

A PRELIMINARY STUDY ON MULTILINGUAL HANDWRITING CHARACTERISTICS AMONGST CENTRAL INDIAN POPULATION

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Abstract: The modern era of technology and advances have opened up new pathways to examine questioned documents. By examining various aspects of handwriting, such as letter formations, slant, spacing and pressure, we can potentially uncover patterns and trends that distinguish different Devnagari - derived languages such as Sanskrit, Hindi and Marathi. This study aims to explore the relationship between Devnagari-derived scripts and their corresponding handwriting styles through graphology. Additionally, we can investigate the impact of educational background and cultural variations on handwriting styles within multilingual subjects. The aim of present study is to establish a methodology to examine the unknown sample of handwriting and establishing identity on the basis of proficiency in particular script. This study sought to bridge the gap in analysis of handwriting by shedding light on the relationship between language, culture, and educational background of individuals proficient in these languages. The sample collection was done in age group of 18- 50 years with subjects having proficiency in Hindi, Marathi and Sanskrit languages. A total of 50 handwriting samples were taken from M.P, Central India population to study the similarities and differences between writing samples of same individual in two different scripts. The study aims at fostering a deeper appreciation for the intricate connection between language and handwriting.

Keywords: Handwriting characteristics, Devnagari script, Multilingual, Questioned Document, Forensic Linguistics.

INTRODUCTION

The modern era holds great opportunities and achievements for forensic science. It will always be that one field which can never stop to grow and develop. The upcoming technologies and inventions will always aid new horizon and perspectives to the forensic science. This study follows the research line of questioned document branch of the forensic science. These modern set of horizon has opened a pathway to enter the enthusiastic world of questioned document examination. Forensically, examination of disputed documents in the court of law is known as questioned document examination.(1) The aim of this research totally focuses of becomes habit is a skill that can be learnt. It requires the concerted effort of the brain, muscle and nerves. As well said, handwriting is the result of neuro - muscular coordination. A person can write those symbols or letters which he/she is accustomed via language they know.
Languages-

Language is a system of communication. A communication will be incomplete without the

involvement of the language. It is used to interpret what other person is trying to convey. It is a mode or manner one transfers the communication from here to there. The process of using language is similar to that of encryption and decryption technologies.(2)

There are no specific proofs regarding the first and original source of language.(3) There are assumptions and theories regarding the origin of language.

Apart from these sources there are some theories which explain the origin of language. They are:-

Fitch's theory of language – Fitch, in his book “The Evolution of Language” stated that language was originated as a need for communication. He also considered it the first and foremost tool for social involvement. Gestures are also a form of language was explained by him.(4)

Whitney's origin of language – Whitney explained the origin of language as the human need to interact with the surroundings. His observations were similar to Fitch. This theory is also known as bow- bow theory.(5)

Charles Darwin's origin of language – according to Charles Darwin, the origin of language is correspondence to the natural sounds, man's cries and voice of animals. He considered the language as a gradual process.(6)

Chomsky's origin of language – The observation involved that the language originated from the call of apes. He made a firm ground of the question, that what was so different in the calls or cries of human that made our language so different that we are able to conquer the world.(7)

Saussure's origin of language- this was the most controversial theory. He believed that language was/is eternal. That means the languages were here in our surrounding without any beginning or end. Humans

and animals have identified their power of language with time and requirement.(8)

The language diversity among Indians is a well-established and recognized

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fact. Through-out the India thousands of languages is spoken.

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listed.

Some of them are Bengali, Hindi, Sanskrit, Pali, Urdu and others. The languages listed under 8th schedule of Indian constitution are used for legal status and official purposes in central and state governments. Also census of India as 2001 has stated that India has 122 major languages and 1599 other languages.(9) The languages are the one of the prominent part of India's culture, social and individual practices leading to political and individual development.

