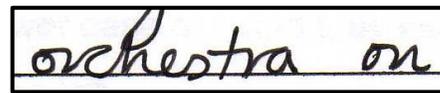
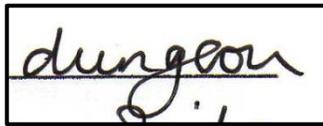
7.3 One of the main movements denoting the handedness in the writing of the left-handers’ was found to be the reversed oval movement, further confirmed by examination of the burr striations

left in the biro ink where possible. In the samples below the obvious connection of the “O” created in a clockwise motion is more commonly thought to be used by a left-hander.

The majority of the left-handed writers in this sample used reversed oval formations to connect successfully to the next letter, (see example L13 below - the letter “O”), but as can be seen (Example L6 – the letter “O”) not all of them used it, and were able to successfully form the connections in the taught manner.

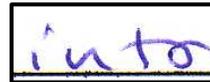


Examples from L13



Examples from L6

7.4 The reverse the oval formation was not generally found in the writing of the right-handers in the group, except in three instances (as in R14 examples below – the letter “O”).

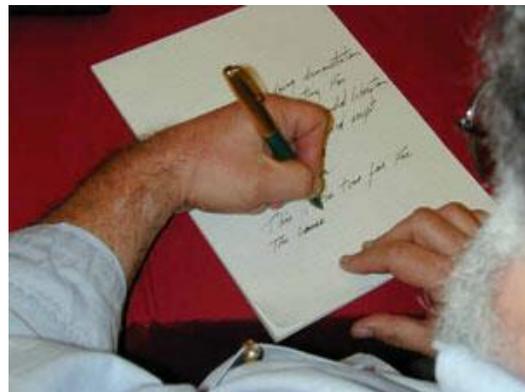


Examples from R14

7.5 The use of the open “g and y” loops was found widely in both groups of writing, although there was a significantly larger percentage in the left-handed group. There were many other types of loops used in both groups, so no significant style type was linked to either the left hand or the right-handed group.

7.6 The shortening of terminal strokes was more evident in the handwriting of the left handers than the right handers.

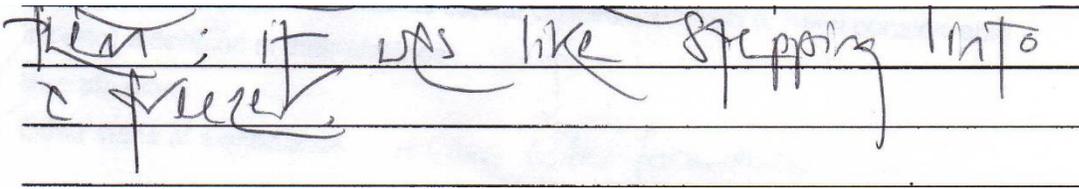
7.7 Much comment has been made on the awkwardness of the writing position^{xvi} of left-handed writers who are often forced to use a “hook position” in order not to smear what has just been written.



www.lefthander.com/writer.htm

“Languages that are written left-to-right, like English, are more difficult to write with the left hand -- a right-hander writes away from his body and pulls the pencil, while a left-hander must write toward his body and push the pencil. If a left-handed child is only permitted to write with the left hand but not *taught* how to write, the child may develop a needlessly uncomfortable, inefficient, slow, messy way of writing that will be a lifelong hardship.”

7.8 On searching among the submitted samples for smooth fluidity or absence thereof, in the left-handed handwriting samples, again the whole gamut of styles were evident, from quickly executed, fluid writing to awkward, stilted writing styles, right through to the intriguingly bizarre (L12).



Example from L12

8. CONCLUSIONS

Looking at the movements of the volunteer samples of handwriting it becomes clear that there is a greater percentage of the particularly denoted left-hander movements (as described in Point 4 above) in the left-handed writers, as one might reasonably expect.

8.1 The strongest handwriting movement among the left-handers denoting left handedness was the evidence of short terminal strokes (57.9%) as opposed to the right-handers (45.6%).

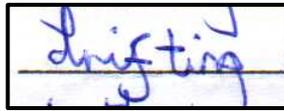
8.2 In the handwriting samples of the right-handers the highest percentage handwriting movement was the open “g and y” loops. However, the percentage of left-handers using this type of open to the left loop or triangle was higher (57.9%) than the right-handers (50%).

8.3 The clockwise “o” formation was found in just over half of the writing of the left handers (52%), whereas it was present in only a very small percentage of the right handers (6.52%) presenting the greatest percentage disparity of the individual handwriting characteristics between the two sets of samples.

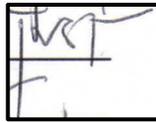
8.4 Of significance, however, is the complete absence of reverse t-crosses on any of the right-handed samples (0%). Whilst some of the left handers did not consistently use reverse t-crosses throughout their script, evidence of the use of reverse t-crosses in the left handed samples occurred in a significant percentage of the texts. (26.3%).



