

Analysis of Similarity in Hand Writing Features of Acquaintances for Forensic Consideration

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Abstract

Formation of letters, characters or symbols using writing implements according to a recognizable pattern which is designed to communicate with another person can be called as handwriting. A person learns to write by copying shapes from standard copybook. However, handwriting differs from one individual to another as it is an acquired skill due to individual's neuromuscular coordination and visual perception; therefore, it is habitual as well as individualized. The pictorial appearance of the writing can change from childhood till adolescence, but the individuality will not change as handwriting is a continuous learning process. This individualization is the basic principle in the document examination. However, at times it may be noticed that some people's handwriting has a similar style and characteristics in common, acquired when these people learn to write by copying letters and words, and tend to take on individual styles with age. But sometimes it may happen that these individual characteristics are also copied often knowingly or unknowingly. Various factors may play hand in this this such as gender and age. In this article we discuss about the comparison of the class characteristics and individual characteristics of friends/acquaintances that are aware of each other's handwriting and analyze whether their imitation is restricted to class characteristics making the pictorial appearance similar or does the individual characteristics are also copied and ingrained into their personal writing habits based on the gender of the person.

Keywords: Handwriting; Class characteristics; Individual characteristic; Gender.

Introduction

A questioned document, as the name suggests, are those documents whose authenticity is under dispute or is suspected of being fraudulent and its origin is to be known with the help of

examination and comparison. These documents could be involved in fraud, forgery, counterfeiting, blackmail etc. Thus, genuineness of a document is a very important aspect.

One of the oldest forms of communication that has developed and evolved over time is

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handwritten documents. A person learns to write at a very young age by copying shapes from standard copybook. The learned copybook, however, diminishes with time and an individual develops his/her own writing style. Handwriting is a complex phenomenon carried out by the synchronization of the brain and muscles hence; it is referred to as a neuro-muscular process. It is an acquired perceptual-motor task where the muscles of the arm, hand, and fingers are under neural control which precisely co-ordinates the timing and movement of muscles for the formation of the structure of the pattern [1]. It is therefore called 'brain writing.

Handwriting is a pivotal part of every person's life, which he/she starts learning through copybook model and eventually transform the same as per his/her habits, which are available in the form of variations. It can be said that the handwriting habit is not innate or hereditary, but it develops gradually and is constantly changing. Handwriting is a form of subjective science as it varies within the same writer or the written document [2].

Handwriting is a conscious act but due to its repeated use, the actual formation of each letter and words become almost automatic or in other words subconscious, such that an experienced writer will concentrate more on subject matter rather than the writing process. The resultant writing will comprise of numerous habits of the writer.

Handwriting differs from one individual to another as it is an acquired skill due to individual's neuromuscular coordination and visual perception; therefore, it is habitual as well as individualized [3]. This individualization is the basic principle in the document examination. The pictorial appearance of the writing can change from childhood till adolescence, but the individuality will not change as handwriting is a continuous learning process. All through the process of development of writing, personal habits contribute to their own characteristics, and writing becomes as individualistic as speech and mannerisms [4].

As it is usually observed, some people copy or try to mimic other person's speech or mannerism to modify his/her own individuality or personality. This is also seen in case of handwriting, where some people's handwriting may have similar styles and characteristics acquired when they learn together.

A friend, a person with whom one has a mutual affection or an acquaintance whom one might know but not as a close friend, have the tendency to assimilate one another's personalities (maybe

the talking style, clothing etc.). However, apart from copying the traits, friends or acquaintances that are well known to each other and are familiar with each other's style of writing may even copy this intentionally or unintentionally.

There are commonly two types of writing characteristics/attributes that have been commonly described: class characteristics (the products of prescribed writing systems) and individual characteristics (the idiosyncrasies of the individual) [5]. These can be used for comparisons of questioned and exemplar specimens. The characteristics are generally used for comparison of handwriting samples.

Various factors influence handwriting such as, the type of pen we use, the writing surface, age, sex, influence of drugs and illness among others. These factors also lead to writing variations or in other words the natural variation. Writers usually produce the same handwriting as they try to modify the given design, which is according to the prescribed copybook model based on their habit. Such variations are termed as natural variation. It is an important element of the writing process as no writer can produce any writing without modifying copybook model. This natural variation forms the basis of individual characteristics of a writer. Research has standardized a system to differentiate handwriting person to person, based on their gender [6]. Due to involvement of hormones, and differences in the physiology, the thinking process of males and females differ vastly [7]. It may not only affect the neuro-muscular function, but the difference in thinking also leads to discrimination between the characteristics of male/female handwriting.

