



ANALYSIS OF HANDWRITING CHARACTERISTICS BASED ON DIVERSE ETHNIC DISTRIBUTION

¹Prajakta Harne, ²Dr. Munish Kumar Mishra, ³Dr. Gurvinder Singh Sodhi

¹ Prajakta Harne

Ph.D. Scholar, Department of Forensic Science

Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad, Uttar Pradesh

Prajakta.harne@email.com

² Dr. Munish Kumar Mishra

Assistant Professor, Department of Forensic Science

Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad, Uttar Pradesh

munish.mishra@shiats.edu.in

³Dr. Gurvinder Singh Sodhi

Assistant Professor, Forensic Science Unit, SGTB Khalsa College,

University of Delhi, New Delhi

sodhigs1@rediffmail.com

Abstract: Handwriting is an acquired art like painting, dancing or cycling. The early stages that accompany the learning and practicing of writing are characterized by a conscious effort on the part of a learner to replicate standard letter formation. He takes a mental impression of the muscles of his hand of writing. Due to repeated use of letters, the actual formation of each letters and words becomes almost involuntary. The handwriting is a coordination process where, brain is the main element which is regulates to execute the subject matter in the form of handwriting. The muscles also play a very important role in execution of handwriting. The objective of this study is to identify the origin of the writer on the basis of handwriting characteristics. This prospective study was carried out among 150 peoples belonging to 15 different countries. Result showed that there are set patterns of class characteristics of handwriting which writer acquires from the country he or she belongs such as design of certain letters and position of writing instrument while executing the handwriting which in turn helps to determine to which country writer belongs.

Keywords: Handwriting examination, Copybook Model, Letter formation, Forensic Science

I. Introduction

Since the inception of forensic science and its application in criminal investigation one indispensable branch came up with its remarkable objective of interpreting the authorship of handwriting as well as the authenticity of documents. Precisely, the solicitation of scientific principles and techniques for the resolution of problems related to disputed documents are covered under the branch of questioned document examination [1]. It may be perceived by a layman about the hesitancy regarding the importance of handwriting and its prominence but handwriting is a projective technique like mannerisms which may encapsulate human behaviour in the expanses of social

abilities, intellectual etiquettes, operational behaviours and potential conducts of dealing with sentiments. Handwriting characteristics and formations of letters are generally influenced by the writing system which the writer has acquired in the due course of learning process. Handwriting is not an innate feature, however individual's ability or privation of coordination may be a part of such feature. Accordingly, the consequential writing comprehends abundant components of involuntary pattern, characteristic pattern, and movement of muscles which are the part of particular individual as personal habit as the brain is key element which controls the muscles to execute handwriting [2]. According to Kelly, similarities in handwriting features

produced by relatives do at times exist when a writer reproduces the characteristics of a different kith and kin or even a known acquaintance [3]. Handwriting is not a response process directed by outlying environment factors. Because the neural and neuromuscular transmission intervals, handwriting would be excessively deliberate if it is based upon uninterrupted response [4].

Generally, it has been observed that a writer has a tendency of experimenting and developing own handwriting characteristics and as the writer continues to write abundantly, in this process the writer would acquire resemblance with either copybook model or some perceived model. Handwriting could be a conscious act though, due to repeated use, the actual formation of each letter and word becomes almost involuntary, so that the writer deliberates most of the sentient thought on the subject matter rather than on the writing process itself. Somewhat, the brain acts as a scheduling sequence of instinctive strokes ahead in time in a feed-forward manner [5, 6]. Consequently, handwriting becomes subconscious habitual patterns which are as much a part of the individual as any of other inherent personal habits or mannerisms [7]. Handwriting is influenced by a perceptual representation of copybook form, adapted by individual perception and the writer's aptitude to reproduce it. It has a physiological as well as a psychological association in the brain that is to say that it is a conscious act but then again because of its repetitive practice the perceptible formation of each letters and words become almost instinctive. This individuality of handwriting makes it a form of physical evidence and for the identification of handwriting there are some basic principles [8]. The handwriting that is characteristic of an individual is the product of a number of influencing factors, each of which contributes to the final form, styles and characteristics of the writer. In many countries signatures, broadly handwriting, are symbolic in nature and are not composed of individual letterforms, but rather symbolic forms or ideograms. The emphasis is upon the idea that when a writer is made acquainted with certain model of letters which are consistent through his/her process of learning; the writer would execute the learned letters in a specific manner. It must be appreciated that every learning process of letter formation is different or slightly different from the copybook model as a result of which writer not only acquires the new manner of letter formation but also retain and transfer to the other writers. One of the said reasons is diverse demographic distribution of writers, i.e., the region or country to which they belong. Indeed, every country has its own mechanism of education which facilitates the transferring of acquired features of handwriting as tuition.

