

Left-hand and Opposite-hand Writing Features Useful as a Basis of Forming Expert Opinions of Authorship - Second Edition

by

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Abstract: When comparing handwritten documents concerning disputed authorship, the examiner is responsible for applying a reasonable explanation to an observed significant difference¹ between features as part of forming an expert opinion of identification. This article discusses and illustrates the features attributed to the use of the left hand and the opposite- or unaccustomed opposite-hand.

Keywords: Left-handed writer, awkward-hand signatures, unaccustomed left hand, handedness, hand preference, handwriting posture, writer's cramp, incomplete cerebral dominance, court-ordered handwriting exemplars.

Introduction to the Second Edition

In recent years, I have received several cases involving the suspicion of left-hand writing as a strategy to conceal one's identity. During this time, I was also presented with cases involving the clients' claim of the use of the opposite hand to write a signature as a justification for its unnatural appearance. These cases encouraged me to continue with the studies that generated the original article. Results from my additional studies have been added to this edition of the bibliography. The first edition included selected images that were drawn from my studies of more than 300 audience members who participated in writing exercises involving writing their signatures with both hands. I have added the same subject's dominant-hand signatures for comparison of the various features.

The previously published companion piece²

1. "Significant difference" is defined by the author as a uniquely observed feature that is not evident in the writer's habitual pattern, and which cannot otherwise be reasonably attributed to the writer or writing circumstances.

2. Joseph, Jacqueline A. The annotated bibliography: Left-hand and opposite-hand writing features useful as a basis of

has been integrated into this article and now includes books, monographs, and DVDs. Many of the works listed have extensive bibliographies to which the reader's attention is also specifically directed. The works can be used to provide recognized and authoritative writings by international authors in the field to support one's conclusions.

Not all bibliographic entries have annotations; however, the absence of an annotation is not an implication that the work has less value than annotated entries. Where included, the author's biographic note is contemporaneous to the date of publication. Journal citations were drawn from *The QDE Index* and *Health and Handwriting: An Annotated Bibliography of Forensic, Legal and Med/Psych Periodical Literature*, both by Marcel B. Matley of A & M Matley Handwriting Experts of San Francisco, California.

It is my hope that readers will become familiar with these features and find this knowledge useful as a basis of forming opinions of authorship.

Commentary

In an investigation involving questioned authorship, most handwriting comparisons concern the matter of whether or not the questioned and the known handwriting were written by the same person rather than the question of which hand was used.

Basis of forming expert opinions of authorship

Many factors are involved in a comprehensive examination and comparison of writing and of the formation of an expert opinion including:

1. The uniquely identifying features in the subject's handwriting;
2. the skill and competence of the examiner; and
3. the nature of the questioned document and the

forming expert opinions of authorship. *National Association of Document Examiners Journal*, 27, No.1: 17-21, Fall 2004.

available material for comparison.

In forming an expert opinion regarding authorship, the subject writer's use of the unaccustomed hand for writing is considered as a reasonable explanation for significant differences between comparable features. The observable differences, along with the appropriate reasonable explanation, can be clearly demonstrated to the fact finder and supported by research, as reported herein and elsewhere.

Adult writers are generally more proficient with one hand than with the other. According to F. E. Dreifuss, the ratio of right-handed to left-handed individuals is 7:1.³ A child will usually be either right- or left-handed by 18 months of age. The hand used commonly for manual tasks may or may not be the hand preferred for writing.

The ambidextrous writer

In forming an expert opinion of common authorship, the examiner considers whether or not a questioned writing is the product of a naturally or circumstantially left-handed writer, or an attempt by the subject writer to conceal his/her identity by using the non-dominant hand. Based on her research of over 4,000 specimens of handwriting, the features indicating opposite-hand writing are discussed by Viola Stevens. From an examination of pairs of specimens of two-handed writers, it was found that, in every pair, one specimen was vastly superior to the other in quality. Furthermore, Stevens found that both left-hand and right-hand writers changed to vertical slant when using the opposite hand.⁴

The foreign script writer

Benny Shanon researched American and Israeli left- and right-hand subjects as they drew horizontal character elements, lines and faces.

3. Dreifuss, F. E. Diagnosis and treatment of incomplete cerebral dominance. *Journal of the American Medical Association*, 206: 141, 1968.