Therefore, the aim of our study is

- a. Compare the class characteristics and individual characteristics of friends/acquaintances who are aware of each other's handwriting.
- b. Analyses whether their imitation is restricted to class characteristics making the pictorial appearance similar or does the individual characteristics are also copied and ingrained into their personal writing habits based on the gender of the person.

Methodology

In this study, 135 handwriting samples were collected of males and females, from

different age groups and of various educational levels i.e., 14-18 years (Undergraduate level), 17-21 years (Graduate level) and 20-25 years (Post graduate level).

The whole experimental design was divided in two steps-

1. **Sample collection:** The participants were asked to fill a proforma bearing details of the writer and as exemplar four lines were dictated "A quick brown fox jumps over the lazy dog. Pack my box with five dozen liquor jugs. Mad Boxer George shot a quick, gloved jab to his dizzy opponent Alex. Sixty zippers were quickly picked from the woven jute bag." and were asked to execute the same four times: out of which two samples in blank sheet and rest two samples in ruled sheets on A-4 size paper. For standardization, ball point pens were provided to the participants. All healthy individuals were taken for sample collection. Samples were collected particularly from those who were well known with each other either by acquaintance or friendship and were familiar with each other's style of writing i.e., features which are pictorially prominent to be captured. These samples were further grouped in pairs as Female-Female, Female- Male and Male- Male (Table 1).
2. **Sample analysis:** Handwriting samples of participants were examined in two categories based on principle of comparison of handwriting features of different authors:
 - A. *Class characteristics:* This class reflects those characters of handwriting which are specific to the group of individuals.
 - B. *Specific Individual characteristics:* This class indicates those characteristics of handwriting which are specific to individual and forms the basis of comparison and identification of the writer. For this purpose, 'T', 'G', 'i' dot, 'crossing,

'z', 'x', 'q', 'j', 'f', 'w' were considered as they are found to show specific features of identification in the samples which were collected for research work.

A statistical approach, mean percentage $\bar{x} = \frac{\sum x_i}{N} * 100$ ('xi' denotes given N number of observation and 'N' denotes total observation) and standard deviation

$$s = \sqrt{\frac{\sum_{i=1}^N (x_i - \bar{x})^2}{N - 1}}$$

('xi' denotes given number of observation and 'N' denotes total observation) was adopted which were used for formulating comparative graphs for this study. The standard deviation indicates the variation or dispersion from the mean value for a class characteristic and individual characteristics.

Observation and Results

Percentage occurrence of various class characteristics and individual characteristics which was compared among gender pairs (Female-Female, Female-Male, Male-Male) of three age groups (14-18 years, 17-21 years, 20-25 years), the following results were interpreted and assimilated:

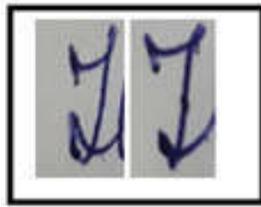
14-18 years (Undergraduate level): Maximum number of Female-Female pair in this age group have similar class characteristics such as alignment, connections, line quality, movement, size, speed, embellishment which were similarly observed in Female-Male pair (≥80% similarity). In case of Male-Male pair, except connection and size all the other characteristics were similar (≥80% similarity) (Graph 1).

Female-Female pair of this age group had same formation of 'i dot', 't cross', 'z', 'G', 'j', 'w' (≥60% similarity), Female-Male had 'i dot', 't crossing' 'x', and 'w' formation similar (≥60% similarity) whereas in Male-Male pair 'T', 'i dot', 't crossing', 'z', 'x' and 'w' were alike (≥ 60% similarity) (Graph 2).

Table 1: Categorization and Denotations

	Categorization And Denotations	Age Group I 14 years - 18 years (Undergraduate level)	Age Group II 17 years - 21 years (Graduate level)	Age Group III 20 years - 25 years (Post graduate level)
FF	Female-Female	15 samples	15 samples	15 samples
FM	Female-Male	15 samples	15 samples	15 samples
MM	Male-Male	15 samples	15 samples	15 samples

Table 2: Similarities and dissimilarities in individual characteristics of different samples



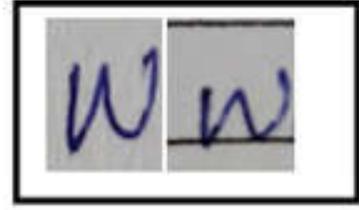
Similarity in letter 'T'



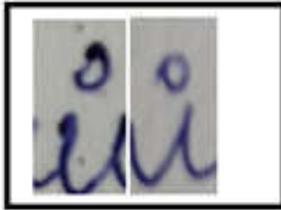
Almost similar formation of letter 'G'



