

Evaluation of Characteristic Similarities of Unaccustomed and Accustomed Handwriting in Hindi Script

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Abstract

In the Questioned Document Examination, determining the authorship of the questioned handprinting (Hindi language) written by an unaccustomed hand with the handprinting samples written with an accustomed hand is a challenging task for handwriting experts. In India, due to its familiarity and ease of conveying the message, criminals prefer Hindi for crime activities such as extortion, defamation, etc. through letters or anonymous letters. This laboratory reported several cases of anonymous letters. In the case of unaccustomed handprinting for an opinion, samples of accustomed handwriting as well as unaccustomed handprinting of a suspect(s) are required, and if there is only one hand of accustomed handwriting, then sometimes it becomes difficult to conclude the opinion. To evaluate the possibilities and limitations for the identification of unaccustomed handprinting in Hindi, handwriting samples of 100 right-handed people, both unaccustomed and accustomed, were collected and analyzed in the laboratory. Hand lenses, scale grids, and microscopy are used for understanding the sequences of strokes. This paper emphasizes the similarities and dissimilarities in the writing habits of the writers, written with both unaccustomed and accustomed hands in Hindi, to conclude the opinion.

Keywords: Accustomed handprinting, handprinting, hindi letters, hindi matra (vowel sign), unaccustomed handprinting

INTRODUCTION

Aspirations for status elevation have also increased in recent years. Numbers of people have adopted malpractices to acquire high status and become impatient with the get-rich-quick syndrome [1]. An economic imbalance among different sections of society has been caused partly by the social inheritance of the people and partly by the processes of modernization and change. The status hiatus created by these factors has been responsible for creating situations of crime and delinquency in society [2]. In forensic science laboratories, “questioned document experts” deal with white-collar crimes, and many fraudulent documents are submitted to ascertain the authorship of the person by the examination of standard handwriting.

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Hindi is a structural language and a constitutionally official language of the Government of India [3]. It is a widely used language for communication in comparison to other Indian languages. In those states where Hindi is used officially and by the public at large, many frauds are committed in Hindi. In many crimes, criminals demand money or spoil the social and familiar images of a person by writing threatening letters, extortion letters, anonymous letters, monthly recovery letters, or demands, which cause

social and mental harassment. Criminals, while participating in criminal activities, have the mindset to hide their identity and make disguised writings. In disguised writings, the writer seeks to impart as much of an appearance unlike his own habitual writing as possible while still making the disguised writing legible [4].

The modus operandi [5] of writing with unaccustomed hand attracts criminals to commit crimes. Criminals often use their unaccustomed hands for writing to escape undetected. In cases of handwritings, a writer who has practiced with an unaccustomed hand becomes successful in hiding his or her identification due to insufficient writing samples supplied by investigating agencies.

Handwriting is a graphical movement of a writing instrument under the control of the brain, and this neuromuscular activity [6] is sometimes called 'brain writing' [7]. The writing is an individual characteristic for each person because the images that are stored in the mind in "copybook form" are reflected in the writing, which culminates in his individual writing habits, called style [8], and also gradually changes during the entire course of his or her life, called natural variation [9]. The handwriting leaves our brainprint on the paper regarding our thoughts, feelings, and behaviors, along with natural variation; hence, our opinion on handwriting examination is based on natural variation.

G.A. Dawson [10] presented a case study on unaccustomed left handprinting in English. Jannine Zimmerman [11] presented his paper at the 1991 ASQDE meeting in Orlando, Florida, titled "Handwriting Identification Based on an Unaccustomed Hand Standard".

Many experts have published their studies and case studies regarding the English language, and they found the same results, but in the case of Hindi writing, the team could not find any research papers in reference to Hindi script.

MATERIAL AND METHODS

For studying the variations in the characteristics of Hindi script, handwriting samples of more than 100 right-handed persons written by both unaccustomed and accustomed hands were collected and analyzed in the Document Division, CFSL, Kolkata. All the collected sample writings contain the same script with letters and their combinations in words and matras (vowel signs). These samples are examined under different categories according to their mode of construction of letters and characters according to copy book form:

1. **Downward strokes:** क (Ka), ग (Ga), ङ (Na), छ (Cha), झ (Jha), ट (Ta), ठ (Tha), ड (Da), ढ (Dha), ण (Uda), त (Ta), द (Da), प (Pa), फ (Pha), म (Ma), ल (La), स (Sa), त्र (Tra), ज्ञ (Gya)
2. **Curved strokes:** ख (Kha), घ (Gha), य (Ya), र (Ra), श (Sa)
3. **Horizontal strokes:** च (Ca)
4. **Bowl strokes:** ज (Ja)
5. **Loop strokes:** थ (Tha), ध (Dha), न (Na), ब (Ba), भ (Bha), व (Va), श (Sha)

Besides these categorizations, the manner of formation of letters depends on the writer's ability to form the letter's design and these may be subject to change while writing because of his perception of how to form the letter. For example, the letter 'क' (Ka) may start with a loop stroke instead of a downward stroke. For comparison of handwritings, various types of optical instruments like a stereoscopic microscope, hand magnifier, and grid scale were used. A collected writing sample from one individual is shown in Figures 1 (a and b).