4. Stevens, Viola. Characteristics of 200 awkward-hand signatures. *International Criminal Police Review*, 237:130-7, April 1970.

Shanon reports that the direction of movement of the handwritten character elements of Israeli subjects writing in Hebrew, written either from right to left or vertically, are observed as features similar to the ambidextrous and left-hand writer.⁵

The left-hand writer

The following is a list of significant features indicating a person is writing naturally with his/her left hand. It is a composite of features found in the publications listed in the bibliography and drawn from my writing experiment studies with more than 300 subjects.

Features having significance indicating a person could be a left-handed writer include:

- Crossing of the lower case *t* from right to left.
- Leftward drag of elongated *i*-dots.
- Long initial stroke of the letter at the beginning of a word which may proceed either in an upward or downward direction.
- Hooks and curves at the beginning of some small and capital letters which commence in a leftward direction.
- Prominent eyelets in beginning part of the small *a*, *d* and *g*, representing an initial underhand motion.
- Overhand motion in forming lower case *v* (made with retrace or eyelet at bottom) and the lower case *h* (eyelet formed where loop and hump are joined).
- Tenting of lower case *h*, *l* and *t*, and tenting of the upper part of capital *I* and *J*.
- Open lower part of the final lower case *g* and *y* with the ending stroke curving to the left; also, triangular or v-shaped lower parts of those letters.
- 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.
- Terminal of the lower case *s* with an absence of a retraced bottom coupled with a leftward extension of the closing part.
- Lower case *f* and *k*, as well as capital *G*, are

5. Shanon, Benny. Graphological patterns as a function of handedness and culture. *Neuropsychologia*, 17:457-65, 1979.

also found to have considerable leftward extension in their closings.

Feature comparisons: The unaccustomed opposite-hand writer

In his study comparing right-hand writers writing with their left hand Greg Dawson reports that the primary difference between the writings was

observed in the writer's skill of execution, whereas the spacing between letters, words, and lines remained proportionally the same.⁶

Features having significance indicating a person is writing with his/her unaccustomed opposite-hand as compared to his/her accustomed writing hand are illustrated below.

- Upright slant versus rightward or leftward slant

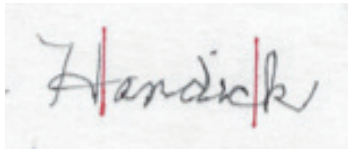


Fig. 1a—Upright slant

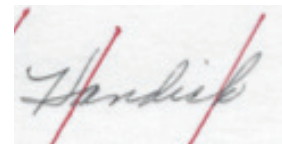


Fig. 1b—Rightward slant

- *t* bar crossings crooked and wandering versus straight

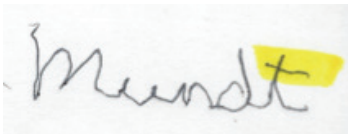


Fig. 2a—Crooked *t* bar



Fig. 2b—Straight *t* bar

- Flat-top *r* versus pointed or rounded

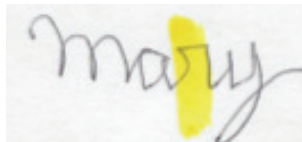


Fig. 3a—Flat-top *r*

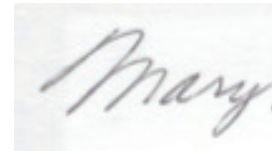


Fig. 3b—Pointed-top *r*

- Flat-top upper zone loops versus pointed or rounded

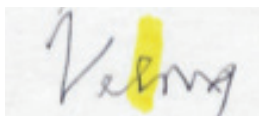


Fig. 4a—Flat-top upper zone loop



Fig. 4b—Rounded-top upper zone loop

- Tent-shaped *t* stem with wide bottom versus retraced



Fig. 5a—Tent-shaped *t*

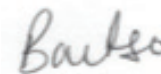


Fig. 5b—Retraced *t* stem

6. Dawson, Greg A. Brain function and writing with the unaccustomed left hand. *Journal of Forensic Sciences*, 30:167-71, Jan. 1985.

