

ORIGINAL ARTICLE

A Preliminary Study Investigating Class Characteristics in Gurumukhi Handwriting

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ABSTRACT

India has been praised for its diversity, particularly in terms of cast, ethos, dialects, religion, and calligraphies. Brahmi characters are ancient India's primeval script system, dating back to the first millennium BCE. The Gurumukhi script is the eleventh most widely used script in the world. The Gurumukhi script is written from left to right and from top to bottom. The common beginnings of the scripts, as well as their divergence, are significant and critical. It is undeniably impossible for an auditor to be familiar with each calligraphy, specifically in a nation state like India, where languages and scripts vary greatly. The aim of this paper defines the class and individual features of Gurumukhi scripts, laying the groundwork for calligraphy forensic testing.

KEYWORDS

• Forensic linguistics • Handwriting comparison • Class characteristics

INTRODUCTION

Handwriting is a kind of writing that is done with a writing device in the hand, like pen or pencil. Handwriting is discrete from prescribed script or typography and conceals both offset lithography and cursive procedures because each and every individual have a distinct and altered handwriting. It can be used to validate the author of a manuscript.¹ Every individual has their personal distinct handwriting grace, whether it is for regular use or as their distinctive

sign.² Even undistinguishable clones with identical appearances and inheritances do not have similar handwriting.³ The aim of this study is to investigate the class characteristics and individual characteristics in the Gurumukhi Handwriting. The environment in which one develops up and the major linguistic one acquires combine with the diverse spreading of potency and methods of bending words to produce an exclusive stylishness of script for every single individual.⁴

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Handwriting is distinctive to each individual, like fingerprints, so every individual's writing will be exclusive as well. An individual's calligraphy will not be comparable to others since they will diverge in any of the script qualities.

Some of the handwriting characteristics are followed;

- Letter shape, for example, roundness or sharpness
- Consistent or unequal letter spacing
- Inclination of the letters
- The elements' regular repetition
- Pen pressure to paper
- Average letter size
- Letter thickness

Scripts are a certain language's writing system. Calligraphy is a widely acknowledged graphic, i.e. printed, demonstration of a language's letters.⁵ Each script might have a different style. It could be used as a representative illustration of the echoes of a specific dialectal. India is a multilingual nation with twenty-two formal languages and scripts.⁶ Brahmi characters eventually gave rise to the majority of current Indian scripts, comprising Devanagari, Gurmukhi, Telugu, Gujarati, Bengali, Oriya, Tamil, Malayalam, Kannada, Sinhala, and a large variety of Central and Southeast Asian scripts.⁷

Gurmukhi is an Indo-Aryan language spoken by around one hundred four million people worldwide, primarily in India's Punjab area, sections of Pakistan, and other countries with Punjabi immigration.⁸ The Punjabi script is written using numerous different writing systems, the employment of which is determined by a variety of factors such as geographical region, local dialect, and religious beliefs. Gurmukhi and Shahmukhi are the two most common written forms of Punjabi, and both are recognized formal calligraphies of the linguistic.⁹

The Gurmukhi characters emerged from the primeval Brahmi structure and were given its decisive form by Guru Angad in the sixteenth era. It is created on a syllabic characters structure consists of marks representing consonants with an intrinsic subsequent vowel. Matras (vowel marks) modify vowels to represent another vowels (or a lack of vowels).¹⁰ The

prehistoric Gurmukhi calligraphy had thirty two consonants, three vowels, nine matras, and two nasal marks.¹¹ Five extra characters and a 10th matra were afterwards added. Gurmukhi is inscribed from left to right, with the typescripts associated beneath the writing line.¹² Some researchers examined the handwriting samples of fifty people from India's Punjab region and discovered that seventy four percent of the models were transcribed in the printed format.¹³ Each letter is written independently in printed style, and letters are detached by a space, as opposed to cursive format, where characters are joined, and assorted style, which is a grouping of printed and cursive. According to the research work, fifty four percent of Gurmukhi authors employed medium-sized writing, sixty six percent wrote with an upright slant, and sixty four percent wrote in a rounded style.¹⁴ Because there are very numerous angular typescripts in copybook form, rounded characters are commonly used in Gurmukhi script.¹⁵ According to the study, 58% of handwriting is horizontally aligned when matched to an imagined reference line. The rest is mostly declining (eighteen percent) or uneven (ten percent). While identifying class traits in human populations is tremendously useful.¹⁶

It is a projective approach, similar to physique dialectal that can outline social performance in the areas of community skills, intellectual patterns, work practices, and potential stress management strategies. It is a method of investigating the frozen graphic patterns formed in the brain and transferred to paper in the form of calligraphy.¹⁷ It is a means of assessing an individual's sensitive growth in relation to adulthood and steady behaviors. While examiners use defined standards, documents are typically processed by hand.¹⁸ This takes an extended time and may outcome in an independent investigation that is tough to duplicate. The premise that no two persons can produce writing correctly the same way and that no one can replicate their own writing exactly, which is known as variation, is the foundation of the discipline of handwriting analysis. Variations are inconsistencies that naturally arise in a person's handwriting.¹⁹

