

■ ORIGINAL ARTICLE

# Handwriting Accents to Reveal Cultural Identity of Author: An Indian Approach

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## ABSTRACT

Handwriting is a neuro-muscular phenomenon, which is affected by the author's gender, age, ethnicity, the system of handwriting learned, content, purpose, writing protocol, whether written from memory, dictated, or copied out, writing instruments, changes in the handwriting of an individual over time, etc. It has been established by studies that handwriting is an acquired skill. Handwriting is also related to the cognitive aspects of the brain with the muscular movements. Therefore, it can be hypothesized that a certain degree of commonness exists in the handwriting features of the people of the same population group. Few researches had been conducted in this aspect to identify the ethnic origin of author through distinctive characteristics of their handwriting, which reflects their ethnic origin. Out of these works, a couple of studies took quantitative approach to statistically examine the characteristics of handwriting. This research will help in identifying the authors of anonymous writings. Also the work will help the anthropological researchers in identifying the ethnic origin of writer based on their ethno-linguistic handwriting features. We approach this problem using multilingual writers. We have focused on a very distinctive ethno-linguistic groups such as Telugu, Malayalam, Bengali and Hindi writers, to double check the results. Further comparison is done with the findings of the data obtained from control population. Each set of group contains 50 samples.

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## INTRODUCTION

India is home to a wide variety of ethno-linguistic groups, which can be witnessed in their different religious practices, cultural traditions and various languages spoken in the country (Pal, U., Jayadevan, R., and Sharma, N. 2012). Being an acquired skill perfected by an individual with practice over a long period of time, handwriting is categorized as the most complex perceptual-motor skill. It is a neuro-muscular phenomenon in which the image formed by brain is replicated on a writing surface via a writing instrument with the help of muscles of limb (Sharma, 2017). The chirography of an individual's writing is a highly individualistic

characteristic which represents the form of writing. It includes the penmanship, use of abbreviations, different shape and size of letters. The chirography is affected by many factors which includes ethnicity, mother tongue, purpose of writing, writing surface, writing instrument, gender, age, changes in writing with time, and most importantly whether the writing is written from memory, dictation or copying (Osborn, 1929).

Any individual's handwriting development begins with mere scribbling on the surface and later these scribbles take the form of letters and figures of a particular language script. It has been observed that the handwriting practice



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which a child acquires generally is copied from the adults around him or her during their early cognitive development. It has been studied and widely accepted that for a 2-year-old child, it is acceptable that he/she start using straight strokes to imitate the orderly shapes given to him/her to copy. The usage of horizontal strokes is observed at the age of 2 years and 6 months and further 6 months later, that is, at the age of three years the children get familiar with the usage of round formations too. This habit of imitating shapes to get accustomed to the writing of script is being widely used across the world to ensure the learning of a particular script. It has been observed that at the age of 5 years 6 months the children are fully familiar with different types of strokes whether they are straight, horizontal, round, vertical, square or triangle, this implies that the child is ready for learning the formation of letter and figures.

The importance of which language is learnt as a first writing language cannot be more emphasized when viewed under the lens of study conducted by Feder in 1991. Feder studied the handwriting habits of children aging from age of 6 years up-to middle school. In this study it was concluded that children with age 6 years to 7 years the handwriting quality and penmanship grows quickly which reaches a stability by the age of 7 years to 8 years. The habit of chirography is seemed to be developed at the age of 8 years to 9 years. Another phase of development is seen in terms of involuntary action, organizations usage of vocabulary to characteristically arrange thoughts into words is observed at the stage of middle school.

Revealing the ethnicity of an individual by means of handwriting identification is termed as handwriting accents. (<https://www.translatemedia.com/translation-blog/handwriting-accents-penmanship-can-betray-language-identity/>). Handwriting recognition has been in practice since late 1800s. First case of handwriting recognition was reported in France in 1894 under the name "*Bordereau Story*" (<http://www.lprinfo.com/history-handwriting-analysis.htm>). The relevance of determining handwriting accents is not a new concept, it was first used in criminal investigation in 1932 in the case of

kidnapping of Charles Augustus Lindbergh, Jr., in the state of New Jersey, USA (<https://www.fbi.gov/history/famous-cases/lindbergh-kidnapping>). Earlier the accent determination was based on the science of linguistic, now-a-days the researchers are basing this determination using the handwriting characteristics.