RESULTS AND DISCUSSION

Firstly, the legibility of the collected writing samples was examined. These accustomed handwritings show consistency within natural variation and are found to be suitable for comparison with unaccustomed handwritings. It was observed that the basic structures of the letters in the sample

writings written in both hands are the same, despite the painful and laborious work undertaken by the unaccustomed hand. During the act of writing, an untrained hand fails to control the movements of the letters, which are preset due to long practice in the writing act and the writer makes the nearest possible approach to normal writing habits. The speed of unaccustomed handwriting was initially slow, showing poor writing skill, poor rhythm due to the loss of pen control but subsequently underwent gradual acceleration; however, when writing with an accustomed hand, the speed could only be found to be moderate.

There are many similarities found between writing habits of accustomed and unaccustomed writers. In the presented writing sample (Figure 1) of one individual person, the basic designs of characters, relative size and proportions, commencement as well as extent of termination of letters, use of vowel signs, punctuation marks, and inscription of diacritics are found to be similar in both sets of writings as shown in Table 1. In the differences, writing samples fail to maintain the speed, skill, movement (mostly finger movement observed), pressure, and alignment between letters and words as shown in Table 2. These differences occur only because an untrained hand is introduced to do the work of the habitual one and for that a joint mental and physical effort is required. Writers want to maintain speed and in many places pen impulse is present with hesitating strokes, but due to graphical maturity they are unable to hide their many individual characteristics like—the basic pattern of the letters, their manner of combining with succeeding letters and also formation of vowel signs used in Hindi writing; a-kar “अ”, u-kar “उ”, oo-kar “ऊ”, i-kar “इ”, ee-kar “ई”, o-kar “ओ”, ou-kar “औ”, etc.

Sample

The writing samples 1 and 2 (Figure 1a and b) of one individual person shows similarities in designs of characters, relative size and proportions, commencement as well as extent of termination of letters, use of vowel signs, punctuation marks, and inscription of diacritics shown in Table 3 and differences in handwriting characteristics shown in Table 4.

After the examination of all 100 collected samples considering the basic structural design with movement characteristics (line quality, directness, slant, rhythm, pen pressure, and speed), the following results were observed:

1. An effort in the construction of letters because of the unfamiliarity of an untrained hand resulting in slow speed of writings that affect the line quality, movement, pen pressure, and complete loss of rhythm.
2. The noticeable loss of pen control due to limitations in muscular movements dramatically changes the pictorial appearance of the texts. The straight lines such as use of headlines are modified.
3. The marginal habit found to be similar in both sets of handwritings.
4. The relative slant and alignment of letters in words and lines varies in unaccustomed handwritings.
5. Variation in alignment is found, which is due to the loss of muscular control in unaccustomed handwritings.
6. The low order of skill shown because of the finger movement (in most of the writers) in unaccustomed handwritings.
7. The curvatures were not smooth but found to be with sudden change in the direction in unaccustomed handwritings.
8. The location of beginning of letters are found to be similar in both sets of writings.
9. The termination of letters in case of left hand writings (unaccustomed hand) goes to leftward and in case of right hand writings (accustomed hand) goes to rightward.
10. Hesitations and pen stops are observed in unaccustomed hand writings of both left and right hand writers.
11. The overall size of the letters in case of unaccustomed hand writings is generally larger than the accustomed handwritings.

Table 1. Similarities in accustomed handwriting and unaccustomed handprinting.

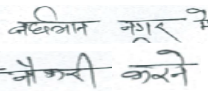
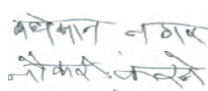
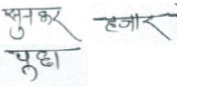
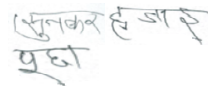
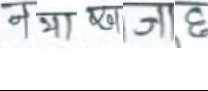
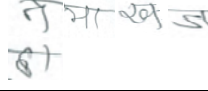
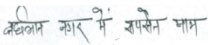
S.N.	Characteristics	Accustomed handwriting	Unaccustomed handprinting	Observations
1.	Basic pattern			Similar except smoothness.
2.	Relative size and proportion			Similar with some variations.
3.	Termination of strokes			Similar, at points the uncontrolled dragging of strokes are observed.
4.	Location of beginning			Similar with some variations.
5.	Vowel signs			Manner, location, and size same with some variations.
6.	Spacing			Between letters and lines similar with some variations.