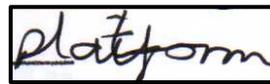
L1



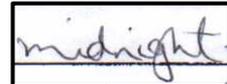
L4



L12



L13



L15

8.5 Percentage Charts

LEFT HANDERS

Handwriting Movement	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	%
1. Reverse t-cross	█										26.3
2. Dragged i-dots	█										10.5
3. Long initial strokes	█										10.5
4. Leftward Initial hooks	█										15.8
5. Eyelets on a,d,g	█										15.8
6. Overhand v, h	█										5.2
7. Tented h, j, t, l	█										15.8
8. Open g,y loops, or angular	█										57.9
9. Short terminals d,l,t,h,m,n	█										73.7
10. S lower retracing	█										26.3
11. Leftward extensions f,k,G	█										10.5
12. Clockwise o formation	█										52.0

RIGHT HANDERS

Characteristic	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	%
1. Reverse t-cross											0
2. Dragged i-dots	█										2.2
3. Initial strokes	█										4.4
4. Initial hooks	█										8.7
5. Eyelets on a,d,g	█										2.2
6. Overhand v, h	█										2.2
7. Tented h, j, t, l	█										19.5
8. Open g,y loops or angular	█										50.0
9. Short terminals d,l,t,h,m,n	█										45.6
10. S lower retracing	█										10.8
11. Leftward extensions f,k,G	█										15.2

9. Conclusion

The final conclusion reached is that the most noteworthy handwriting trait that has emerged from the close analysis of the total of 65 samples of writing is the reverse t-crossing, drawn from right to left as being uniquely produced by lefthanders.

While the clockwise “o” formation on its own is not a conclusive sign of left-handedness, the percentages found in the left handers as opposed to the right handers in this survey demonstrate that it is would be of particular significance in detecting handedness, especially when found in combination with the reverse t formation.

Whilst it should be borne in mind that some left-handers show few or no left-handed traits, the appearance in a script of these two movements together would help the Forensic Document Examiner to give a higher determination of probability in the visual detection of handedness.

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PRIMARY QUALITIES and CHARACTERISTICS of HANDWRITING

The principal part of any comparison is the discovery, identification, and evaluation of all writer habits that occur in the movement and structures of the writings. The features to be evaluated are those that are most apparent, the primary features, which include the following:

Pictorial Appearance

Different general appearances among writings do not necessarily indicate different writers. A writer can change the general appearance of his or her writing by adopting a different style and by willful disguise. The general appearance of writing can change from any cause that affects movement, such as different writing positions, stress, undue restraint, accidents, use of drugs, and alcohol. Signatures may vary in general appearance depending on the purpose requiring a signature. Business signatures may differ in some small way for social signatures.

The pictorial appearance is the feature most closely followed in imitated writing that is intended to create a resemblance; it can differ for different styles of writing by the same writer; it can be changed intentionally; and it can change as a result of the conditions of the writer and circumstances of the writing.

Conclusions of identity should not rest heavily on the pictorial appearance of writing because of numerous variations involving general appearance.

Base Line Alignment

Base line alignment refers to the lining of the base of the writing along a prescribed or imaginary line. Base alignment of letters in freehand writing is seldom rigidly straight. Some writers do, however, maintain rigid base alignment without a base line guide. (See Figure 1)

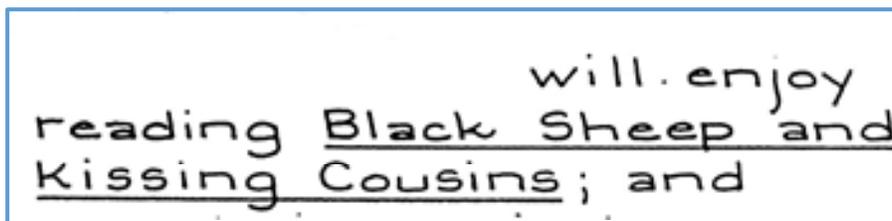


Figure 1

Writing guided by a straight edge which produced a rigid base alignment necessitating that lower extenders be added after the line of writing was finished.

Initial and Terminal Strokes

The initial stroke in writing also referred to as beginning stroke or approach stroke is the first stroke that commences a line or letter.

Terminal strokes are the final or ending strokes on a word or letter. Most final strokes extend beyond the letter itself. Extended terminal strokes may be short garlands, straight lines, long sweeping curves or flourishes.

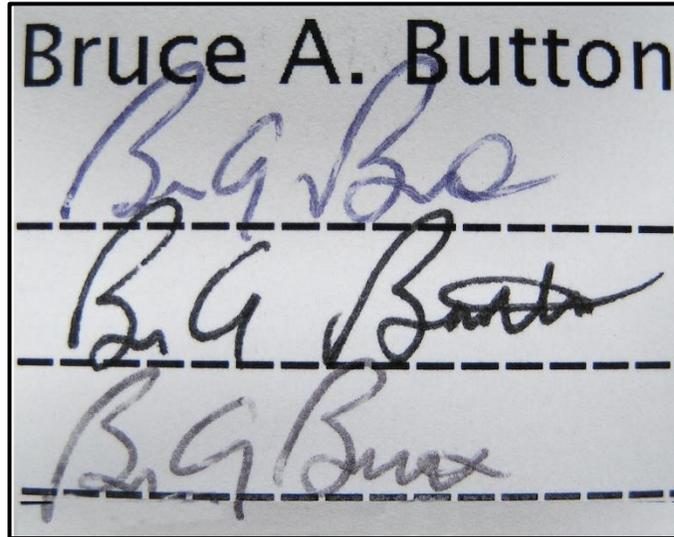


Figure 2 – Different Endings for the same writer

Height-to-Width Ratio of Letters

Writers usually maintain their height to width ratio of letters even when the writing changes size. The proportions of uppercase to lowercase letters remains fairly consistent.

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Ibid. pp. 98 – 115

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