**Related Works:** The basis of handwriting recognition relies on the fact that every individual has his/her own personalized handwriting. The handwriting is an acquired skill, as an individual we start learning handwriting at primary school level where we learn writing by copying the pen-printed style of letter formation (Osborn, 1929). As the time progresses our handwriting becomes personalized with changes coming at regular intervals due to factors such as enhanced skill, more practice, increased speed of writing, increasing age, illness etc. (Hilton, 1963). These changes which occur in handwriting happens in the general handwriting characteristics whereas the basic letter formation i.e., the individual writing characteristics remains unchanged. This fact is the basis for the identification of the handwriting of an individual (Hilton, 1963).

As spoken language the handwriting of an individual is also affected by the fact of his/her own mother-tongue. As in spoken language the mother-tongue affects the accent of the any other language learnt to be spoken afterwards same accent can be detected in the secondary language learnt to write after the mother-tongue. This accent is referred to as the handwriting accent of an individual. (<https://www.translatemedia.com/translation-blog/handwriting-accents-penmanship-can-betray-language-identity/>). Many researchers have argued that determining the ethnicity or ethnic origin from the handwriting of an individual is difficult. But on the other hand, there are immense proof available in the literature where the ethnicity or the ethnic origin of an author can be determined from the way of writing the secondary language learnt (Kapoor & Saini, 2017; Hadhrami, 2017; Farooq, Lorigo & Govindaraju, 2006; Cheng 2005).

Determining the handwriting accent is extremely beneficial in the field of forensic science. With the results obtained one can establish the identity of the anonymous authors, threat, ransom

letters, which ultimately help the investigating agencies to narrow down the list of the suspects. Also, for this purpose the science of linguistic also plays a major role. The fact that the learning of a secondary language is greatly affected by the mother tongue is well established in the linguistic science (Shabani, *et al.* 2016; Denizer, 2017; Yigzaw, 2013; Mehrabi, 2014). The results of the studies indicate that when a secondary language is spoken its accent, grammar and pronunciation is greatly influenced by the mother tongue of the individual. When the same secondary language is written, the same influence is observed there also. This fact can be established by using the technique of text-mining of computing science (Ramaiah, *et al.*, 2012). It has been observed that the characteristics influenced by the movement of the limbs are affected by the writing movements of mother tongue. Also, the basic letter formation, the movement of strokes is found to be influenced by the mother tongue. By determining such similarities one can establish the handwriting accent of the questioned author.

**Objectives:**

The objectives of the research work are summarized below.

1. To identify the individuals with bi-lingual writing characteristics in the target population.
2. Establish the similar letter formations in both first and second languages.
3. Identify the handwriting accent on the basis of regional ethnicity.

**METHOD**

For a study of handwriting pertaining to different individuals, the sample handwritings from various persons should be available. To collect such samples of handwritings the following protocol will be used:

The standard format to obtain Handwriting exemplar is known as ‘London letter’. This letter comprises all the alphabets in lower case as well as the upper case of English script, and offers a good number of characters for thorough examination. The bi-lingual writers who can write in their mother tongue as well as in the English language easily will be asked to provide their handwriting samples in English language. The sample for each

first language is 100 in the age group of 21 to 30 years. The analysis of the writing samples will be carried out by examining the handwriting habits (similarities and dissimilarities) along with the natural variations. For a thorough and scientific examination, lenses of various magnifications (2X approx.) were used along with stereomicroscope.

Examination is done to see whether the samples exhibit the characteristics of a freely and naturally prepared writing. Some of the characteristics of naturally prepared writing include consistent slant and size, thickening and thinning of the lines as the writing instrument changes direction, and tapered beginning and ending strokes that occur once the writing instrument comes into contact with or leaves the paper. Additionally, each body of writing is examined to assess internal consistency, comparability, and variation and to determine the presence or absence of individualizing characteristics. Statistical operations are to be utilized to test the validity of the hypothesis.

| Sl. No. | General Characterists | Sl. No. | General Characterists |
|---------|-----------------------|---------|-----------------------|
| 1       | Alignment             | 7       | Proportion of Letters |
| 2       | Skill                 | 8       | Movement              |
| 3       | Slant                 | 9       | Rhythm                |
| 4       | Speed                 | 10      | Pen Pressures         |
| 5       | Spacing               | 11      | Line Quality          |
| 6       | Relative Size         |         |                       |

Table 1 General Characteristics identified

| General Characteristics | Sub-Category | Numerical Nomenclature |
|-------------------------|--------------|------------------------|
| Alignment               | Horizontal   | 1                      |
|                         | Ascending    | 2                      |
|                         | Descending   | 3                      |
| Skill                   | Inferior     | 1                      |
|                         | Medium       | 2                      |
|                         | Superior     | 3                      |
| Speed                   | Slow         | 1                      |
|                         | Medium       | 2                      |
|                         | Fast         | 3                      |

