

# Examination and Comparison of the Handwriting Characteristics of Devanagari Script with Gurumukhi and Telugu Script

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## Abstract

India has been acclaimed for the extent diversity especially in the context of cast, culture, languages, religion, and scripts. Brahmi script is the oldest writing system of ancient India, developed in 1st millennium BCE. Brahmi script eventually gave evolution to all the modern scripts of India including Devanagari, Gurumukhi, Telugu, Gujarati, Bengali, Oriya, Telugu, Tamil, Malayalam, Kannada, Sinhala and scripts found in south and central Asia. Hindi language written in Devanagari script and is one of the official languages of India. About forty five percentage of the Indian population use Hindi. Telugu language is one of the official languages of India with 6.93% native speakers, whereas Punjabi is the language of Punjab state and is the 5<sup>th</sup> most spoken language in European country which is written in Gurumukhi script. The similar origins, including the divergence among these scripts, are influential and critical. In forensic laboratory document examiners receive distinct handwritten scripts for proving the authentication/genuineness. Undeniably it is difficult for an examiner to know each and every script especially in a country like India where there is an enormous divergence in languages and their scripts. The present study describes the class and individual characteristics of Devanagari, Telugu and Gurumukhi scripts, those originated from the Brahmi script and there by forming a base for forensic examination of scripts unknown to forensic examiner.

**Keywords:** Scripts - Brahmi; Devanagari; Gurumukhi; Telugu; Examination

## Introduction

Scripts are the writing system of a particular language. A script is a conventionally accepted graphic, i.e. written, representation of the alphabet used in a particular language. Each script can have various styles. It could be assimilated as the symbolic representation of the sounds of a particular language. India being a multi-linguistic country has twenty-two official languages and their scripts. Brahmi script is the oldest writing system of ancient India, attestations of which reach back into the 1st millennium BCE [1]. Brahmi script eventually gave evolution to most of the modern scripts of India including Devanagari, Gurumukhi, Telugu, Gujarati, Bengali, Oriya, Tamil, Malayalam, Kannada, Sinhala and a very high number of scripts of central and Southeast Asia [2].

Hindi is written in Devanagari script is one of the official languages of India. Around forty-five percentage of Indian population use Hindi language for communication. Hindi is the most prioritized language which is used officially for documentation in the northern and central region of India. The Dravidian languages consist of Telugu, Tamil, Malayalam, and Kannada languages makes it second largest language family [3]. Telugu is the official language of Andhra Pradesh and Telangana. Punjabi written in Gurumukhi script is 10th most spoken language of world [4].

Devanagari, Telugu and Gurumukhi scripts originated from Brahmi script are written from left to right, having strong preferences for symmetrical rounded shapes within squared outlines [5]. Devanagari and Gurumukhi script is recognized by a horizontal line that runs along the top of the letter and a puranviram ("|") is placed at the end of the sentences. Devanagari, Telugu and Gurumukhi scripts belongs to abugida writing system, where the consonant and vowels form a compound word. Devanagari script is composed of eleven vowels and thirty-three consonants, where as Telugu script consists of eighteen vowels, and thirty-five consonants, which combines to form syllables, on the other hand Gurumukhi script have thirty-five consonants, additional six consonants, nine vowels diacritics, two diacritics with nasal sound and one diacritic that germinates consonants, and three subscript characters.



पुस्तक - उत्सव और  
 नाम - यशोदा

दिनांक - 20 मार्च

यशोदा ने मेरा नामा बाप....

