

**Sherlock Holmes:
Blood Identification and the Writing Machine¹**

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A puzzle evokes a question and places the questioner into a state of uncertainty to ponder its resolution. The Sherlock Holmes Canon presents the detective with winding pathways to reach a resolution. Two instances that have spurred curiosity and led to present-day crime solving forensic procedures are the blood and paper investigations mentioned in *A Study of Scarlet* and “A Case of Identity”. This essay discusses how scientific instruments mentioned in these two stories by A. Conan Doyle have served as precursors to modern day forensic procedures: the Holmes Blood Identification Test and the typewriter as a writing machine. These experiments relied on Holmes using the scientific method which is explained, as are value claims often overlooked in this method. Both incidents involve semiotics to interpret the visual signs and thinking processes that were necessary when determining the innocence or guilt depicted of a suspect.² In the first instance the Blood Identification Test is prominent not as a pertinent part of the mystery, but rather in its mention as an experiment that later becomes significant when crime laboratories become operable in the early 1900s. The use of blood identification for persons suspected of crimes has advanced with technology and the use of DNA. The second becomes important when the typewriter became the instrument for letter identification. The emergence of computers and laser printers has added to this first introduction by Doyle of the typewriter’s mark that is used to identify counterfeiters today.

Doyle’s Sherlock Holmes stories have influenced the development of scientific crime detection. Stanton Berg presents a strong case for this assertion by citing comments made by such noted scientists as Alphonse Bertillon, Edmond Locard, and Sir Sydney Smith.³ He recounts how these authorities’ references to Holmes led to modern scientific crime detection. Professor Ernst Sittig, a German linguist and cipher expert gives Holmes credit for describing a

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² Semiotics involves the study of signs and the codes used to interpret and understand sounds, flavors, odors, visuals, events, objects, people, and places. See Marino C. Alvarez, “Signs, Codes, and Uncertainties,” presented at the Sherlock Holmes: Past and Present Conference, Senate House, London, England, June, 2013.

³ Stanton O. Berg, “Sherlock Holmes: Father of Scientific Crime Detection”, *The Journal of Criminal Law, Criminology and Police Science*, vol. 61, no. 3, 1970, 446-452. Northwestern University School of Law.

technique to decipher Cretan inscriptions.⁴ David Crown notes that the earliest reference to typewriter identification appears in "A Case of Identity".⁵

The Blood

Blood stains and traces of blood occur in several stories of the Canon. In the story, *A Study in Scarlet* the word "Rache" is written in blood on a wall. Bloody footprints are found at Birlstone Manor (*The Valley of Fear*) and also in a tenement house on Howe Street ("The Adventure of the Red Circle"). Curiously, blood marks appear on the floor of Hugo Oberstein's house, but when the body of Cadogan West is found lying on the railroad line there are no signs of blood ("The Bruce-Partington Plans"). Victor Hatherley is shown to Dr. Watson's surgery with a bloodstained handkerchief wrapped around his hand ("The Engineer's Thumb"). When Holmes examines an upstairs bedroom he finds traces of blood upon the window-sill and drops of blood scattered upon the wooden floor ("The Man With The Twisted Lip"). Blood stains aroused curiosity and posed complex uncertainties for the official police. When an investigation yielded a suspect and a possible tie with a blood stain found at a crime scene a major problem was encountered. Such a match between a suspect and the blood stain could not then be ascertained. At the time of Sherlock Holmes's experiment blood stains could be identified but they could not be attributed to a specific individual.⁶ A statement such as "This blood stain originated from that particular person" could not have been made since there was no method of assigning individuality to any particular blood stain.

With my inquiry into whether this statement still held today, I contacted Billy Fields of the Mayor's Office, and received a response from Tabitha A. Bullock, DNA Supervisor, Metropolitan Nashville Police Department.⁷ She replied that the statement did, indeed, hold true when capabilities were limited to the technology of blood grouping and enzyme testing; however as DNA capabilities have emerged and improved over the past 20 years, the accuracy of this statement has changed. She then described this updated process:

⁴ Ibid, Berg, 1970, p. 449.