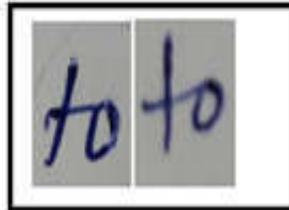
Almost similar formation in letter 'f'



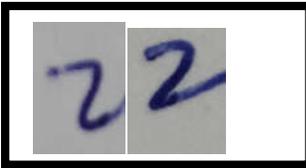
Similarity in letter 'w'



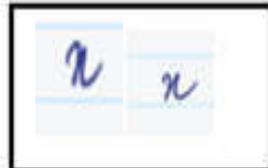
Similarity in 'i dot'



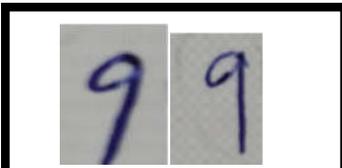
Similarity in 't-crossing' formation formation



Similarity in letter 'z'



Similarity in letter 'x'



Similarity in letter 'q'

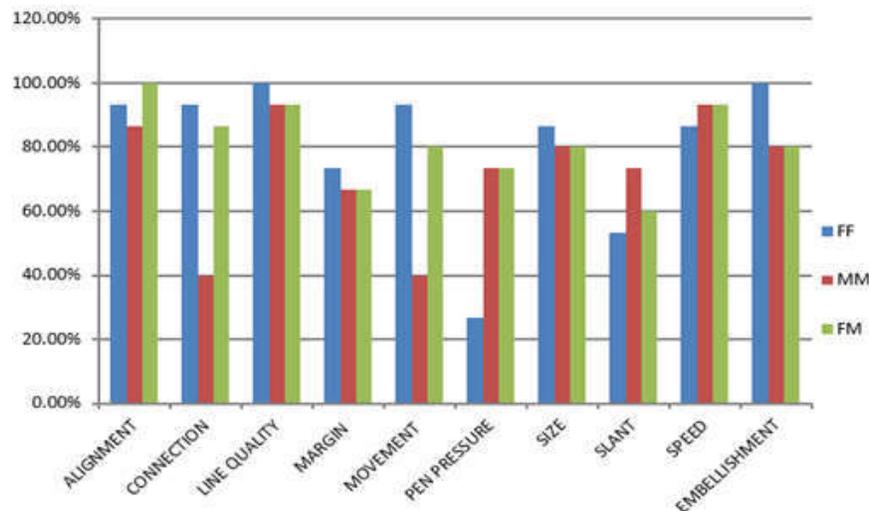


Similar 'j' formation

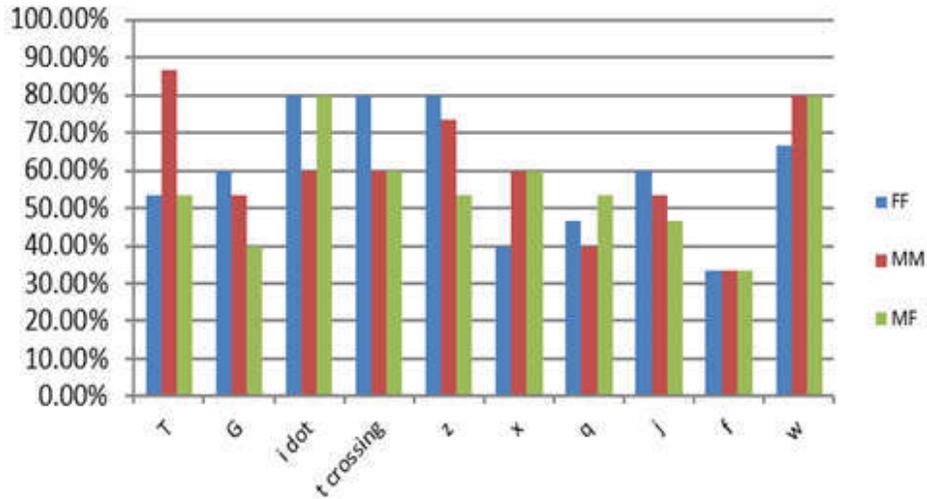
17-21 years (Graduate level): Maximum numbers of Female-Female pair in this age group have similar class characteristics such as connections, line quality, movement, embellishment ($\geq 80\%$ similarity). In Female-Male pair, connection, line quality, movement, slant, speed was found to be same ($\geq 80\%$ similarity), whereas in case of Male-Male pair, connections, line quality, slant and embellishment were similar ($\geq 80\%$ similarity) (Graph 3).