यशोदा जल्दी बंधा उठीं कि पिता के मन दिव्य बंधी पुत्रासी  
 लीं मी। सिद्धे नामस उरुं उं, यश रीणां भौंरुं उं मन  
 दिव्य सिद्धे 'धर्म' धीना' ही नाम मी। दिव्य सिद्धे मनें  
 गंधी - गंधांती री बंधी भौंरुं उं ही रींरी उं -  
 'धर्म बंधी ना कि उरुं ना उं, नेकी भाषी उं उं भौंरुं  
 ही भाषणा, भाषणा मुंथ उं' उंसी उंसी मधिकां  
 रा मी नाम मन यश सिद्धा। सिद्धे उंने बंधे री नाम  
 उंरी उं उं उं उं मन दिव्य दिव्य ही मंथ बंधा उं उं उंरी  
 उं उं सिद्धे उंने उंने उंने उंने उंने उंने उंने उंने उंने  
 दिव्य ना भाषी। दिव्य उंने उंने उंने उंने उंने उंने उंने  
 री गंधी उं उंने मी, यश उंने उं मन उंने सिद्धे उंने  
 दिव्य नाम री रींरा भौंरुं उं भाषा मी कि दिव्य उंने  
 उं उंने मी उंने। सिद्धे उंने उंने उंने उंने उंने उंने  
 नाम पिता कि ही उंने मधिकां यशोदा। यशोदा सिद्धे  
 दिव्य उंने उंने दिव्य दिव्य सिद्धे। उंने उंने  
 उंने मन दिव्य उंने यशोदा सिद्धे उंने। उंने उंने  
 उंने बाप उंने उंने उंने री रींरा मधिकां मी।  
 यशोदा बंधी सिद्धे यशोदा नाम गंधांती उंने उंने उंने  
 मी। सिद्धे उंने उंने यशोदा यशोदा सिद्धे उंने  
 नामस उंने उंने उंने मन सिद्धे उंने।

पुस्तक - स्वर्ण कौं  
 भाषा - हिंदी

उमर - 20 वर्ष

बूँद-बूँद की कीमत

जल ही जीवन है, लेकिन जीवन देने वाले इस जल को  
 क्या हम सहेज रहे हैं? शायद नहीं! हमने पानी इतना  
 खर्चा कर दिया है कि अब पूरी दुनिया में जल संकट  
 का खतरा मंडराता दिख रहा है। भ्रान्त मत नही जाओ,  
 तो वह दिन दूब नही जब लोग पानी-पानी के  
 लिए तरसेंगें।

हम जब भी पर्यावरण और प्रकृति के संरक्षण  
 की बात करते हैं, तो जल संरक्षण सबसे ऊपर  
 आता है। अगर जल को सहेजना और संरक्षित  
 करना है, तो उसके स्रोत को संरक्षित यानी  
 समझना जरूरी है। इसी स्रोत को समझने के लिए  
 देश के जाने-माने पर्यावरणविद् राकेश खत्री पर  
 'जल चित्र' नाम से फिल्म का मुख्य उद्देश्य भी  
 यही है कि लोग पानी के बारे में जानें, उसे  
 सहेजें। हम सब नै प्रकृति और पर्यावरण को  
 समझने और सहेजने के मामले में सिर्फ लापरवाही  
 ही बरती है। लेकिन अब संभ्रमता है। प्रकृति  
 को बचाना है। इसके साथ-साथ पानी का  
 संरक्षण बेहद जरूरी है।

c. Gurumukhi script

d. Devanagari Script

Figure 2: c. Gurumukhi script sample; d. Devanagari script sample, collected by same individual

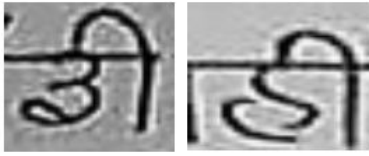
The handwriting characteristics studied include alignment, connections, initial and terminal strokes, pen pressure, punctuations, margins, size of letters, slant, and speed of writing, as shown in Table 1.