Table 2. Dissimilarities in accustomed handwriting and unaccustomed handprinting.

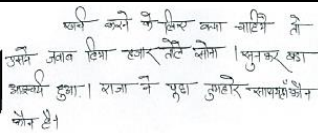
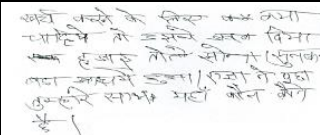
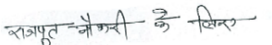
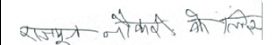
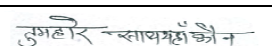
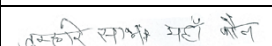
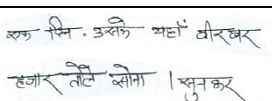
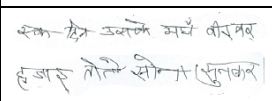
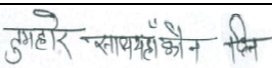
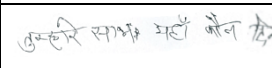
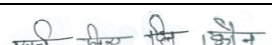
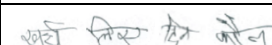
S.N.	Characteristics	Accustomed handwriting	Unaccustomed handprinting	Observations
1.	Smoothness and rhythm			Smoothness and rhythm failed completely in unaccustomed handwritings.
2.	Pen pressure			Lighter in unaccustomed handwritings.
3.	Size of letters			Bigger in unaccustomed handwritings.
4.	Skill			Skill of low order in unaccustomed handwritings.
5.	Slant and alignment			Slant and alignment varies in unaccustomed handwritings.
6.	Execution of letters			Slow execution of letters observed in unaccustomed handwritings.
7.	Curvatures and loops			Smoothness in formation of curvatures and loops failed in unaccustomed handwritings.

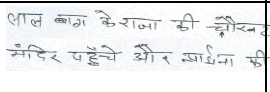
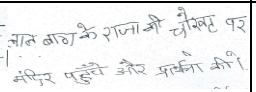
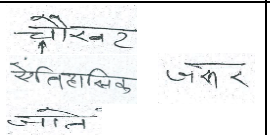
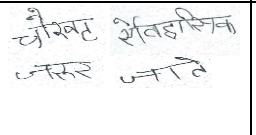
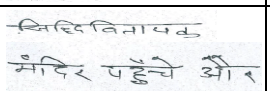
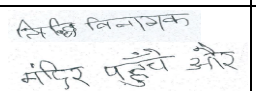
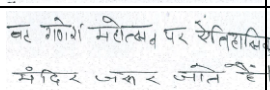
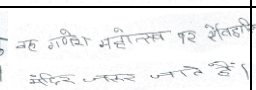
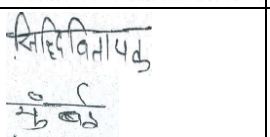
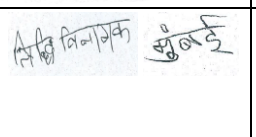
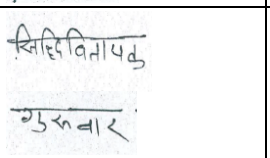
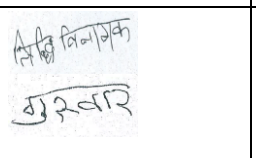
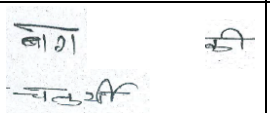
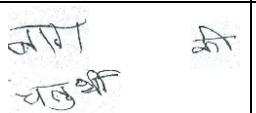
Table 3. Similarities in accustomed and unaccustomed writings.

S.N.	Characteristics	Accustomed handwriting	Unaccustomed handwritings	Result
1.	Basic pattern	ल ल प र मं जल	ल ल प र म जल	Similar except smoothness and erratic movement in unaccustomed handwritings.
2.	Relative size and proportion	लाल यपरिवार मंदिर	लाल अपरिवार मंदिर	Similar with some variation.
3.	Termination of strokes	पर यपरिवार	पर अपरिवार	Almost same, at points the uncontrolled dragging of strokes are observed.
4.	Location of beginning	बाग क्रिश्न को जल	बाग क्रिश्न को जल	Almost same with some variations.
5.	Vowel signs	के को चतुर्थी मुंबई पहुँचे	के को चतुर्थी मुंबई पहुँचे	Manner, location, and size same with some variations.
6.	Spacing	पर ऐतिहासिक मुंबई में	पर ऐतिहासिक मुंबई में	Between letters and lines same with some variations.