- Acute angle connecting strokes versus curved



Fig. 6a—Acute angle connectors

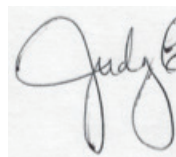


Fig. 6b—Curved connectors

- Flattened lower zone loops versus pointed or rounded



Fig. 7a—Flattened lower zone loop

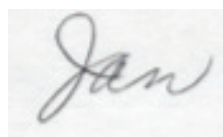


Fig. 7b—Rounded lower zone loop

- Dragged terminals versus stunted



Fig. 8a—Dragged terminal

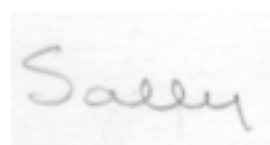


Fig. 8b—Stunted terminal

- Uncertain versus certain movements

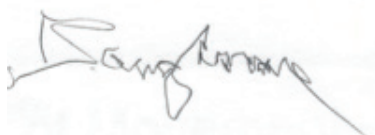


Fig. 9a—Uncertain movements

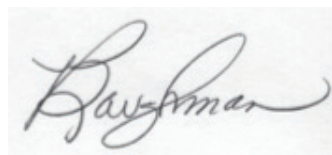


Fig. 9b—Certain movements

- Fine tremor versus smooth line quality

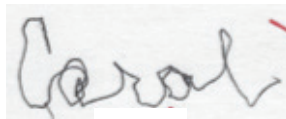


Fig. 10a—Fine tremor



Fig. 10b—Smooth line quality

- Directional changes of movement abrupt versus fluid

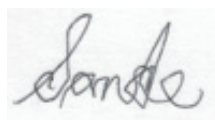


Fig. 11a—Abrupt directional changes

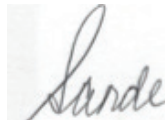


Fig. 11b—Fluid movement

Conclusion

A proficient handwriting examiner considers that questioned handwriting having an unnatural appearance may or may not have been written by someone using either the left hand or the unaccustomed opposite hand. Contrary to some views that left-handed writers are less skillful than right-handed writers, Gordon Stangohr, in his study, reported no remarkable skill difference between the two groups. Some features of opposite-hand writing are also observed in the writing of the ordinarily unskilled writer. This justifies the need to do a thorough and exhaustive investigation comparing all available information and exemplars, especially any opposite-hand requested exemplar.

Bibliography

Journals

- Alford, Edwin F. Jr. (1970) Disguised handwriting: A statistical survey of how handwriting is most frequently disguised. *Journal of Forensic Sciences*, 15:476-88.
- Alford systematically explores the most common methods writers use to alter their writing and illustrates the frequency of occurrence of the particular features that were changed. Writing from actual cases was not used, in which event the motivation for disguise would be more compelling and/or practiced. Alford discusses his methods of collecting the writing and the criteria used in his study of 135 sets of writing. The features he uses are change of slope, spacing, size, the use of awkward hand, hand printing, arrangement, change of angularity, deceptive spelling, altered approach and terminal strokes, alteration of upper and lower extensions, capital and lower-case letter forms, the *i* dot or period, and handwritten numbers. He notes that the features most often changed were those which most drastically affected the pictorial appearance of the writing. Alford's caution is about wrongly attributing differences to disguise or overlooking possible identifying features because they were masked, which could lead to serious error. This article is illustrated with before and after writing of same writer writing the same sentence. It also shows what changed and what remained unchanged.
- Edwin F. Alford, Jr.*, Crime Laboratory, Post Office Department, Washington, D.C.
- Alford, E. F. Jr. & Ronald M. Dick. (1978) Intentional disguise in court-ordered handwriting specimens. *Journal of Police Science and Administration*, 6:419-23.
- This paper discusses the history of handwriting testimony in courts which lays the foundation for policies adopted by forensic laboratories for the use of exemplars which are also discussed. Court-ordered handwriting exemplars are discussed. Intentional disguise of handwriting while giving request exemplars, and the use of awkward-hand writing specimens are discussed. Intentional disguise, as a basis of an expert's opinion using handwriting evidence, is cautioned. Alford and Dick state that it is a well-known fact that some individuals are capable of writing in vastly different styles which could be a skill used for the purpose of deception. Case law is cited. Includes case reports and illustrations.
- E. F. Alford, Jr.*, Chief Document Examiner and Chief of the Identification Branch, U.S. Secret Service, Washington, D.C.
- Ronald M. Dick*, Questioned Document Section, Florida Department of Criminal Law Investigation.
- Beacom, Mary S. (1961) Was this document written with the left hand? *Journal of Forensic Sciences*, 6:321-30.
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F. E. Dreifuss, Professor of Neurology, University of Virginia.

