

STUDY OF GENETIC AND ENVIRONMENTAL INFLUENCE ON HANDWRITING OF MONOZYGOTIC TWINS

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ABSTRACT

Handwriting is the unique manner of writing created by an individual using a writing instrument. The aim of this research is to study the genetic and environmental influence on handwriting of monozygotic twins. Samples of 10 pairs of monozygotic twins were taken, 7 pairs being males and 3 pairs being females. A total of 6 samples were collected from each pair. It can be observed from the study that the characteristics of monozygotic twins can be influenced on each other basic similarities can be seen in various characteristics like letter formation, alignment, style, curve etc and few individual characteristics like arc, hook, blub, loop formation can also be similar between twins.

KEYWORDS: Monozygotic Twins, Genetic, Environmental, Handwriting

Handwriting is a writing created by a person with a writing instrument. Handwriting includes both printing and cursive styles and is different from formal calligraphy or typeface. Because each person's handwriting is different and unique so it can be used to verify a writer.

It is perfectly certain that, in the matter of handwriting, family identicalness is as common as in gait, habit of speech, feature or any other eccentricity by which one family is distinguished from another. Peculiarities of family handwriting, like other hereditary symptoms and dispositions now and again pass over a generation, and then once more re-appear, bearing evidence, in not a few points of similarity, actually a lot of them, of their relation to the original copy. twins, especially the identical twins have a much greater similarity in their genetic constitution. The heightened similarity in handwriting of twins demonstrates that greater genetic similarity impacts handwriting similarity positively. One can observe many similar letter formations in pair of siblings and twins, which don't seem to be consciously acquired i.e. which do not show any sign of imitation and appear to be automatic. Therefore, these can be stated as the most likely subconsciously acquired characteristics that can be found due to genetic similarity. The term twin most especially refers to two individuals (or one of two individuals) who have shared the same uterus (womb) and are usually, but not necessarily born on the same day. Identical twins also known as monozygotic twins occur when a single egg is fertilized by a single sperm to form one zygote but the zygote then divides into two separate

embryos. They have identical DNA but differing environmental influences throughout their lives affect which genes are switched on or off. This is called epigenetic modification. The siblings and twins have a significant amount of shared same environment, as they tend to live together. The twins typically have greater similarity in their environment as they often go to the same school and get their first lesson on handwriting and education together. This result in their handwriting is also being more similar (Seeman, E. and Saudek, R. 1932). Besides imbibing the environment, the siblings and twins also tend to copy each other. These can be called consciously acquired characters as the person knowingly and deliberately makes them similar^[2]. The current study aims to understand the genetic and environmental influence of handwriting on monozygotic twins.

REVIEW OF LITERATURE

On the Discriminability of the Handwriting of Twins by Sargur Srihari et al (2008). This paper describes the methodology and results of such a study where handwriting samples of twins were compared by an automatic handwriting verification system. Results of the verification tests show that the handwriting of twins is less discriminable than that of non-twins: an overall error rate of 12.91% for twins and 3.7% for non-twins. One paper on handwriting of monozygotic and dizygotic twins by Tomasz Dziedzic et al (2007). The study found that in the samples of both types of twins, differences in handwriting features predominated over

similarities. The analysis was conducted on handwriting and signature samples submitted by 54 pairs of twins, including 31 pairs of MZ and 23 pairs of DZ twins. Some research was also done on Genetic and Environmental Influences on Writing and their Relations to Language and Reading by Richard K. Olson et al (2011). Identical and fraternal twins (N = 540, age 8 to 18 years) were tested on three different measures of writing, three different language skills (Phonological Awareness, Rapid Naming, and Vocabulary), and three different reading skills (Word Recognition, Spelling, and Reading Comprehension). Substantial genetic influence was found on two of the writing measures, Writing Samples and Handwriting Copy, and all of the language and reading measures. Shared environment influences were generally not significant, except for vocabulary. Non-shared environment estimates, including measurement error, were significant for all variables.

METHODS AND METHODOLOGY

Total 10 numbers of handwriting samples on blank A-4 size plain sheets were collected from 10 pairs of monozygotic twins which included seven pairs of male-male

twin pairs and three pairs of female-female (sororal twins) pairs.

Standard reference English paragraph was given to every person to copy three times (i.e. 1sheet containing 1 paragraph) with same ballpoint pen from both the twins.