Table 2 Sub-Categories and their Numerical Nomenclature

| General Characteristics | Sub-Category                      | Numerical Nomenclature |
|-------------------------|-----------------------------------|------------------------|
| Slant                   | Vertical                          | 1                      |
|                         | Forward                           | 2                      |
|                         | Backward                          | 3                      |
| Relative Size           | Small                             | 1                      |
|                         | Medium                            | 2                      |
|                         | Large                             | 3                      |
| Line Quality            | Smooth                            | 1                      |
|                         | Consistent                        | 2                      |
|                         | Normal                            | 3                      |
| Proportion of Letters   | Same                              | 1                      |
|                         | Different                         | 2                      |
| Movement                | Finger<br>Combined with<br>Wrist  | 1                      |
|                         | Wrist<br>Combined with<br>Forearm | 2                      |
|                         | Finger<br>Movement                | 3                      |
|                         | Wrist<br>Movement                 | 4                      |
|                         | Forearm<br>Movement               | 5                      |
| Spacing                 | Narrow                            | 1                      |
|                         | Medium                            | 2                      |
|                         | Wide                              | 3                      |
| Pen Pressure            | Light                             | 1                      |
|                         | Medium                            | 2                      |
|                         | Dark                              | 3                      |
| Line Quality            | Jerky                             | 1                      |
|                         | Interrupted                       | 2                      |
|                         | Smooth                            | 3                      |

Table 2 General Characteristics: Sub-Categories and their Numerical Nomenclature (continued...)

| Type of Alphabet       | Name of Alphabet |
|------------------------|------------------|
| Letters above the Line | B, L             |
| Letters below the Line | G, Y             |
| Letters on the line    | a, R             |

Table 3 Individual Characteristics: Letter formation

| Data Set | 1st Language | 2nd Language | Labeling     |
|----------|--------------|--------------|--------------|
| Set-I    | Telegu       | English      | S1 to S50    |
| Set-II   | Malayalam    | English      | S51 to S100  |
| Set-III  | Bengali      | English      | S101 to S150 |
| Set-IV   | Hindi        | English      | C1 to C50    |

Table 4 Segregation of data based on first language

**RESULT & DISCUSSION**

For the purpose of analysis of the data the writers with Telugu as first language are treated as test samples, Set-I labeled as S1 to S50, Malayalam as first language are treated as test samples, Set-II labeled as S51 to S100, Bengali as first language are treated as test samples, Set-III labeled as S101 to S150 and the writers with Hindi as first language are treated as control samples, Set-IV labeled as C1 to C50 (refer Table 4). From the data analyzed for general and individual characteristics, it is found that the writers of set I exhibit similar general handwriting characteristics specially in terms of alignment, relative size and proportion of letters which is in accordance with that of their first language. The same results were observed for the writers of set II, III, IV.

For individual characteristics the following common observations were made for Set I:

- Spur commencement of ‘g’ with retrace at apex and rotundity of oval, formation of elongated loop with compression at base.
- Rotundity of oval of ‘R’, formation of retrace at buckle part as well as tapered curve finish and straight nature of staff of character.
- Inward hooked commencement of ‘a’, rotundity of oval, formation of a twist/ a retrace at staff and peculiar curve finish.
- Slanted nature of staff of ‘B’, rotundity of lobes, formation of leg at buckle part, direction of extent of character.
- Shape of body curves parts of ‘s’, formation of cusp at apex and an impulse at base of these character as a variation.
- In ‘i’ dot, formation of circle and its relative location and size.

For individual characteristics the following common observations were made for Set II:

- tick commencement of ‘g’ with retrace at top and round circular formation, formation of elliptical loop with compression at base.
- Sphericalness of oval of ‘R’, formation of buckle at the mid body, with tick curve finish and round nature of staff of character.
- Outward hooked commencement of ‘a’, roundness of oval, formation of a twist/buckle at staff and distinct curve finish.
- Round/curved start of staff of ‘B’,