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An excellent and comprehensive discussion of burr striations as a result of the use of ballpoint pens relative to the direction of movement, most notably in the curved strokes. One illustration.

J. E. Franks, Department of English Language and Literature, The University of Birmingham, England.

Franks, J., T. Davis, R. N. Totty, R. A. Hardcastle & D. M. Grove. (1985) Variability of stroke direction between left- and right-handed writers. *Forensic Science Society Journal*, 25:353-70.

This article illustrates the research methods the authors applied to thousands of writers, and the results. As an indication of handedness, this research shows that the significant differences between left- and right-handed writers in the direction of pen movement in straight lines, such as the crossing of the horizontal bar in capital letters *A*, *H* and *T*, is a more reliable indicator than the direction of pen movement in the circle letters' clockwise strokes. This paper was presented, in part, to the American Society of Questioned Document Examiners 1983 meeting.

J. Franks and T. Davis, Department of English Language and Literature, University of Birmingham, UK.

R.N. Totty and R.A. Hardcastle, Forensic Science Laboratory, Birmingham, UK.

D. M. Grove, Department of Statistics, University of Birmingham, UK.

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Harrison discusses the list of the eight factors in the recognition of disguised handwriting that would have been deliberately introduced by the writer. Included are the use of opposite hand, disturbance of internal consistency, reduction of fluency and rhythm, and inconsistency of the element of disguise. Fully illustrated with detailed case reports.

Wilson R. Harrison, M.Sc., Ph.D., Director, Home Office Forensic Science Laboratory, Llanishen, Cardiff.

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Jacqueline A. Joseph, Board Certified Forensic Document Examiner, Portland, OR.

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Kurtz, Carolyn. (1996) The Left-Handed Writer. *World Association of Document Examiners Journal*, 200:3-4.

Carolyn Kurtz, Forensic Document Examiner, Southampton, Pennsylvania.

Levy, Jerre. (1982) Handwriting posture and cerebral organization: How are they related? *Psychological Bulletin*, 91:589-608.

Mikels, J. Ronald. (1971) Special techniques in forged document examination: how to identify left-handed writing. *Law and Order*, 19:78-84.

Includes a good photo of the upside-down left-handed pen hold which explains the resulting *i* dot which, when the writer writes with speed, is formed like a bowl or slanted vertically. This may also be observed in the period, colon, and other similar punctuation marks. The tapering of the *t* bar on the left of the stroke indicates the writer moved from right to left to cross the *t*. The *t* would also have

a wavy or slanted bar indicating the left-handed writer used finger movement while the base of the hand remained immobile. This creates an additional problem not experienced by the right-hander, whose hand is free to move forward, like a pivot, during the crossing of the *t* from left to right. Mikels comments about a smudge pattern which may occur when the left-hand writer's hand moves across previously written lines during the writing. As the hand moves downward to the next line of writing, ink impressions are transferred from the base of the hand onto the paper.

Shanon, Benny. (1979) Graphological patterns as a function of handedness and culture. *Neuropsychologia*, 17:457-65.

This article discusses Shanon's research involving American and Israeli left- and right-hand subjects as they drew horizontal character elements, lines, and faces. The comparison of biological and environmental factors of both groups, because Americans write and scan from left to right whereas Israelis scan and write from right to left, resulted in data supporting an interactive model stipulating that: (a) the natural directionalities associated with right- and left-handers are different: left-to-right and right-to-left respectively, (b) the culturally induced directionalities associated with English and Hebrew writing are different: left-to-right and right-to-left respectively, and (c) the behavior exhibited by right-handers is fully determined by natural, biological tendencies/genetics, whereas left-handers are susceptible to environmental influence.

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This article discusses two cases and illustrates the comparative features of the normal writing and writing produced with the unaccustomed hand of one person on one document. Singh and Gupta discuss the indications of common authorship concluding

that the body of the writings was written with the normal hand, whereas the signatures on the documents were written with the unaccustomed hand. Illustrations are in Hindi. Includes bibliography.

Amar Singh and S. N. Gupta, Central Forensic Institutes, Bureau of Police Research and Development, India.

Smith, Willa W. (2004) Disguise through other-hand writing. *National Association of Document Examiners Journal*, 27:3-7.