Each pair of twins were given sample name accordingly i.e. twin-1, twin-2, twin-3, twin-3, twin-4, twin-5, twin-6, twin-7, twin-8, twin-9 and twin-10. Then sub sample name were given to handwriting sample of each person accordingly as follows; Twin pair 1 (1a1, 1a2, 1a3) and (1b1, 1b2, 1b3) to Twin pair 10 (10a1, 10a2, 10a3) and (10b1, 10b2, 10b3). Sample analysis was carried out by comparing the handwriting samples of twins. A hand magnifier was used to study minute details of each alphabet of handwriting sample. Scale was used to take measurements of spacing between words, spacing of left and right margins. Handwriting comparison done in following manner for all handwriting samples of 10 pairs of twins. The handwriting samples of each twin pair were examined and compared on the basis of class characteristics, as listed in table 1.

Table 1: Categorization of class characteristics

Sr. No.	Class characteristics	Categories			
		1.	Speed	Low	Medium
2.	Skill	Poor	Average	Good	-
3.	Slant	Forward	Vertical	Backward	Mixed
4.	Spacing	Narrow	Medium	Wide	-
		Average space between words in cm.	Average space of right margins in cm.	Average space of left margins in cm.	-
5.	Movement	Finger	Wrist	Finger-Wrist comb	Forearm
6.	Alignment	Ascending	Horizontal	Descending	Irregular
7.	Line quality	Uniform	Defective	-	-
8.	Rhythm	Uniform	Defective	-	-
9.	Legibility	Good	Poor	-	-

For the second level of examination, the minute characteristics, as listed in TABLE 2, between twin pairs were examined and compared.

Table 2: Categorization of minute characteristics

Sr. No.	Minute Characteristics	Categories			
		1.	Position i/j-dot	Leftward	Above
2.	Shape of i/j-dot	Dotted	Ticked	Circle	Caret
3.	Position of t-crossbar horizontally	Leftward	Centre	Rightward	-
4.	Position of t-crossbar vertically	Low	Centre	High	-

At the third level of examination, after examine and comparing class and minute characteristics following specific individual characteristics like Pen pressure

Punctuation Embellishments Connective strokes Arc Buckle Bulbs Hook Loop Staff Oval and eye of alphabets were taken in consideration and after that synopsis were formed.

Sample 1a

Twin - Ia,
Sample No - 1

Date - 15/11/2017

Handwriting refers to a person's unique style of writing characters created with a writing utensil, such as a pen or pencil. Handwriting is separate from calligraphy or typeface, because each person's handwriting is unique, it can be used to verify a document's writer. The deterioration of a person's handwriting is also a symptom or result of certain diseases. Each person's handwriting is unique. Even identical twins write differently. A person's handwriting is also relatively stable and changes little over time, so is handwriting hereditary.

Writer's Full Name - Pooja Kushi. Ashokhoni

Date of Birth - 17/06/1996 AS

Native Place - Bhavnagar

Sample 1b

Twin - Ib,
Sample No - 1

Date: 15/11/2017

Handwriting refers to a person's unique style of writing characters created with a writing utensil, such as a pen or pencil. Handwriting is separate from calligraphy or typeface. Because each person's handwriting is unique, it can be used to verify a document's writer. The deterioration of a person's handwriting is also a symptom or result of certain diseases. Each person's handwriting is unique. Even identical twins write differently. A person's handwriting is also relatively stable and changes little over time, so is handwriting hereditary.

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RESULTS AND DISCUSSION

The table below is the comparison between the samples of the monozygotic twins on the basis of handwriting characteristics.