II. Methodology

The present study was carried out by procuring handwriting samples from one hundred fifty (150) healthy individuals, of age group between 25- 35 years, from fifteen (15) different countries irrespective of their gender. The authors (individuals) were provided with a common sample text and were asked to scribe the same in their own writing style. For maintaining uniformity of the study, only English script was taken as a reference language. Abundant time was allowed to the authors to get relaxed and scribe the sample text in order to obtain their original handwriting characteristics. It must be noted that all the handwriting samples were taken in Delhi (India) in the month of March and April to provide an ideal atmosphere to avoid external influence on handwriting.

III. Observation Table

Letter	Collected Samples					
	1. Chile					
R						
S						
V						
Q						
Z						
2. Tibet						
Y						
R						
B						
3. Italy						
W						
X						

Z	z	z	z	z	z
A	a	a	a	a	a
Q	q	q	q	q	q

4. China

Z	z	z	z	z	z
Q	q	q	q	q	q
F	f	f	f	f	f
F	f	f	f	f	f
T	t	t	t	t	t
i (dot)	i	i	i	i	i

5. United Kingdom & England

R	r	r	r	r	r
k	k	k	k	k	k
f	f	f	f	f	f

6. Germany

r	r	r	r	r	r
z	z	z	z	z	z

f	f	f	f	f	f
s	s	s	s	s	s
k	k	k	k	k	k

7. Australia

q	q	q	q	q	q
s	s	s	s	s	s
s	s	s	s	s	s
z	z	z	z	z	z
f	f	f	f	f	f
f	f	f	f	f	f
f	f	f	f	f	f
f	f	f	f	f	f
f	f	f	f	f	f
r	r	r	r	r	r
g	g	g	g	g	g
j	j	j	j	j	j

8. Canada

q	q	q	q	q	q
s	s	s	s	s	s
f	f	f	f	f	f

g	ગ	ગ	ગ	ગ	ગ
z	ઝ	ઝ	ઝ	ઝ	ઝ
z	ઝ	ઝ	ઝ	ઝ	ઝ
9. India					
q	ા	ા	ા	ા	ા
f	ફ	ફ	ફ	ફ	ફ
z	ઝ	ઝ	ઝ	ઝ	ઝ
t	ટ	ટ	ટ	ટ	ટ
s	સ	સ	સ	સ	સ
r	ર	ર	ર	ર	ર
r	ર	ર	ર	ર	ર
10. Nepal					
r	ર	ર	ર	ર	ર
r	ર	ર	ર	ર	ર
q	ા	ા	ા	ા	ા
g	ગ	ગ	ગ	ગ	ગ
f	ફ	ફ	ફ	ફ	ફ

k	ક	ક	ક	ક	ક
11. Turkey					
G	ગ	ગ	ગ	ગ	ગ
k	ક	ક	ક	ક	ક
s	સ	સ	સ	સ	સ
g	ગ	ગ	ગ	ગ	ગ
r	ર	ર	ર	ર	ર
f	ફ	ફ	ફ	ફ	ફ
12. France					
G	ગ	ગ	ગ	ગ	ગ
K	ક	ક	ક	ક	ક
k	ક	ક	ક	ક	ક
z	ઝ	ઝ	ઝ	ઝ	ઝ
s	સ	સ	સ	સ	સ
s	સ	સ	સ	સ	સ
x	ચ	ચ	ચ	ચ	ચ
f	ફ	ફ	ફ	ફ	ફ

p					
g					
13. South Korea					
G					
q					
q					
r					
z					
f					
K					

14. United States of America

G					
r					
r					
q					
z					
z					
k					

f					
F					
g					
w					
15. Hong Kong					
f					
r					
y					
i					

IV. Result and Discussion

The use of writing style as a source of information, the standardization structure, by eliminating characteristics introduced by the writing style, provides the handwritten words a standard form, but then again, for the moment, it rescinds certain data. In various work, the probability of using the writing style as a source of information is helpful to the recognition process has been anticipated [9]. As per the data collected during research work, it has been observed individuals from various countries have developed their own pattern of design of given English alphabets consecutively making deviation from original copybook model and the same has been followed by other individuals belonging to specific country who might have acquired those features from their fellow countrymen. This fact helps in determination of origin of country from which given individual has learned the process of executing design of various letter. These variations of pattern of design of English alphabets from copybook model among individuals of specific country contribute to the fact that the individuals belonging to different countries have habit of holding the writing instrument in particular manner which again varies from country to country. In some countries individuals are in habit of holding writing instruments near to the pen nib and in