This article describes an empirical study of dominant-hand versus non-dominant-hand printing using subjects from a case involving anonymous letters. All but one of the 32 writers using the non-dominant hand wrote larger, had difficulties with stroke direction, and produced squared, angular, or jagged strokes where curves normally occur. All writers kept many of their natural writing habits with the exception of their fine motor skill capability. Illustrated.

Willa W. Smith, Forensic Document Examiner, Tampa, FL.

Stangohr, Gordon R. (1968) Opposite-hand writings. *Journal of Forensic Sciences*, 13:376-89.

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Stevens, Viola. (1970) Characteristics of 200 awkward-hand signatures. *International Criminal Police Review*, 237:130-7.

An excellent paper detailing Stevens' research project studying signatures of inmates serving sentences on charges of forgery. They were volunteered samples of the inmates' signatures written with both the right and left hand, totaling over 4,000 specimens from over 200 inmates. Stevens includes research from the medical literature about the physiological and neurological human factors that may produce handedness in an individual. Her research led to answers about the percentage of a given population that normally uses the left hand for writing (9%), how frequently ambidexterity in handwriting is encountered (rarely), how opposite-hand writing differs from preferred-hand writing (flat-top *r*, *d*, *l* and other looped letters; vertical slant dominates; fine or bizarre tremor; open base *t*, wandering *t* bar crossing; dragging terminal strokes; abrupt changes in direction, and a comparatively low level of skill of execution). Stevens also answers the question of

whether or not awkward-hand writing can be identified as to its source with the advice that the observed significant differences be carefully evaluated in terms of all possible factors which could account for variations such as illness, medications, fatigue, self-disguise, and the possibility of a forger's attempt to simulate an awkward-hand signature. Includes bibliography.

Viola Stevens, Document Examiner, Crime Laboratory Division, Wisconsin Department of Justice.

Suen, C.Y. (1983) Handwriting generation, perception and recognition. *Acta Psychologica*, 54:295-312.

This work was supported by a research grant from The Natural Sciences and Engineering Research Council of Canada. The paper summarizes what was found to characterize handedness in the areas of writing speed, legibility, and character formation. The results were based on several experiments conducted by Suen and the research team at Concordia University. The subjects included a small group of left-handers and a small group of right-handers. Comparatively, the most significant differences were found between writing styles (printing to cursive) within each group. For both groups, it was found that cursive, as compared to printing, measured the fastest writing style, notably due to the number of pen-lifts used when printing versus writing in cursive. The experiments were useful in finding a way to correlate writing habits with the neurological organization of the specific portion of the human brain that processes language. Includes bibliography and tables of statistics.

C. Y Suen, Department of Computer Science, Concordia University, Montreal, Quebec.

Talbot-Wilson, M. G. (1986) Variability of stroke direction between left- and right-handed writers. *Forensic Science Society Journal*, 26:177-9.

Todor, John I. (1980) Sequential motor ability of left-handed inverted and non-inverted writers. *Acta Psychologica*, 44:165-73.

This research is built on the work of Jerre Levy (See Levy, above). Tests were given to 14 female college students who were all left-handed, seven with inverted pen holds and seven with non-inverted. The more difficult the task, the better the performance of the non-inverted subjects, which was a finding that held up when the same tasks were performed with their non-dominant, right hands. The conclusion was that the non-inverted, left-handed writers had

a substantial performance superiority which was related to the writers' brains. However, it might just have been due to the physiological convenience of one's habitual manner of movement. In other words, just because brain organization may determine one's preferred pen hold, the pen hold, and not the brain organization, might determine difficulties in complex movement tasks. The intellect of both groups could still very well be equal in mental processing tasks. Todor's research proves that some difficulties in handwriting are inherently attributable to the physical manner of writing, and thus can be indicative of authorship and suggestive of a non-standard, but habitual, manner of writing.

Totty, R. N., R. A. Hardcastle & Jane Dempsey. (1983) Dependence of slope of handwriting upon sex and handedness of the writer. *Forensic Science Society Journal*, 23:237-40.

This article discusses the findings from 200 subject writers that right-hand writers wrote with a greater forward slope than left-handed writers.

R. N. Totty & R. A. Hardcastle of the Forensic Science Laboratory England.

Jane Dempsey, of the Department of Mathematics, Lanchester Polytechnic, England.