In forensics, graphology is the study of script, particularly that establish in ransom notes, poison pen letters, or extortion

demands.²⁰ The credentials of a felonious based on its temperament, which is also useful in determining the mode of operation of any serial killer or senseless criminal. If a creative model of calligraphy is existing, QDEs examine for forgeries and modifications and compare them.²¹

Handwriting analysis seeks minor distinctions between the writing of a recognized writer and the writing of an unknown writer. Instead of looking for resemblances in the writing, a QDE looks for variances, because it is the distinctions that establish whether the manuscript is a counterfeit. A QDE considers three factors: letter formation, stroke formation, and formatting.²²

- Letter form – Arcs, diagonals, the proportionate dimensions of characters (the aspect ratio between the proportions of small and big characters, as well as the altitude and breadth of a single letter), the angle of letters, and the practice and presence of joining lines between characters are all instances of letter formation.²³ A letter can be formed inversely liable on where it is in a word - commencement, central, or termination. As a result, a specialist will look for samples of every character in each settlement.
- Stroke formation – This comprises the smoothness and darkness of the outlines, which reflect how much compression the writer puts while writing and the rapidity with which the writer writes.²⁴
- Formatting – It comprises the space between characters, the space between words, the positioning of words on a stroke, and the blank boundaries on a page left by the writer. It also takes into interpretation line spacing. Grammar, spelling, terminology, and punctuation should also be examined. Simulation, or the challenge to disguise one's handwriting or to duplicate another's, is a struggle that appears through handwriting analysis. Simulation is a keymatter since it can make determining the validity of a questioned document considerably more difficult, if not impossible. Nonetheless, it is feasible to define simulation.²⁵

METHODOLOGY

In the current work, fifty samples were gathered from people aged eighteen to twenty five from Delhi. All samples were collected from random people who were fluent in their native language and second language as English. The place of this study is Delhi. The individuals were instructed to write the information on white paper with blue or black pen. Handwriting characteristics in the models were studied and matched in order to reach a decision. The consent form has been filled by each sampler before giving the handwriting sample. The examination was carried out with the use of a magnifying glass, a camera, and a computer system. The writers were instructed to produce the content while sitting comfortably. A magnifying glass was used to examine the gathered samples in normal light. For the handwriting characteristics examination, all individual and class features were studied.

The acquired data was organized for data analysis into two sets: S-1 to S-50 for Set I and C-1 to C-50 for Set II. Authors whose native language is Punjabi make up Set-I, whereas authors whose language is English make up Set-II. All of the samples had the general features indicated in *Table 1* recognized on a regular basis, and *Table 2* guided additional tabulation for statistical analysis. The ordinal data collecting approach for statistical analysis of handwriting features is shown in *Table 2*.

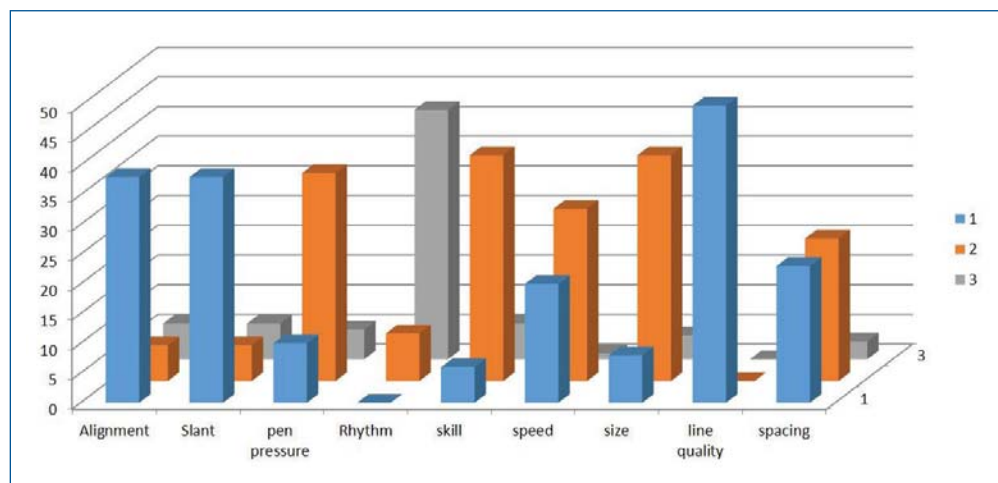
Table 1: General Characteristics of handwriting²⁵