ACCUSTOMED HAND WRITING	UNACCUSTOMED HAND WRITING
वैदिक नगर में जयसैन पाप का राजा राज करता था। एक दिन उसने यहाँ वीरधर नाम का एक राजपूत नौकरी के लिए आया। राजा ने उससे पूछा कि उसे खाने करने के लिए क्या चाहिए तो उसने जवाब दिया हजार तैले सोमा। सुनकर बड़ा आश्चर्य हुआ। राजा ने पूछा तुम्हारे साथ श्रम कौन है।	वैदिक नगर में जयसैन नाम का राजा राज करता था। एक दिन उसने यहाँ वीरधर नाम का एक राजपूत नौकरी के लिए आया। राजा ने उससे पूछा कि उसे खाने करने के लिए क्या चाहिए तो उसने जवाब दिया हजार तैले सोमा। सुनकर बड़ा आश्चर्य हुआ। राजा ने पूछा तुम्हारे साथ श्रम कौन है।
ACCUSTOMED HAND WRITING	UNACCUSTOMED HAND WRITING
लाल बाग के राजा की चौकट पर तेंडुलकर। क्रिश्न लीजेंड खचिन तेंडुलकर गुस्वार के गणेश चतुर्थी के अक्षर पर यपरिवार लाल बाग के राजा भगवान गणेश के मंदिर पहुँचे और प्रार्थना की। मुंबई में रहने के दौरान वह गणेश महोत्सव पर ऐतिहासिक सिद्धि विनायक सिद्धि विनायक मंदिर जल जाते हैं।	लाल बाग के राजा की चौकट पर तेंडुलकर। क्रिश्न लीजेंड खचिन तेंडुलकर गुस्वार के गणेश चतुर्थी के अक्षर पर यपरिवार लाल बाग के राजा भगवान गणेश के मंदिर पहुँचे और प्रार्थना की। मुंबई में रहने के दौरान वह गणेश महोत्सव पर ऐतिहासिक सिद्धि विनायक सिद्धि विनायक मंदिर जल जाते हैं।

Figure 1. (a) A view of one collected sample writing of both accustomed and unaccustomed hands.
(b) A view of one collected sample writing of both accustomed and unaccustomed hands.

Table 4. Dissimilarities in accustomed and unaccustomed writings.

S.N.	Characteristics	Accustomed handwriting	Unaccustomed handwritings	Results
1.	Smoothness and rhythm			Smoothness fails completely in unaccustomed hand.
2.	Pen pressure			Lighter in unaccustomed handwritings.
3.	Size of letters			Bigger in unaccustomed handwritings.
4.	Skill			Low order skill in unaccustomed handwritings.
5.	Slant and alignment			Slant and alignment variations in unaccustomed handwritings.
6.	Execution of letters			Slowly execution of letters seen in unaccustomed handwritings.
7.	Curvatures and loops			Smoothness in formation of curvatures and loops fail in unaccustomed hand.

The loop formation of letters as well as loop of vowel signs use in u-kar “उ”, oo-kar “ू”, o-kar “ो”, ou-kar “ौ” etc. in which the oval is clockwise movement in accustomed hand but in case of unaccustomed hand (left hand) where the commencement found with a movement impulse. The unaccustomed hand failed to retrace the line properly, sometimes finishes leftward with thin line. These all similarities and dissimilarities are shown in Table 5.

Table 5. A comparative study of similarities and dissimilarities in accustomed and unaccustomed handwritings.

S.N.	Similar characteristics	Dissimilarities characteristics
1.	Basic pattern	Smoothness and rhythm
2.	Relative size and proportion	Pen pressure
3.	Termination of strokes	Size of letters, curvatures, and loops
4.	Location of beginning	Skill
5.	Vowel signs	Slant
6.	Spacing	Execution of letters

CONCLUSION

The basic form and formation of the letters remain the same. There is an effort to maintain the basic design of the characters, resulting in a slow speed of execution and strokes lacking smoothness. In the case of unaccustomed handwriting, the overall size of the letters is found to be larger than in accustomed handwriting. There is a complete loss of rhythm. The downward strokes, which are smooth and straight in accustomed handwriting, but found to be slightly wavy in unaccustomed handwriting. A writer who has practiced for many years for one basic design cannot be taken away

at his will instantly by changing the hand, which is the slave of the brain. In the given study, it is possible to express an opinion on unaccustomed Hindi handwritings, if accustomed handwriting samples in sufficient quantity are provided by the investigation agency because the graphic maturity attained by the writer could not be altered by the change of hand except for the smoothness and uncoordinated erratic movement of the strokes.

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