⁵ David A. Crown, "Landmarks in Typewriting Identification", *The Journal of Criminal Law, Criminology and Police Science*, vol. 58, no. 1, 1967, 105-111. Northwestern University School of Law.

⁶ Conan Doyle wrote the story in 1886 and it was first published in 1887 in *Beeton's Christmas Annual*. This story was later published by Ward, Lock & Company, London in 1888. The first American edition was published in 1890 by J.B. Lippincott & Company, Philadelphia, Pennsylvania.

⁷ This quotation and other details surrounding this inquiry appear in Marino C. Alvarez, *A Professor Reflects on Sherlock Holmes*, (London: MX Publishing, 2012), 54-57.

The purpose of DNA technology is to determine the source of biological fluids such as bloodstains. DNA is used to analyze a bloodstain of unknown origin and determine the DNA profile of the blood. DNA profiles are also generated from samples collected directly from individuals, and are referred to as known or reference samples. The DNA profiles from unknown samples (i.e. blood, semen, saliva, vaginal discretion, skin cells, etc) can then be compared to the DNA profiles generated from reference samples. A report is then issued regarding the results of these comparisons. DNA reports may not use the exact wording: "This blood stain originated from that particular person;" however, DNA reports commonly state "The DNA profile obtained from the bloodstain matches the DNA profile obtained from Person X." Sometimes laboratories choose the words "consistent with" as opposed to "match." The caveat to reporting a "match" is that a statistic expressing "how common" the DNA profile is required. It is not uncommon for DNA statistics to reach 1 out of quadrillions or quintillions. When comparing statistics in the quadrillions or quintillions to a global population of around 6 billion, the statistical weight is significant.

A number of DNA laboratories place more weight on a "match" with a high statistical value by making a statement such as: "To a degree of scientific certainty, excluding the existence of an identical twin, Person X is the source of the bloodstain." A statement such as this is considered an identity or source attribution statement. In my experience, this type of statement was made when random match probabilities exceeded 600 billion, approximately 100 times the world population. Some laboratories may set the bar lower than 600 billion, others may stick to a "match" statement regardless of how high the statistics reach.

The evolving technology and the sophisticated process of DNA blood analysis provide a retrospective study into the procedure introduced by Conan Doyle's Sherlock Holmes with the first mention and description of the blood identification test in the story, *A Study in Scarlet*, 1887.⁸ Watson first meets Holmes, who is engaged in an experiment that he is soon to discover as "an infallible test for blood stains." Holmes mixes a drop of blood in a liter of water. Then he adds a "few white crystals" and "a few drops" of a transparent fluid. The contents of the beaker yields "a dull mahogany colour, and a brownish dust was precipitated to the bottom of the glass jar." Holmes compares this procedure to the guaiacum test that he calls "very clumsy and

⁸ E.J. Wagner states a procedure had already been developed testing the presence of blood by Henry Letheby at the London Hospital in 1864 using a microscope in a murder trial. See E.J. Wagner, *The Science of Sherlock Holmes*. (Hoboken, NJ: John Wiley and Sons, 2006), 173-175.

uncertain.” He also dismisses the microscopic examination for blood corpuscles for the same reasons, especially if the blood stains had been allowed to set for hours before analysis.

The Writing Machine

The use of the typewriter keys as identifying marks in solving criminal cases had its beginnings in a Sherlock Holmes story (*A Case of Identity*). Mary Sutherland a prominent character in this story was a typist. However, reference is made to the use of a typewriter in other cases where Laura Lyons had a typewriting business (*The Hound of the Baskervilles*), and Lady Hilda Trelawney Hope takes the role of a typist when answering an advertisement about typewriting (“The Adventure of the Second Stain”). Conan Doyle made an entry in his diary that he had completed “A Case of Identity” on 10 April 1891.⁹ An individual’s handwriting was compared to that of a typewriter typescript. “It is a curious thing...that a typewriter has really quite as much individuality as a man’s handwriting....Some letters get more worn than others, and some wear only on one side.”¹⁰ This story was published in 1891, twenty-three years after the first practical typewriter was invented in 1868, and before such a technique was used in any actual case.¹¹ In fact, it prompts Sherlock to expound:

“I think of writing another little monograph some of these days on the typewriter and its relation to crime. It is a subject to which I have devoted some little attention. I have here four letters which purport to come from the missing man. They are all typewritten. In each case, not only are the ‘e’s’ slurred and the ‘r’s’ tailless, but you will observe, if you care to use my magnifying lens, that the fourteen other characteristics to which I have alluded are there as well.”