Webb, Frederick E. (1978) The question of disguise in handwriting. *Journal of Forensic Sciences*, 23:149-54.

This paper discusses the basic elements of disguise and the importance of request and/or court-ordered specimens. Includes the list of landmark cases related to disguise: Gilbert v. California, 388 U.S. 263 (1967); US v. Wade, 388 U.S. 218 (1967); US v. Doe, 405 F.2d 436 (2d Cir. 1968).

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Jeannine Zimmerman, Aurora Police Department, 15001 E. Alameda Drive, Aurora, CO.

Monographs and DVDs

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This work discusses the types of handwritten forg-

eries classified according to method as well as how to approach the full examination with the requirements for forming opinions of identification or non-identification. Matley discusses how each approach can serve as a reliability test for each of the others. Includes illustrative cases, index and bibliography.

Matley, Marcel B. (1997) *Oh, my aching arm!: The cause and cure of general writer's cramp. A monograph on the physiology of handwriting.* A & M Matley Handwriting Experts of California, San Francisco, CA.

In his study of writer's cramp, Matley considers all aspects of the basic anatomy of the hand and arm, the grip of the pen, the grasp of the pen, and how they affect handwriting. Includes 26 illustrations with bibliographic comments about the cause of writer's cramp including commentary about the way the hand, arm, and elbow moved that resulted in the illustrated writing defect (such as awkward ovals, displaced pressure and change of angle due to elbow swinging in and out). Includes "An Essay in the Psychology of Free Choice" by Matley, who considers why choice is a fundamental element in curing writer's cramp.

Matley, Marcel B. (2000) *Health and Handwriting: An annotated bibliography of forensic, legal and medical periodical literature. Third edition,* much enlarged. A & M Matley Handwriting Experts of California, San Francisco, CA.

The third edition includes a list of ten annotated reference books useful for information about medical terms, anatomy, drugs, and the development and diagnosis for hand dysfunction. The citation for Rose Lajoie Toomey's *Health Clues in Handwriting* provides 25 health clues with their theoretical indications that are the result of the author's empirical and primary research in cooperation with medical professionals. All of the 135 citations to journal articles pertaining to the topic of health and handwriting have Matley's annotations that are highly educational for handwriting and document examiners. The section on case law provides 35 citations regarding expert testimony in courts of law as to one's mental condition based on handwriting as well as testimony about the cause of signature dissimilitude that may be useful in defending the basis of forming one's opinion. This excellent work cites the scien-

tific literature and key case law that any FDE could use to validate the relationships between handwriting and health factors and the admissibility of expert testimony in this regard.

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This is a video of Matley and Joseph's five-hour workshop that was presented to the members of the National Association of Document Examiners in Austin, TX. It qualifies for three semester-credit hours at East Tennessee State University/Criminology Department.

Pillar One: The Physiological Factors Involved in the Production of Handwriting: How the Human Body and the Writing Environment Play a Part in the Uniqueness of Handwriting.

Pillar Two: The Psychological Factors Involved in the Production of Handwriting: How the Psyche Plays a Part in the Uniqueness of Handwriting.

Matley, Marcel B. (2016) *The QDE Index: A guide to periodical articles in English on document examination, handwriting expertise and expert testimony.* A & M Matley Handwriting Experts of California, San Francisco, CA.

Compiled, annotated and published by Marcel Matley, *The QDE Index* is the most comprehensive collection of titles, authors and case law in the field of questioned document examination. Providing 4,700 citations covering 3,750 papers published in 450 journals, the citations are drawn from forensic, legal, academic, and popular press journals.

Books

Conway, J. V. P. (1959) *Evidential Documents.* Springfield, IL: Charles C. Thomas, pp. 201-204.

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Ms. Joseph's published papers include "Identifying the Maker of Handwritten Numbers" and "Handwriting Forensics: Anonymous Note Writer Identification" and many others that may be downloaded from her website.

She has lectured, nationally and internationally, to her forensic colleagues on topics ranging from becoming a more effective rebuttal witness to a fresh look at post-litem motam exemplars. Along with Marcel Matley, she teaches *The Two-Pillars of Individuality and Identifiability in Handwriting* which offer a better understanding of the act of writing and help examiners build and defend more reliable opinions.

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