S. no.	General characteristics
1	Alignment
2	Skill
3	Slant
4	Speed
5	Spacing
6	Relative Size
7	Proportion of Letters
8	Movement
9	Rhythm
10	Pen Pressure
11	Line quality

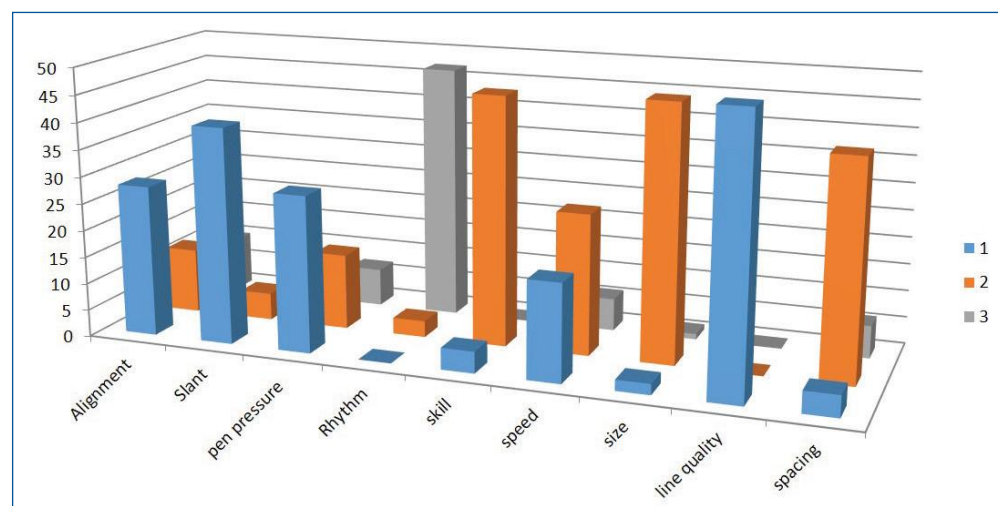
Table2:Sub-Categories and their Numerical Nomenclature²⁵

General characteristics	Sub-categories	Numerical nomenclature			
Alignment	Horizontal	1	Line quality	Smooth, consistent	1
	Ascending	2	Proportions of letter	Same	1
	Descending	3		Different	2
Skill	Inferior	1	Movement	Finger movement with wrist	1
	Medium	2		Wrist movement with forearm	2
	Superior	3		Finger movement	3
Speed	Slow	1		Wrist movement	4
	Medium	2		Forearm movement	5
	Fast	3	Spacing	Narrow	1
Slant	Vertical	1		Medium	2
	Forward	2		Wide	3
	Background	3	Pen pressure	Light	1
Size	Small	1		Medium	2
	Medium	2		Dark	3
	Large	3	Rhythm	Jerky	1
				Intermittent	2
				Smooth	3

Table 2: Contd...



Graphical representation of general handwriting characteristics of authors whose first language is Gurumukhi



Graphical representation of general handwriting characteristics of authors whose first language is English

RESULT AND DISCUSSION

The Gurumukhi scripts evolved from the Brahmi calligraphy, which was printed from left to right. The resemblances and dissimilarities offer an important purpose for comparing the handwriting samples of the scripts. Gurumukhi is the formal language of Punjab, should be matched forensically. It is vital to show the legitimacy of documents during forensic testing. Consequently, to some extent, this study assists the examiner in comparing the samples originating from the same background in order to analyze the class and individual features.

The outcomes of this study and evaluation of the writing samples, as well as the explanations made, indicate that the document examiner does not need to be fluent in the linguistic that he or she is expected to evaluate. In this study, handwritten samples of 50 Gurumukhi or English script were examined by assessing their general and individual writing features in order to form a firm judgment about their authorship. The comparable letter formation of the Roman alphabet capital 'E' and the Gurumukhi alphabet 'ੲ' has been identifying. In these letters, the central section where two curves come across is retraced with strokes. The flow of the strokes follows the same line in both letters, and the writer begins the letter with a slight hook and connects it to the following letter. Demonstrates a similar letter construction of the English letter 'n' and the Punjabi letter 'ਨ'. An eyelet is located at the meeting point of two shoulders, both of which are rounded. In the instance of the Punjabi letter 'ਨ', the horizontal stroke is straight, however, while writing 'ਨ' and 'n', the individual wrote it in a little slanted manner.

Graphological investigations are particularly significant in forensic science for dealing with cases involving psychiatric action of any unlawful or situations concerning suicide transcripts, unspecified characters. Simulation is only one element that could contribute to an erroneous writing examination. Drugs, weariness, and disease are also contributors. Additional variables are produced by human fault, such as matching uppercase and lowercase characters or a lack of excellent exemplars.