some countries much above the pen nib and so on. Notwithstanding, developments in technology, handwriting continues to take up a large proportion of time in the course of daily activities and, for this reason at least, handwriting is a significant concern [10]. The objective in handwriting recognition is to attain invariance and generalization. For writer identification, one endeavors for relatively contradictory with the intention to outstandingly render the specificity of individual handwriting style for writer discrimination. It is important, however, to mention the idea that writer identification could reduce certain ambiguities in the pattern recognition process if information on the writer's general writing habits and idiosyncrasies are available to the handwriting recognition system [11].

V. Conclusion

Handwriting is a complex task that requires attention and memory, as well as linguistic and motor skills [12, 13]. It is well established that handwriting is an acquired behavior, precisely which means that one learns to form a letter either from a copybook model or from an acquainted prototype. In either case, the learner would realize the pattern formation of the letter and attempt to rehearse the same. In such a course the learner, in one way or other, fashions a model which is a hybrid of the learned copybook model features as well as individual's inherent deliberations. By this study the authors observed that, writers of similar region execute a particular model with a degree of permissible deviation which in point of fact falls within the meaning of individual characteristics. By and large the letter formation was found to be of same appearance which indicates that the root of learning involves the itemized specimens which has been reminisced by the instant writers as reference model. During the study, it was also observed that there are certain influences of the native script upon the writers which affected their handwriting; nevertheless, the writings were displaying their prominent features. Generally, acquainted handwritings are acquired by the writers which the writer carries on for generations. Huber and Headrick (1999) described qualitatively various demographic features that influence handwriting in general. With the hand printed project sample established and in conjunction with the associated demographics, a quantitative assessment of character features as a function of age, gender, ethnicity, education level, location of cursive training, and handedness has been established [14]. Similarly, the idea of this study was to calculate the chances that how a group of writers from a particular geographical region executes handwriting with a qualified extent of similarity and therefore the outcome indicates that comparison may assist the handwriting experts to derive opinions regarding the demography and

ethnicity.

References

- [1] Robertson, E. W. (1991), "Fundamentals of Document Examination", Nelson-Hall.
- [2] Bradford, R. R. and Bradford, R. (1992), "Introduction to Handwriting Examination and Identification", Nelson-Hall
- [3] Kelly, J. S., Lindblom, B. S. "Scientific Examination of Questioned Documents, CRC Press; 2nd Ed. (2006)
- [4] Schomaker, L.: 1991, Simulation and recognition of handwriting movements: A vertical approach to modelling human motor behaviour, PhD thesis, University of Nijmegen, NICI, The Netherlands.
- [5] Plamondon, R. and Maarse, F.: 1989, An evaluation of motor models of handwriting, IEEE Trans. Syst., Man, and Cybern. 19(5), 1060–1072.
- [6] Plamondon, R. and Guerfali, W.: 1998, The generation of handwriting with delta-lognormal synergies, Biological Cybernetics 78, 119–132.
- [7] Said, H., Tan, T. and Baker, K. (2000), "Personal identification based on handwriting", Pattern Recognition 33 (1), 149–160.
- [8] Srihari, S., Cha, S., Arora, H. and Lee, S. (2002), "Individuality of handwriting", Journal of Forensic Sciences, 47 (4), 1–17.
- [9] Crettez, J.-P. (1995), "A set of handwriting families: style recognition", Proc. of the 3rd International Conference on Document Analysis and Recognition, Montreal, Canada, pp. 489–494.
- [10] Christensen, C. A. (2009). The critical role handwriting plays in the ability to produce high-quality written text. In R. Beard, D. Myhill, J. Riley, & M. Nystrand (Eds.), *The SAGE handbook of writing development*. London, UK: Sage
- [11] Maarse, F. J.: 1987, The study of handwriting movement: Peripheral models and signal processing techniques, PhD thesis, University of Nijmegen, Department of Experimental Psychology, The Netherlands
- [12] Bara, F., & Gentaz, E. (2010b). Haptics in teaching handwriting: the role of perceptual and visuo-motor skills. Human Movement Science, 30, 745 – 759
- [13] Graham, S., & Weintraub, N. (1996). A review of handwriting research: Progress and prospects from 1980 to 1994. Educational Psychology Review, 8, 7 – 87.
- [14] Huber, R. and Headrick, A. (1999). *Handwriting Identification: Facts and Fundamentals*. CRC Press, Boca Raton, FL.