Table 3: Comparison of class characteristics of twin pair 1

Twin pair 1			
	Characteristics	1a(male)	1b(male)
1	Speed	Medium	Medium
2	Skill	Medium	Medium
3	Slant	Irregular	Irregular
4	Spacing		
	Between words (average- cm)	0.55 cm	0.52 cm
	Right margin (clockwise) Average cm.	1.95 cm	2.1 cm
	Left margin (clockwise) Average cm.	2.21 cm	1.7 cm
5	Alignment		
	Overall paragraph	Horizontal	Descending
	Upper body	Horizontal	Descending
	Middle body	Horizontal	Descending
	Lower body	Horizontal	Descending
6	Rhythm	Uniform	Uniform
7	Line quality	Uniform	Uniform
8	Movement	Wrist & Finger combined	Wrist & Finger combined
9	Legibility	Good	Good

Table 4: Comparison of minute characteristics of twin pair 1

Twin pair 1		
Characteristics	1a	1b
Position of i/j dot	Rightward	Rightward
Shape of i/j dot	Ticked	Ticked
Position of 't' crossbar horizontally	Rightward	Rightward
Position of 't' crossbar vertically	Centre	Centre

From the table 3 and 4 it is observed that, Both writing sample 1a and 1b of twin pair 1 showed same pictorial effect. Position of 'I' dot in rightward direction and it was of ticked shape in both 1a and 1b writing sample marked as A1. Position of t-crossbar horizontally in rightward position in both 1a and 1b writing sample which is marked as A2. Position of t-crossbar vertically in centre in both writing sample 1a and 1b. Connecting stroke between

alphabets 'H' and 'a' is present within word 'Handwriting' present in both 1a and 1b writing sample marked as A3. Alphabet 't' and 'o' both are connected by t-crossbar in both 1a and 1b writing sample marked as A4. Alphabet 't' and 'e' connected by t-crossbar in both 1a and 1b writing sample which is marked as A5. In writing sample 1a Alphabet 'y' is formed by two pen strokes and lower arc which is similar to 1b writing sample marked as A6. Letter 'd' from both 1a and

1b shows backward slant which is marked as A7. Same type of date formation is observed from both 1a and 1b writing sample which is marked as A8. In both 1a and 1b writing sample punctuation mark is of ticked shape.

From the above table and discussion, it is observed that sample '1a' and '1b' though have individual characteristics of handwriting but on close examination, handwriting sample '1a' and '1b' possess some individual characteristics pictorial effect, i-dot t-crossbar, connecting strokes, arc formation, punctuation mark which lead to confirm that handwritings of monozygotic twins 1a and 1b can be linked to each another. Similarly the observations for the other twin pairs was formed and the results were analyzed for the same.

It is observed that sample '2a' and '2b' though have individual characteristics of handwriting but on close examination, handwriting sample '2a' and '2b' possess some individual characteristics t-crossbar, ending strokes, arc formation, spelling mistake, letter style which lead to confirm that handwritings of monozygotic twins 2a and 2b can be linked to each another. From the sample '3a' and '3b' though have individual characteristics of handwriting but on close examination, handwriting sample '3a' and '3b' possess some individual characteristics i-dot formation and placing, arc formation, alignment and slant of some particular letters, question mark (?) formation which lead to confirm that handwritings of monozygotic twins 3a and 3b can be linked to each another. it is observed that sample '4a' and '4b' though have individual characteristics of handwriting but on close examination, handwriting sample '4a' and '4b' possess some individual characteristics writing speed and skill, alignment, connecting strokes, eye formation, arc formation, embellishment in letter formation, hook formation which lead to confirm that handwritings of monozygotic twins 4a and 4b can be linked to each another. it is observed that sample '5a' and '5b' though have individual characteristics of handwriting but on close examination, handwriting sample '5a' and '5b' possess some individual characteristics writing skill, connecting strokes, eye formation, arc and bulb formation, formation of question mark (?), ending stroke which lead to confirm that handwritings of monozygotic twins 5a and 5b can be linked to each another. it is observed that sample '6a' and '6b'

though have individual characteristics of handwriting but on close examination, handwriting sample '6a' and '6b' possess some individual characteristics writing skill, connecting strokes, arc and bulb formation, formation of hook, ending stroke which lead to confirm that handwritings of monozygotic twins 6a and 6b can be linked to each another.

CONCLUSION

From the present study, it was observed that characteristics of handwriting of monozygotic twins can be influential to one another. Some basic similarities can be seen in letter formations, alignments, embellishments, style and curves of the alphabets in handwriting of monozygotic twins. In general it can also concluded that peculiar characteristics as seen in this present study, like arc, hook, bulb and loop formation, staff and terminal strokes shows more dependency of characteristics in monozygotic twins. Since, the sample size for the present study is limited henceforth, direct correlation between the handwriting of monozygotic twins can only be affirmed after rigorous sample study is been established.

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