Female-Female pair had formation of 'i-dot', 't crossing', 'z', 'q', 'j' and 'w' alike ($\geq 60\%$ similarity), in Female-Male pair 'i dot', 't crossing', 'x' and 'w' were similar ($\geq 60\%$ similarity) while in Male-Male pair the formation of 't crossing', 'x' and 'w' was same ($\geq 60\%$ similarity) (Graph 4).

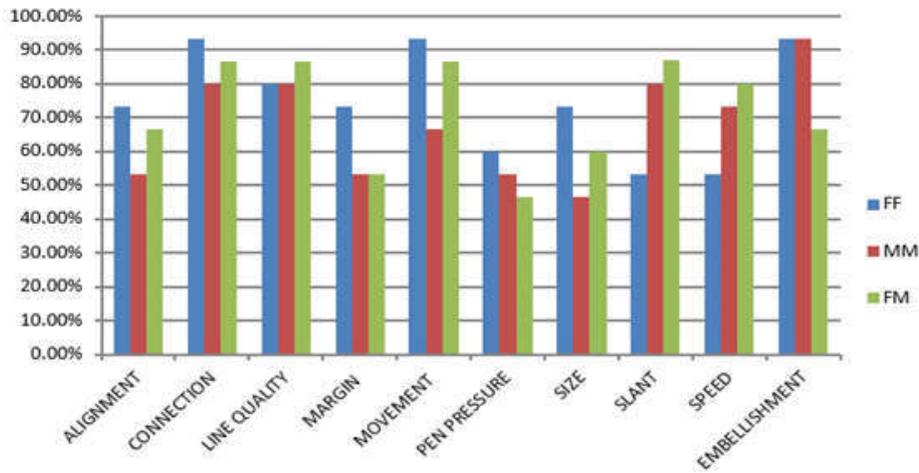
20-25 years (Postgraduate level): Maximum number of Female-Female pair in this age group have similar class characteristics such as connections, margin, movement, pen pressure, size, slant, speed, embellishment which were similarly observed in Female-Male pair in addition to margin ($\geq 80\%$ similarity). In case of Male-Male pair, except alignment, margin and pen pressure all the other characteristics were similar ($\geq 80\%$ similarity)



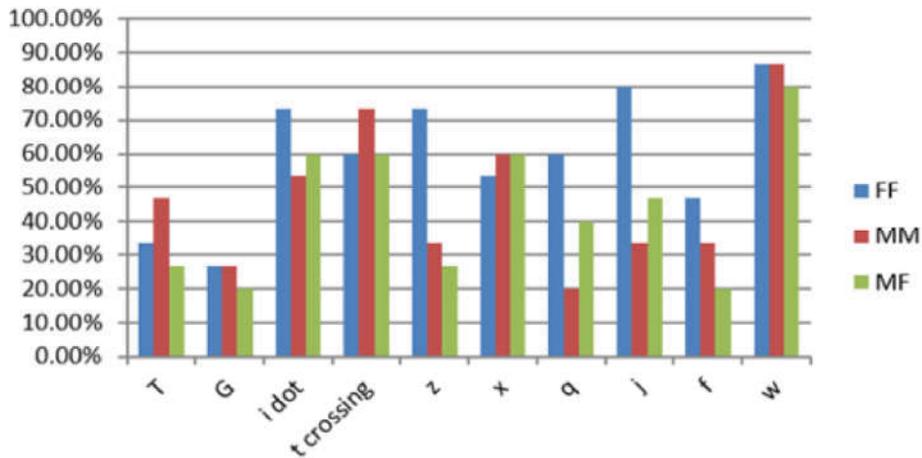
Graph 1: Represents the percentage of Class Characteristics among Female-Female, Female - Male and Male-Male of the age group 1 - 14 years to 18 years.



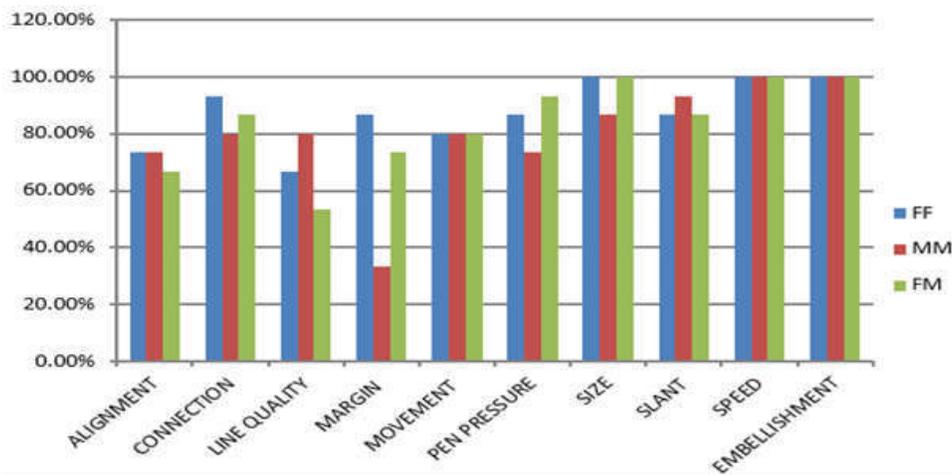
Graph 2: Represents the percentage of Individual Characteristics among Female-Female, Female -Male and Male-Male of the age group I - 14 years to 18 years