S. No.	Characteristics Observed	Sub Classification of Characteristics			
		Uphill	Downhill	Vertical	-
1.	Alignment	Uphill	Downhill	Vertical	-
2.	Connections between letters	Present	Absent	-	-
3.	Initial and terminal strokes	Blunt	Tampered	-	-
4.	Pen Pressure	High	Low	Graduated	-
5.	Punctuations	Present	Absent	-	-
6.	Margins	Top	Bottom	Left	Right
7.	Size of letters	1-3mm	4-6mm	7-9mm	-
8.	Slant of letters	Upward	Downward	Vertical	Mixed
9.	Speed of writing	Fast	Slow	Moderate	-

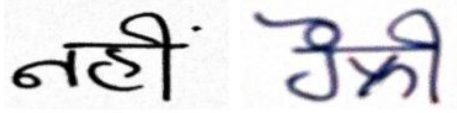
Table 1: Handwriting Characteristics studied are as above

## Results

Numerous individual characteristics were found while comparing the scripts, showing the similar movement of forming a consonant and vowel, example of which is shown as following:



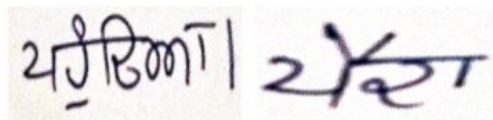
The formation of “ੀ” in “ही” in Devanagari script and “ੜੀ” in Gurumukhi script is similar.



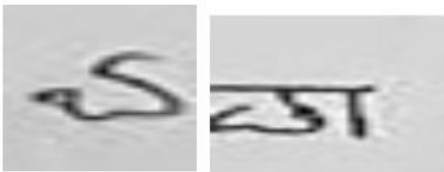
The formation of “ੀ” in the words of Devanagari and Gurumukhi script are similar.



The formation of “ੀ” in the words of Devanagari and Gurumukhi script are similar.



The formation of “य” in the words of Devanagari and Gurumukhi script are similar.



The formation of “ఱ” in Devanagari script and “ఱ” in Telugu script is similar.

The results for the observed characteristics were tabulated for Devanagari script and Gurmukhi Script, followed by Devanagari and Telugu script.

S. No	Characteristics	Devanagari Script	Gurmukhi Script	
1.	Alignment	Uphill	46.66%	44.64%
		Downhill	6.66%	10.36%
		Vertical	46.66%	45%
2.	Connections between letters	Present	6.66%	-
		Absent	93.33%	100%
3.	Initial and Terminal Strokes	Blunt	80%	86.66%
		Tapered	20%	13.33%
4.	Pen Pressure	High	13.33%	13.33%
		Medium	-	-
		Low	6.66%	6.66%
		Graduated	80%	80%
5.	Punctuation	Present	93.33%	93.33%
		Absent	6.66%	6.66%
6.	Margins	Top	6.66%	6.66%
		Bottom	33.33%	33.33%
		Left	33.33%	33.33%
		Right	20%	20%

7.	Size of Letters	1-3mm	46.66%	46.66%
		4-6mm	53.33%	53.33%
		7-9mm	-	-
8.	Slant of letters	Forward	33.33%	33.33%
		Backward	30.33%	30.33%
		Vertical	33.33%	33.33%
9.	Speed of writing	Fast	26.66%	26.66%
		Slow	13.33%	13.33%
		Moderate	60%	60%

**Table 2:** Results for Devanagari and Gurmukhi Script characteristics writing analysis

S. No	Characteristics	Devanagari Script	Gurmukhi Script	
1.	Alignment	Uphill	26.66%	20%
		Downhill	33.33%	27%
		Vertical	40%	45%
2.	Connections between letters	Present	-	-
		Absent	100%	100%
3.	Initial and Terminal Strokes	Blunt	90%	90%
		Tapered	10%	10%
4.	Pen Pressure	High	13.33%	13.33%
		Medium	-	-
		Low	6.66%	6.66%
		Graduated	80%	80%
5.	Punctuation	Present	93.33%	93.33%
		Absent	6.66%	6.66%
6.	Margins	Top	-	-
		Bottom	33.33%	33.33%
		Left	40%	40%
		Right	26.66%	26.66%
7.	Size of Letters	1-3mm	46.66%	46.66%
		4-6mm	53.33%	53.33%
		7-9mm	-	-
8.	Slant of letters	Forward	26.66%	26.66%
		Backward	26.66%	26.66%
		Vertical	46.66%	46.66%
9.	Speed of writing	Fast	33.33%	33.33%
		Slow	40%	40%
			26.66%	26.66%