Writing systems of India

There are 25 writing system of India which are in use till today. There are more than 50 languages in India in which writing and publishing is in practice. Different script of different languages derives from these writing systems of India. In addition to these, there are other scripts as well which are not popular and not commonly used. The diversity of writing systems in India underscores the nation's linguistic complexity and cultural heritage, showcasing the coexistence of various scripts and languages across the subcontinent.(10)

Scripts of India

The Indian script is considered as "Lipi". The word is derived from the word "lip" which means "to smear". It is said that devnagri is the

script that enables a person to write any language from the world. The Brahmi script is considered to be written by Lord Brahma. This script is the ancient form of devnagri script. The devnagri alphabets are said to be derived from Brahmi script around 11th century C.E. originally the alphabets were adapted to make Sanskrit script but after some time, it was use to write many languages. Devnagri script is the most unique language and script as

mentioned by different researchers. It official

of India such as Hindi, Marathi, Sindhi, Nepali, Sanskrit,

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Konkani

many more. Devnagri has 13 vowels and 34 consonants along of vowel and 3 of rakar.(11)

Indeed, Hindi, Marathi, and Sanskrit share a common origin as they all derive from the Devanagari script. However, there are notable differences that set them apart:

Vowels and Consonants: Differences exist in the number of vowels and consonants in each language. Hindi, for instance, has a different set of vowels and consonants compared to Marathi and Sanskrit.

Location of Use: These languages are primarily spoken in different regions of India. Hindi is more widespread in the northern and central regions, while Marathi is predominant in Maharashtra, and Sanskrit is often associated with classical texts and rituals.

Phonetics: Pronunciation and phonetic characteristics vary among these languages, leading to distinct spoken sounds.

Compound Characters: All three languages employ compound or composite characters, formed by combining basic characters to represent specific sounds or phonemes.

Modifiers (Matrass): Modifiers, known as "matrass," are used to alter the pronunciation of characters or to indicate specific phonetic nuances.

Writing Direction: The script is written from left to right in these languages, following a horizontal orientation.

Case Sensitivity: Unlike some other languages, Devanagari-based languages like Hindi, Marathi, and Sanskrit do not have a concept of uppercase or lowercase letters. The script is written as it is spoken.

Phonetic and Syllabic: These scripts are both phonetic and syllabic, which means that the

characters represent both individual sounds and combinations of sounds.

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Shirorekha: The distinctive feature of the formation at the letters, known as "Shirorekha." This line

is a key element in the script's visual structure.(12)

These linguistic and scriptural variations reflect the cultural and regional diversity within India, highlighting the richness of its languages and scripts.

Table 1 Shows number of letters in script's Varnmala

Head	HINDI	MARATHI	SANSKRIT
Number of vowels	11	16	16
Number of consonants	42	36	34
Total number of letters	53	52	50

Interscript Comparison

This interscript comparison can be done on two basis, that are –

Class characteristic examination

Individual characteristic examination(13)

Class characteristic examination involves certain factors to entitle the result or conclusion. The class characteristic factors which are compared in this study are as follows:-

Form- It can be angular, rounded or eyed.

Skill- It explains whether the written material is legible or not along with the pictorial aspect.

Shading- It determines the heavy strokes and light strokes.

Movement- The movement of finger, forearm or wrist is determined.

Embellishment- The degree of ornamentation is determined.

Terminals- The ending stroke's features are examined.

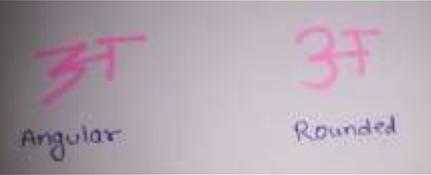
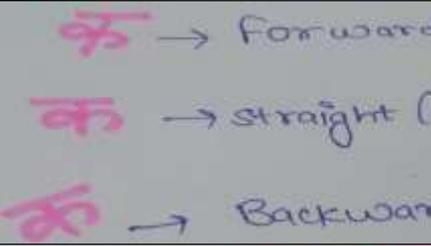
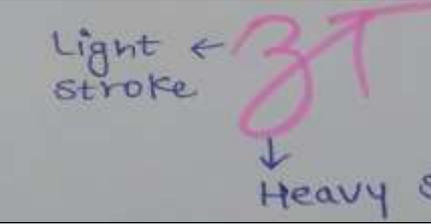
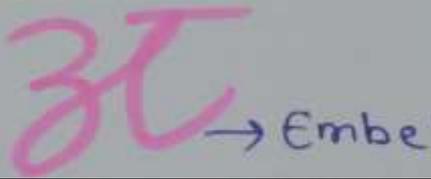
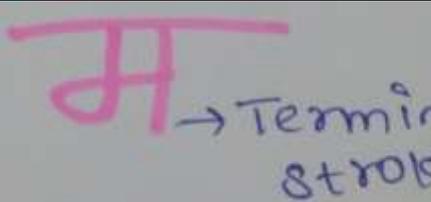
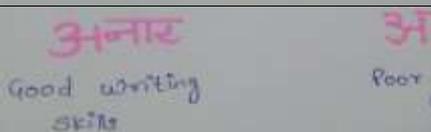
Slant- The degree of slant is measured.