CONCLUSION

The study's goal is to identify class and individual features among samples that devised from the same source, as well as to forensically establish a foundation for the analysis of samples that are unfamiliar to the forensic manuscript surveyor. Constructed on various thoroughly analyzed features, it was possible to determine that pen compression, punctuation, boundaries, letter dimensions, incline, and rapidity of characters were identical in the models evaluated in Gurmukhi script. Although each writer has a distinct handwriting style, their secondary language writing also reflects a multitude of distinct characters that they have picked up along the process of acquiring their major language handwriting. The discovery made in this research amply illustrates how a person's distinct characteristics acquired throughout the process of acquiring their main language appear in their secondary language. This might be because the subconscious mind of the person absorbs stimuli intended to create a character that is similar to one in the secondary language even if it is not in the primary language. The results of this study will be useful in determining who wrote the questioned document based on a single handwriting sample that is accessible in either English or regional handwriting; the other handwriting source must be identified.

REFERENCES

1. Harrison, W.R. Suspect documents, Praeger publishers; 1958.
2. Osborn, A.S. Questioned documents, 2nd edn. Boyd printing company; 1929.
3. Hilton, O. Scientific examination of questioned documents, revised edn. CRC press; 1993.
4. Brewster, F. Contested documents & forgeries, the book company ltd; 1932.
5. Huber, R.A., Headrick, A.M. Handwriting identification: facts and fundamentals, CRC Press; 1999.
6. Kelly, J.S., Lindblom, B.S. Scientific examination of questioned documents, 2nd edn. CRC press; 2006.
7. Mehta, M.K. Identification of handwriting and cross - examination of the expert, 2nd edn. N. M. Tripathi publication; 1961.

8. Allen, D. Handwriting examination of unfamiliar scripts. *International journal of forensic document examiners* 1999; 5: 424.
9. Mathur, S. and Chaudhary, K.S. Examination of Handwritten Documents of Unfamiliar Scripts: A Forensic Viewpoint on Various Indian Languages. *IMPACT: International Journal of Research in Applied* 2014; 2: 4-137.
10. Mohamed, R. Statistical Examination of Common Characteristics for Disguised Handwriting amongst Malaysian. *Health and the Environment Journal* 2010; 1: 2-30.
11. Prasad, S. Handwriting Analysis Based on Segmentation Method for Prediction of Human Personality Using Support Vector Machine. *International Journal of Computer Applications* 2010; 8: 12-26.
12. Rahiman, A.M. HABIT: Handwriting Analysis Based Individualistic Traits Prediction. *International Journal of Image Processing* 2010; 7: 2-209.
13. Feder K.P., Majnemer A. Handwriting development, competency, and intervention. *Developmental Medicine & Child Neurology* 2007; 49(4): 312-7.
14. Graham S., Weintraub N. A review of handwriting research: Progress and prospects from 1980 to 1994. *Educational psychology review* 1996; 8: 7-87.
15. Srihari S.N., Cha S.H., Arora H., Lee S. Individuality of handwriting. *Journal of forensic sciences* 2002; 47(4): 856-72.
16. Tappert C.C., Suen C.Y., Wakahara T. The state of the art in online handwriting recognition. *IEEE Transactions on pattern analysis and machine intelligence* 1990; 12(8): 787-808.
17. Edelman S., Flash T. A model of handwriting. *Biological cybernetics* 1987; 57(1-2): 25-36.
18. Cornhill H., Case-Smith J. Factors that relate to good and poor handwriting. *The American Journal of Occupational Therapy* 1996; 50(9): 732-9.
19. Berninger V.W., Vaughan K.B., Abbott R.D., Abbott S.P., Rogan L.W., Brooks A., Reed E., Graham S. Treatment of handwriting problems in beginning writers: Transfer from handwriting to composition. *Journal of educational Psychology* 1997; 89(4): 652.
20. Van Galen G.P. Handwriting: Issues for a psychomotor theory. *Human movement science* 1991; 10(2-3): 165-91.
21. Graham S., Miller L. Handwriting research and practice: A unified approach. *Focus on exceptional Children* 1980; 13(2).
22. Said H.E., Tan T.N., Baker K.D. Personal identification based on handwriting. *Pattern Recognition* 2000; 33(1): 149-60.
23. Plamondon R., Maarse F.J. An evaluation of motor models of handwriting. *IEEE Transactions on systems, man, and cybernetics* 1989; 19(5): 1060-72.
24. Alston J., Taylor J. Handwriting: Theory, research and practice, New York: Nichols Publishing Company; 1987.
25. Vinny Sharma. Handwriting accents to reveal cultural identity of author: an Indian approach. *Indian J forensic med Pathol* 2021; 14: 168-173.
26. Ramsay J.O. Functional components of variation in handwriting. *Journal of the American Statistical Association* 2000; 95(449): 9-15.