**Table 3:** Results for Devanagari and Telugu Script characteristics writing analysis

The alignment in Devanagari script is (46.66%) uphill, (6.66%) downhill and (46.66%) vertical. In Gurmukhi script, it is (44.64%) uphill, (10.36%) downhill and (45%) vertical. The Connections in Devanagari script are present in (6.66%), while absent in (93.33%), whereas in Gurumukhi Script connections were not found. The initial and terminal strokes in Devanagari script were blunt in (80%) and are tapered in (20%), where as in Gurumukhi script, blunt in (86.66%) and are tapered in (13.33%). Pen pressure in Devanagari script and Gurumukhi script is high (13.33%), low (6.66%) and graduated in (80%). Punctuations in Devanagari and Gurumukhi script were present in (93.33%), while absent in (6.66%). Margins in Devanagari script and Gurumukhi script were (6.66%) at the top, (33.33%) at the bottom, (33.33%) at left and (20%) at right. Size of letters in Devanagari and Gurumukhi script is (46.66%) for 1-3mm, (53.33%) for 4-6mm. The slant of letters in Devanagari and Gurumukhi script were forward (33.33%), backward (30.33%) and vertical for (33.33%). The speed of writing in Devanagari and Gurumukhi script is fast (26.66%), slow (13.33%) and moderate (60%).

While comparing Devanagari and Telugu script, the alignment in Devanagari script is (26.66%) uphill, (33.33%) downhill and (40%) vertical, whereas Telugu script, it is (20%) uphill, (27%) downhill and (45%) vertical. The Connections in Devanagari and Telugu script were not present. The initial and terminal strokes in Devanagari and Telugu script were blunt in (90%) and were

tapered in (10%). Pen pressure in Devanagari script and Telugu script is high (13.33%), low (6.66%) and graduated in (80%). Punctuations in Devanagari and Telugu script were present in (93.33%), while absent in (6.66%). Margins in Devanagari and Telugu script were (6.66%) at the top, (33.33%) at the bottom, (40%) at left and (26.66%) at right. Size of letters in Devanagari and Telugu script is (46.66%) for 1-3mm, (53.33%) for 4-6mm. The slant of letters in Devanagari and Telugu script is forward (26.66%), backward (26.66%) and vertical for (46.66%). The speed of writing in Devanagari and Telugu script is fast (33.33%), slow (40%) and moderate (26.66%).

## Discussion

The Devanagari, Telugu and Gurumukhi scripts were originated from the Brahmi script, written from left to right direction. The similarities and the differences at the same time generate an essential purpose to compare the handwriting samples of these scripts. Devanagari and Telugu being two of the official languages of India, and Gurumukhi being the official language of Punjab is eminent to be compared forensically. During forensic examination it is necessary to prove the authenticity/geniuses of document. Thus, this study up to an extend helps the examiner to compare two different scripts originated from same background so that the class and individual characteristics can be examined.

## Conclusion

The aim of the study is to find the class and individual characteristics among the scripts originated from the same origin and forensically forming a base for the examination of scripts even if unknown to the forensic document examiner.

Based on numerous characteristics that have been carefully studied it could be concluded that in Devanagari and Gurumukhi script the characteristics including pen pressure, punctuation, margins, size of letters, slant and speed of writing were similar in the samples examined. While the characteristics including alignment, connections, and initial and terminal strokes show slight differences. Simultaneously, in Devanagari and Telugu script the characteristics including connections, pen pressure, punctuation, margins, and the size of letters, slant, and speed of writing. While the characteristics alignment shows slight divergence.

Individual characteristics that are present in Devanagari script of the writer were found in a great extent in the Gurumukhi script and to some extent in Telugu script. So it could be concluded that these characteristics of handwriting do not show much divergence in two different scripts originated from a similar background, and a lot of them are present in both the scripts. During a forensic examination, the expert undergoing examination for two distinct scripts that are unknown to him, can generate an idea about the genuineness of handwriting and prove the authenticity of the writer.

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