Width- Width of those letters which contains loop

Spacing- The spacing between the letters within a word

Speed- Using quality of strokes, speed is determined.

Table 2 shows the different class characteristics

Font	
Slant	
Shading	
Embellishment	
Terminal	
Width and spacing	
Skill	

Individual characteristic examination will include individual examination on the basis of letter formation. It will help to form the individualization or to establish the authorship. The handwriting is persistent and unique. Its universal nature makes it easy to trust upon it.(14)

Forensic examination of questioned document requires a lot more attention than other fields due to the vulnerability of evidences. It requires much more manual work rather than technical approach. Many researchers and authors have approached the idea of interscript comparison, offline recognition of scripts, study on evolution of various symbols of any script, letter formation and many more. Also many authors have studied the relation of language with handwriting, behaviour and nationality. The gap lies in practical approach. (15) Practically, it becomes quite impossible to compare two scripts. In this study an approach is made, to examine the questioned documents written in two different scripts of same origin using class characteristics and individual characteristics of the handwriting of an individual. This study is mainly focused upon three different languages – Hindi
Marathi
Sanskrit

This study follows the principle that handwriting being a product of neuromuscular activity and examination of handwriting follows the same principle irrespective of the scripts. Most of the literate person in India knows at least 3 language [scripts] i.e. Hindi, English and their native language. Thus this approach of examination of handwriting features in different languages of the same origin of an individual becomes realistic. (16)
Methods and Methodology

1
In the present study, 50
between the age group of 18-50
who were
central India
the desired scripts and knew how to
1
read, write and comprehend them. The 25
Hindi

Marathi individuals
Sanskrit

pen.
Central India
Hindi Central India based population. The

A)
10X Magnifier

Hand Magnifier
B) Methodology

The individuals were asked to sit comfortably in sitting position and write the content. The entire data collection process took place in well-lit surroundings, ensuring that the handwriting samples were obtained under consistent lighting conditions. The content was normalized to ensure consistent sizing, alignment, and orientation. once the samples were collected, Starting with the sample one, we Observed the class and individual characteristics of the handwriting in the scripts using 10x Magnifier and hand magnifier. Data analysis was done to draw conclusions about the multilingual interscript comparison and any patterns or variations observed across different languages or authors.

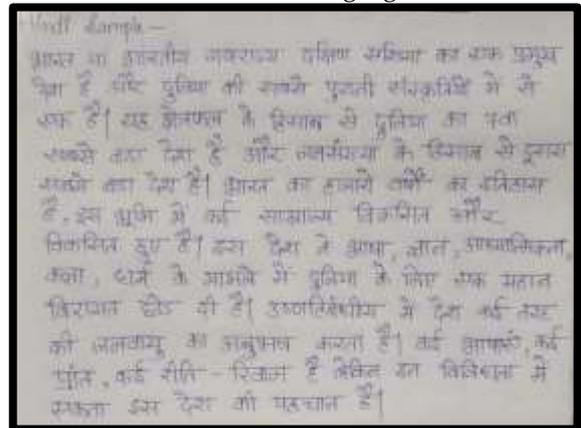


Figure (1) Hindi Sample from the individual (A) who is bilingual and Knows Hindi and Marathi Scripts

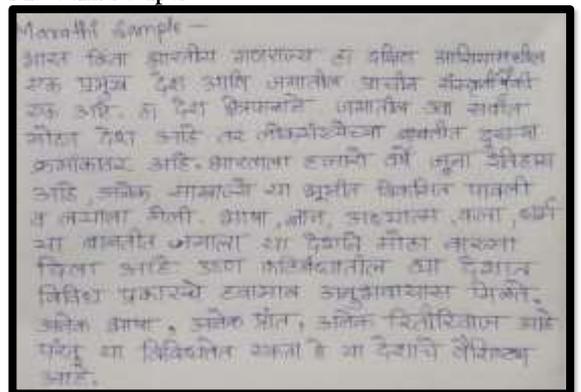


Figure (2) Marathi Sample from the same individual (A) who is bilingual and knows Hindi and Marathi Scripts