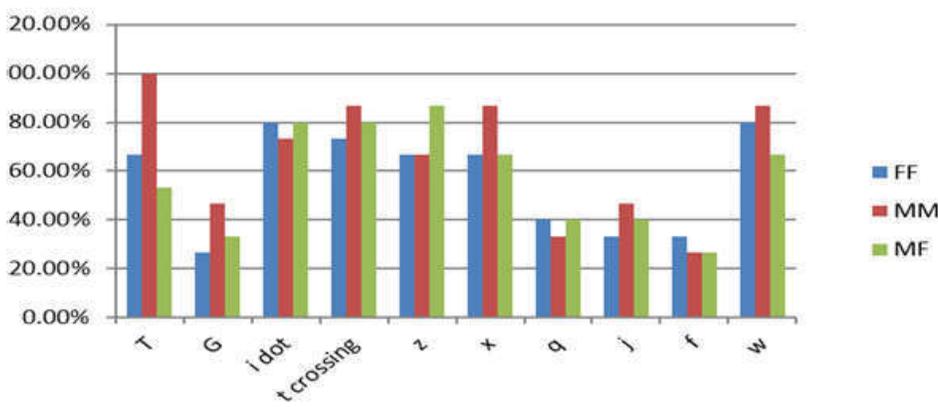
Graph 3: Represents the percentage of Class Characteristics among Female-Female, Female -Male and Male-Male of the age group II - 17 years to 21 years.



Graph 4: Represents the percentage of Individual Characteristics among Female-Female, Female - Male and Male-Male of the age group II 17 years to 21 years.



Graph 5: Represents the percentage of Class Characteristics among Female-Female, Female-Male and Male-Male of the age group III - 20 years to 25 years.



Graph 6: Represents the percentage of Individual Characteristics among Female-Female, Female- Male and Male-Male of the age group III 20 years to 25 years

(Graph 5). In Female-Female pair 'T', 'i dot', 't crossing', 'z', 'x' and 'w' formation is similar ($\geq 60\%$ similarity), in Female-Male 'i dot', 't crossing', 'z', 'x' and 'w' were alike ($\geq 60\%$ similarity) while Male-Male pair had formation of 'T', 'i dot', 't crossing', 'z', 'x' and 'w' similar ($\geq 60\%$ similarity) (Graph 6).

Similarities and dissimilarities found in individual characteristics of different samples are as follows (Table 2).

Conclusion

Handwriting is a pivotal part of every person's life, which he/she starts learning through copybook model and eventually transform the same as per his/her habits which are available in the form of variations. It can be said that the handwriting habit is not innate or hereditary, but it develops gradually and is constantly changing.

Humans are social beings and there is no denying the fact that a lot of social beings imitate or mimic other person's speech or mannerism to modify his/her own individuality or personality. This is also seen in case of handwriting where some people's handwriting may have similar styles and characteristics in common, acquired when these people learn to write by copying letters and words, and tend to take on individual styles with age. However, apart from copying the traits, friends or acquaintances that are well known to each other and are familiar with each other's style of writing may even copy this intentionally or unintentionally.

The present study was done to examine tendency to imitate the class characteristics and individual characteristics among friends/acquaintances that are aware of each other's handwriting. From the mentioned study the authors observed and hence, conclude that irrespective of gender and age of the volunteer's majority of the class characteristics

like connection, size, speed, embellishments etc. are reproduced among friends and similarly the individual characters letters like 'T', 'i-dot', 't-cross', 'z', etc. are found to be imitated. While taking in consideration the gender it was noted and therefore can be deduced that the level of imitation of majority of the class characteristics among the female-female volunteers were more, followed by female-male volunteers and least in case of male-male volunteers, though no said pattern is followed in case of individual characters.

The main purpose of this study is to shed light on the fact that while handwriting is believed to be individualistic and is considered as a determinant for the source of authorship in forensic science, this piece of evidence should not be ignored that people who hand-writes regularly can reproduce other individual's class as well as individual characters of handwriting.

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