Several years ago I wrote that students can compare the events portrayed in this story to typewritten messages typed on personal or school typewriters or compare the type of letters and words to deduce fonts (e.g., roman, san script) and type of printer (e.g., dot matrix, laser).¹² This analysis can be conducted with messages typed and printed from various makes of typewriters

⁹ Martin Booth, *The Doctor, The Detective, and Arthur Conan Doyle*. (London: Hodder and Stoughton, 1998), 142.

¹⁰ Doyle, 1905, p. 199.

¹¹ H.J. Walls, “The Forensic Science Service in Great Britain: A Short History,” *Forensic Science Society Journal*, vol. 16, 1976, 273-278.

¹² Marino C. Alvarez, “The Reader as a Sleuth: Engagement by Intrusion.” In N.D. Padak, T.V. Rasinski, & J. Logan, (Eds.), *Literacy Research and Practice: Foundations for the Year 2000* (Fourteenth Yearbook of the College Reading Association. Pittsburg, KS: College Reading Association), 1992, 101-108.

and printers, using questions such as “Does the imprint of the letters signify letter differences as in the typewriter?” “Are there differences in the degree of impression made on a piece of paper by the keys of a typewriter when compared to a dot matrix or laser printer?” “Can you identify the kind of printer used in these messages?”

William Hagen's early publication (1894) described ink and its impressions and mentioned the use of the typewriter for identification.¹³

*All typewriter machines, even when using the same kind of type, becomes more or less peculiar by use as to the work done by them. One of these characteristics which each machine manifests is that produced by varying alignment, in which some of the type make peculiar imprints which very positively connects the work done with the machine by which it was produced, and this occurs more particularly to such of them as have been used for some time, and so distinctly marked does particularity become connected with the printing done by each machine that little skill is required when comparing the work done by a dozen of them. **A knowledge of this fact sometimes becomes important in tracing up the source of an anonymous letter printed by a typewriter machine.***

[Bold italics mine]

The implications apply to science that affects our everyday lives. For example, many of us are aware of how the forces of friction can wear metals, as in the impact of typewriter keys on the platen. This same principle can be applied to the use of the dot matrix versus the laser printer. A dot matrix printer of a few years ago could be identified by make and individual machine due to the impressions made by the keys. However, so too can a laser printer be identified by individual machine as ink is sprayed onto paper. Crime laboratories are able to detect color printers and photocopiers by their nearly invisible yellow dots that encode identifying information in every printed page of paper. These minuscule dots serve as features that law enforcement agencies can identify as in the case of counterfeit currency. An example of yellow dots that serve as a watermark identification is shown below:¹⁴

¹³ William E. Hagen. *A Treatise on Disputed Handwriting and the Determination of Genuine From Forged Signatures*. (Albany, NY: Banks & Brothers, 1894), 203.

¹⁴ Image was retrieved from http://www.chipple.net/mt/2005/10/20_002557.php and information concerning laser printers' invisible watermarks can be obtained by visiting this website.



This watermarking process changes the digital image so that the viewer can see the background image or the text without any corruption in the image. The imprint of these watermarks identifies and authenticates the owner of a digital image and serves as either a crime solving measure or, in the case of preventing one from copying visual images of the originator, the watermark becomes part of the transferable process; and, therefore verifies the owner of the work. Invisible watermarking can be detected and is used in cases such as copyright protection, tracking, and annotation of photographs.