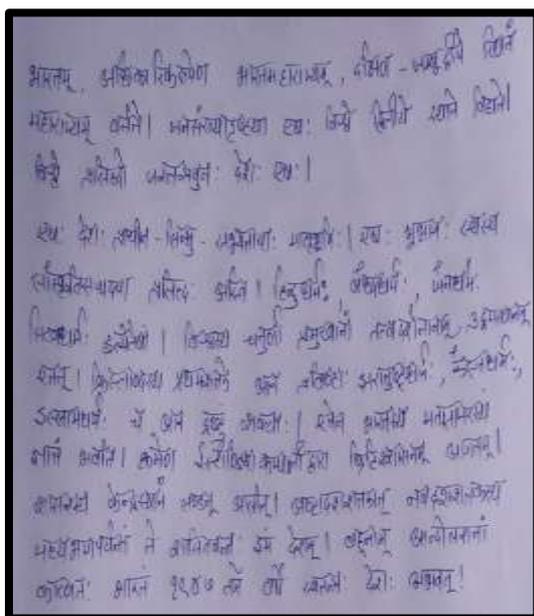
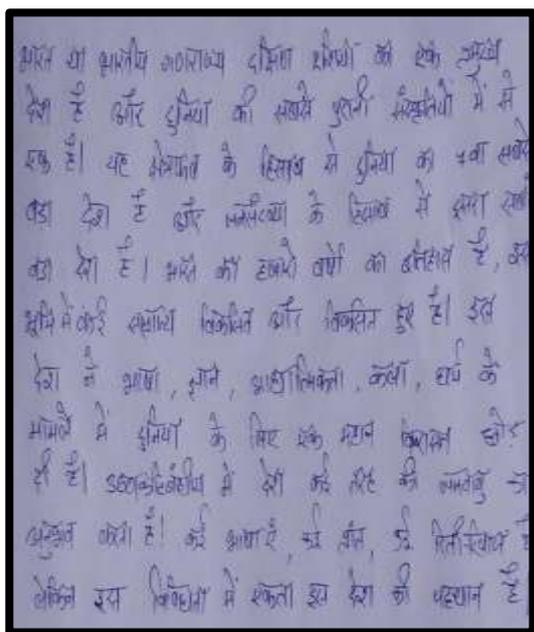


Figure 3 Hindi Sample from the individual (b) who is bilingual and knows Hindi and Sanskrit Script

Figure 4 Sanskrit Sample from the individual (b) who is bilingual and knows Hindi and Sanskrit Script

The class characteristics of handwriting such as slant, movement, skills, connections, shading, width, Form, Connections, terminals, pen pressure, embellishments were studied.

Sr.no.	Class characteristics
1	Form
2	Skills

3	Connections
4	Shading
5	Movement
6	Embellishments
7	Terminals
8	Slant
9	Width
10	Spacing
11	Speed

The individual letters which follow the similar character formation and structure style were examined and compared for individual traits.

Results

In this study an attempt has been made to minimize all the problems and myths and generate a manual method for interscript comparison. And so far, it has been achieved. The study used samples for interscript comparison of handwriting features in Hindi, Marathi and Sanskrit script. The class characteristic parameters are compared and recorded. Similarly, the individual characteristics are also compared and recorded. While reaching to the opinion after comparison, the objective of the study is fulfilled. The results for the study are listed below-

Table 3 List of the samples which were comparable with the other script written by the same person in percentage

S. No.	Heads	80-90%	70-80%	60-70%	50-60%	Below 50%
01	On the basis of class characteristics	90%	10%	None	none	None
		of samples	of samples			
		were comparable and matching with the other	were comparable and matching with the other			

		sample s given	sample s given			
		by the	by the			
		same individ ual in	same individ ual in			
		other script	other script			
02	On the basis of In dividual characteris tic	70% of sample s were compar able and matchi ng with the other sample s given by the same individ ual in other script	20% of sample s were compar able and matchi ng with the other sample s given by the same individ ual in other script	10% of sample s were compar able and matchi ng with the other sample s given by the same individ ual in other script	No ne	No ne

Discussion

The scripts of Hindi, Marathi, and Sanskrit all trace their origins back to the Devanagari script, which is traditionally written from left to right. This shared ancestry, while establishing a common foundation, also gives rise to both similarities and differences among these scripts. Consequently, there arises a compelling need to systematically analyze and compare handwriting samples across these languages.

Forensic examination demands the ability to ascertain the authenticity and genuineness of documents with a high degree of confidence. In this context, the study serves a significant purpose. It equips forensic examiners and document analysts with a valuable tool for scrutinizing and discerning between two distinct scripts that share a common historical lineage.