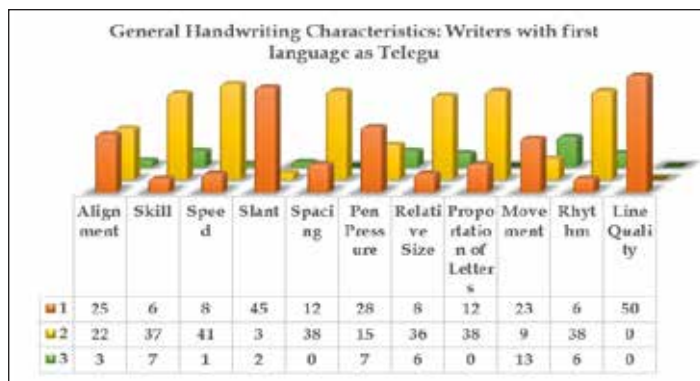


Figure 1 General Characteristics: Sub-Categories and their

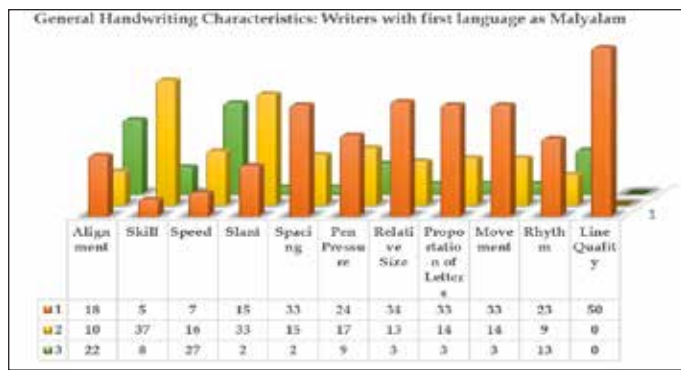


Figure 2 General Characteristics: Sub-Categories and their

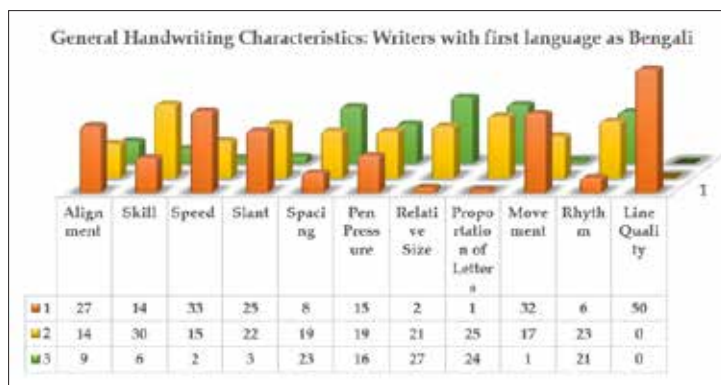


Figure 3 General Characteristics: Sub-Categories and their

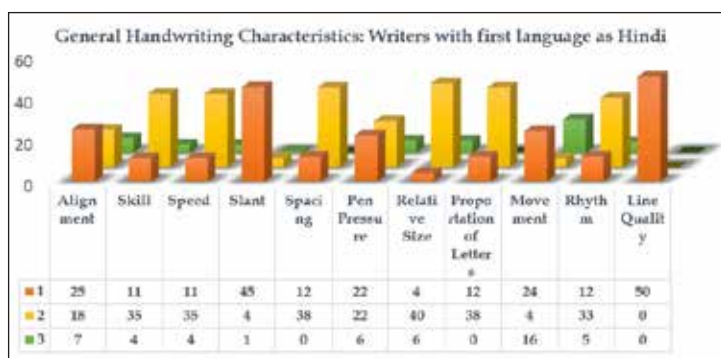


Figure 4 General Characteristics: Sub-Categories and their

sphericalness of lobes, formation of buckle at mid body, short and round appearance of character.

- Shape of body curves at start and end with small loops of 's', formation of point at apex and an impulse at base of these character as a variation.
- In 'i' dot, formation of circle and its relative location and size.

All these characteristics are found to be in accordance with the letter formation style of their mother tongue.

**CONCLUSION**

The examination of the writings of different individuals was undertaken. Their writing habits have been studied the both general and individual. The aspect of natural variation, with regard to its nature and extent, was also studied from these writings. Like-with-like comparison of the writings of each individual show that they show consistency. It was also observed that each individual has a unique set of writing habits. It is thus concluded that two individuals show similar set of writing habits.

Since the sets of handwritings show very surprising similarities of individual characteristics in letters of common words, which are greatly influenced by the script of the author's mother tongue, which explains why these characteristics are not found in concordance with the established principles of handwriting science.

With respect to the results obtained it can be concluded that the handwriting of an individual is greatly influenced by the mother tongue of the author, which in turn can determine the accent of handwriting. The results obtained here are in concordance with the hypothesis of the experimental work, which was spoken language affects the letter formation of the second written language learnt subsequently. **IJFMP**

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