Another form of secret writing is steganography that changes the image so that only the person who has electronically written a message and the intended recipient are able to decipher the message.¹⁵ Since the process is invisible it is very difficult for someone other than the intended receiver to detect. Because of the innocuous visual display of a message, this process provides secret transmissions more readily than do messages that are either encoded or encrypted. Steganography appears in many forms such as visual images, audio files, listings, articles, or as invisible ink written between the lines. This process is also effective when applied to information on computer files that are deemed to be secret. Such files include image files, document files, media files, etc. Since these files are typically large in size, steganography lends itself to this kind of deception.

Scientific Method

Dr. Hans Gross has been called the father of criminal investigation. His *Criminal Investigation: A Practical Handbook for Magistrates, Police Officers, and Lawyers* is a fundamental guide for criminal investigation and forensic science. Chapters include “Footprints

¹⁵ See Gary C. Kessler, “Steganography: Hiding Data Within Data”, September 2001, <http://www.garykessler.net/library/steganography.html>. An edited version of this paper appeared in the April 2002 issue of *Windows &.NET Magazine*.

and other Impressions,” “Traces of Blood,” and “Ciphers and other Secret Writings.”¹⁶ As a secondary student at Stella Matutina in Feldkirch, Austria, in 1875, Conan Doyle continued his studies and advanced his skills with the German language. It is possible that in later years he may have read Dr. Gross's 1883 handbook in German and became more familiar with footprints, blood stains, and ciphers. Professor Ralph Turner was an eminent forensic scientist who founded the first police laboratory in Kansas City, Missouri and the founder of the American Academy of Forensic Science. One of his primary interests was his study of Sherlock Holmes. He equates the work of Dr. Gross in Austria with that of Arthur Conan Doyle when Sherlock Holmes applies the scientific method to his criminal investigations. He stated that both Gross and Doyle’s “descriptions of methods of collecting and interpreting forensic evidence were strikingly similar.”¹⁷

Sherlock Holmes follows the procedures of the scientific method in his experiments. The scientific method consists of stating the problem, forming a hypothesis, devising a methodology, collecting data, and making implications and posing future research inquiries from the results. The scientific method applied to the Sherlock Holmes Blood Identification Test encompassed these procedures. First, the problem and the research question: “Does a stain reveal the presence of blood?” Second, “What chemical substances are needed to combine to reveal the presence of hemoglobin in a stain?” Third, “When distilled water, a drip of whole human blood, white crystals, and a few drops of transparent fluid are poured sequentially into a test tube what can be deduced visually from this mixture?” Fourth, using visual analysis his findings signified that the changing of the mixture to a dull mahogany color and a brownish dust indicated the presence of hemoglobin. Fifth, it was his contention that this test was “the most practical medico-legal discovery for years.... it gives us an infallible test for blood stains.” Although the reliability of the method has been questioned, there is little to doubt that his experimentation with

¹⁶ Hans Gross, *Criminal Investigation: A Practical Handbook for Magistrates, Police Officers, and Lawyers*. Publisher: Madras A. Krishnamachari, 1906. First edition published in 1893, titled *Handbuch für Untersuchungsrichter als System der Kriminalistik*. First English adaptation was published in 1906. Translated by John Adam and J. Collier Adam.

¹⁷Ralph E. Turner, “Historical Perspectives in Forensic Science.” In Samuel M. Gerber and Richard Saferstein (Eds.), *More Chemistry and Crime*, (Washington, DC: American Chemical Society, 1997), 3.

blood identification set the precedence for later crime laboratories to refine and utilize this method for blood identification.¹⁸

In a similar vein, with the writing machine's key impressions on paper, Sherlock Holmes used the scientific method to determine the guilt of Mr. James Windibank/Hosmer Angel. Sherlock Holmes first began by stating the problem and the research question: "Who wrote the letter" and "Why was the letter typewritten?" Second, a hypothesis was formulated relating to the typewritten letter and the absence of a signature. He then conceived of a method by which to test his question and hypothesis by examining the paper, the imprints of the keys, and the clarity of some keys versus others. For example, "slurring over of the 'e,' and a slight defect in the tail of the 'r.'" Based on these results he was able to identify the typewriter and associate the person who typed the letter. This identifying procedure of typewriter characteristics has evolved into the 21st Century and the special traits exhibited by laser printers and copiers.