By conducting a comparative analysis of handwriting samples from Hindi, Marathi, and Sanskrit, the study facilitates a detailed exploration of both class and individual characteristics within the scripts. These characteristics encompass a wide array of elements, including letter formation, spacing, slant, pressure, and other distinctive attributes that contribute to the unique handwriting styles in each script.

The significance of this research lies in its potential to enhance the capabilities of forensic experts and document examiners. Through the systematic comparison of these scripts, the study aids in the identification of not only class characteristics shared among scripts of the same origin but also individual traits specific to each writer. This, in turn, bolsters the examiner's ability to authenticate documents and discern between genuine and potentially fraudulent materials.

Following the detailed analysis of each script, the data acquired was subjected to comprehensive analysis. Our objective was to draw meaningful conclusions regarding multilingual interscript comparisons and to identify

any discernible patterns or variations observed across different languages or among various authors. This analytical approach allowed us to gain valuable insights into the intricacies of handwriting across different scripts and provided a deeper understanding of how individuals express themselves through their writing in various languages. The study's findings contribute to our knowledge of linguistic and cultural diversity and have implications for fields such as forensic analysis and document examination.

The class characteristics such as pen pressure, slant, alignment, speed, strokes, terminals, width, embellishments, connections, skills, form are very comparable in nature for the Hindi, Marathi and Sanskrit scripts. This is due to the 70% similar characters in the Varnmala. Also they are written from left to right and have

shirorekha. The class characteristics interscript comparison may open a place to bridge the gap involved in interscript comparison. Along with that individual traits which were found to be common among both the scripts for an individual, can help us to lead to individualization if studied carefully and thoroughly.

This study takes a novel approach by delving into the study of individual characteristics to ascertain the identity of the writer. It endeavours to determine whether it is feasible to confidently conclude that two given samples were authored by the same individual. Notably, the results of this research demonstrate that it is indeed possible to make such determinations based on the presence of common individual traits.

By conducting meticulous observations and comparisons, the study successfully identified instances where two samples were unequivocally written by the same person. This breakthrough has profound implications for forensic science and document analysis. It underscores the potential of utilizing individual characteristics as a powerful tool for writer identification across scripts. This discovery enhances the precision and reliability of forensic handwriting analysis, bolstering the field's ability to establish the authenticity of documents and uncover instances of deception or fraud.

Conclusion-

In this study an attempt has been made to minimize all the problems and myths and generate a manual method for interscript comparison. And so far, it has been achieved. The study used samples for interscript comparison of handwriting features in Hindi, Marathi and Sanskrit script. The class characteristic parameters are compared and recorded. Similarly, the individual characteristics are also compared and recorded. While reaching to the opinion after comparison, the objective of the study is fulfilled.

The research study on multilingual authorship development through handwriting analysis in Devnagri-derived languages yields several significant outcomes. These outcomes contribute to the understanding of the intricate relationship between language, culture, and handwriting styles within the context of these languages.

Devnagri-derived languages are spoken across diverse regions with their own distinct cultural influences. By analysing handwriting samples

from different regions, the research aims to uncover patterns and trends specific to each region.

The study has examined the influence of language proficiency on handwriting styles within Devnagri-derived languages. By comparing the handwriting samples of individuals with varying levels of language proficiency, the research aims to identify whether there are noticeable differences in handwriting styles based on language fluency.

Handwriting analysis has practical applications in forensic investigations. The research study aims to contribute to the field of forensic graphology by providing insights into multilingual interscript comparison within Devnagri-derived languages. The findings of this study can assist forensic experts in accurately attributing authorship, verifying the authenticity of handwritten texts, and resolving cases involving disputed or fraudulent documents.

The research study aims to foster an appreciation for linguistic diversity and cultural understanding. By exploring the handwriting styles within Devnagri-derived languages, the study highlights the richness and diversity of these languages and their cultural significance. The major outcomes are also listed here-

Explore Cross-Linguistic Handwriting Transfer Effects

Assess the Reliability of Handwriting Analysis for Authorship Attribution

Develop a Handwriting Profile for the Multilingual Subject

In conclusion, the research study on multilingual authorship development through handwriting analysis in Devnagri-derived languages is expected to yield valuable outcomes that enhance our understanding of language, culture, and handwriting styles. The identification of language-specific patterns, exploration of regional variations, and examination of the influence of cultural factors and language proficiency will contribute to forensic investigations, educational practices, and promote linguistic diversity and cultural understanding.

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