The values of the Sherlock Holmes stories go beyond their structural elements (theme, plot, character, and setting). The blood identification test and the paper tracings are but two forensic techniques that evolve from *A Study in Scarlet* and "A Case of Identity".

Value Claims

Value claims account for the "So What?" of scientific investigations. Value claims are derived from the knowledge claims (outcomes). Holmes's use of value as determined by a clue or an outcome vested in the scientific method is notable. The scientific method typically does not account for value claims. But in criminal investigations just as in scientific experimentations the value or educational worth of the knowledge claims (outcomes) are vital in determining the extent that an investigation has influenced new learning and knowledge. In the case of the blood identification experiment the instrumental value: Is X good for Y? The Sherlock Holmes Blood Test (X) was good for (Y) determining if there was blood present in a stain. Holmes's blood identification test also indicated comparative value: Is X better than Y? His test was preferable over Y (guaiacum test) which was not as tidy or accurate. The typewriter inspection indicated that (X) a typewriter has discriminating keys that mark the machine once the paper is examined;

¹⁸ See Leon S. Holstein, "Knowledge of Chemistry – Profound", *Baker Street Journal*, vol. 4, no. 1 (January 1954), 44-49; also Samuel E. Gerber, "A Study in Scarlet Blood Identification in 1875". In Samuel E. Gerber (Ed.), *Chemistry and Crime* (Washington DC: American Chemical Society, 1983), 31-35.

therefore, (Y) the instrumental value of this discovery indicates that a typewritten paper can be traced to the machine that made the ink impressions. There are five value claims that should be considered in a scientific investigation: instrumental value, intrinsic value, comparative value, decision value, and ideal value.¹⁹ Sherlock Holmes realizes the importance of value claims when he examines a clue and then reaches a resolution of a case. The implications of these early writings are evidenced in the present scientific investigations and experiments with DNA and visible and invisible imprinting.

Discussion

Bridging the gap of the present and the past can be illustrated by the following two cases: Sherlock Holmes's blood identification test and comparing the typewriter with the computer to present-day methods. Each involves the solving of a riddle and places Sherlock Holmes within the realm of uncertainty. Both instances led to the extension of using his investigative techniques beyond the Victorian era into the 21st Century. In both instances Holmes used visual thinking and interpretation to examine the semiotic signs and codes displayed by the blood and writing machine paper samples. Noteworthy of these two writings are the implications that were later made by scientific inquiry and analyses that promoted the use of both procedures in forensic crime laboratories. Richard Saferstein writes that the first crime laboratory was started in 1910 by a French criminologist Edmond Locard who was inspired by Conan Doyle's *The Adventures of Sherlock Holmes*.²⁰

A. Conan Doyle brings the reasoning of the scientific method to new heights in his Sherlock Holmes stories. The scientific procedures that Holmes employs in his investigations take the reader beyond the structural elements of a story into the milieu of the historical scientific era of the time. The blood identification test and typewriter characteristics are two such examples. Simplifying complexity is the goal when Sherlock Holmes engages with riddles and uncertainty in his investigations. The impact of these writings has influenced later discoveries for

¹⁹ D. Bob Gowin and Marino C. Alvarez, *The Art of Educating with V Diagrams* (Cambridge University Press: Cambridge UK, 2006), 60-61; also, Marino C. Alvarez and D. Bob Gowin, *The Little Book: Conceptual Elements of Research* (Rowman & Littlefield: Lanham, MD, 2010), 15-16.

²⁰ Richard Saferstein., "Forensic science: Winds of Change." In S.M. Gerber (Ed.), *Chemistry and Crime: From Sherlock Holmes to Today's Courtroom*. (Washington, D.C.: American Chemical Society, 1983), 39-43.

their use as technology has advanced. A deeper sense of meaning can be derived from these readings that extend one's analytical thinking by bridging the present to the past.