

Probability of Gender Identification through Handwriting Analysis

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ABSTRACT

Handwriting is a unique identity of every individual which can neither be copied nor be recreated. Examination of handwriting has always been of great utility in forensic science not only as a source of physical evidence in criminal investigation but as a tool for personal identification. An attempt was made to examine and analyze certain handwriting characteristics such as pen pressure, slant of words, size of letters, completeness of letters, spacing between lines and placement of diacritics to determine the gender of the individual. About 70 samples, 35 each male and female with their consent, were collected from the students of various departments in a survey conducted at Annai Fathima College of Arts and Science, Thirumangalam. The participants were asked to fill out a survey paper using a DOMS GL 0.6 pen. The samples were analyzed and compared properly in consideration of the characteristics. From this study, it was concluded that the determination of gender from handwriting characteristics like pen pressure, slant of words, completeness of letters and placement of diacritics is possible as they show a great difference in their percentage of similarity in male and female individuals whereas the size of letters shows a slight difference in their percentage and hence cannot be used as a parameter for gender determination.

Keywords: Handwriting, Gender determination, Parameter.

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INTRODUCTION

Handwriting/penmanship is a complex motor skill involving the interplay of sensory, neurological and physiological impulses. It results due to factors like visual, knowledge or skill, pathways of central nervous system (CNS) anatomy and physiology of bones and muscles of the arm.¹

It is an acquired capacity and each person has their unique style of handwriting, whether it is everyday handwriting or their signature. Even identical twins who share appearance and genetics do not have the same handwriting.² The place where one grows up and the first language one learns melt together with the different distribution of force and ways of shaping words to create a unique style of handwriting for each person. Because each person's handwriting is unique and different, it can be used to verify a document writer.

The hand is an extremely complex and delicate mechanism, containing some 27 bones controlled by more than 40 muscles. Most of the muscles are situated in the lower arm and connected to the fingers by an intricate set of tendons. Their ability to manipulate a writing instrument is precisely coordinated by a timing system under neutral control of the movement of the arm, the hand and the fingers. The precise ordering and timing of the movements determines the structure of the pattern that is recorded by the writing instrument.

Handwriting could be called mind-writing because it reveals the personality, emotions, likes and dislikes, strengths and weaknesses, intellect and much more about an individual.³⁴

The teaching of handwriting has been an important feature in the curriculum in both England and the United States since the inception of schooling. Children are usually taught first to form letters in a printed fashion before progressing to cursive

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or 'joined-up' writing at about the age of eight. There is an expectation that by the start of secondary schooling, children will have adopted a fluid joined-up writing script which often already shows some markers of individuality.^{3,4}

Characteristics of Handwriting

The handwriting of an individual is as unique as the fingerprint.

Pen pressure

Pen pressure may be defined as the force or pressure applied on the writing instrument during the writing operation.⁵

Pen pressure can be classified into the following main classes:

- Light pen pressure
- Heavy pen pressure
- Medium pen pressure
- Graduated pen pressure

Size of letters

The size of the letters measures the height and width of capital and lowercase. Also, through the study of dimension, we

analyze the existing relationship between capital letters and lowercase, the length of upper extensions and lower extensions, and the proportion of all the strokes.⁶ The inferiority complex is discovered compensated in the size of capital letters.

Size consistency

It is the ratio of height: to width of the letter formed while writing them. It can be big, small, or intermediate. A forger can never copy size consistency. If they try to do so, we can see tremors in the strokes.

Slant of words

It is the direction of letters while writing. The slant of the letters can be to the right, to the left, straight, or mixed slant.

Spacing between words and letters

The spacing between the letters and words, i.e., intra-letter and intra-word spacing, can be consistent or inconsistent.

Spacing between lines

The amount of space that the writer leaves between the lines on the page gives clues to the orderliness and clarity of his thinking, and to the amount of interaction that he wishes to have with his environment. Normal spacing has its harmony and flexibility.

Line quality

It shows the overall appearance of handwriting. We can examine this through-line flow (the strokes formation, freely written writing, the usual handwriting habit), shakiness (presence or absence of tremors), and irregularities (written regularly or not). It indicates the writing speed, copied, prolonged or altered writing.

Page margin

The page is space, and the way that the individual fills his page with script shows mental stability. The left side of the paper represents the past from which the writer starts, and the right side symbolizes goals and the future. Placement on the page also shows the quality of the person's taste, social, cultural, and artistic tendencies, or a lack of these. Unconscious feelings toward space and its use give clues to the person's self-esteem and how it will relate to others.

Pen lifts

It is the lifts of the writing instrument while writing on paper. A forged document contains unusual pen lifts, i.e., pen lifts at an unexpected place.

Size and shape of diacritics

The minute and prominent habits of writing letters. The dot positions on the letter "i" or the crossbar position on the letter "t".

Initial and terminal strokes

Initial Strokes – Initial strokes are found at the beginning of letters and words. They may be straight, curved or hooked, long or short strokes.

Terminal Strokes – Terminal strokes are ending strokes on letters and words. They also may be straight, curved, or hooked, long or short and are consistent with writers. These are also overlooked by forgers unless the terminal stroke is very distinctive.⁷

Embellishment

The fancy curls, loops, or any unusual letter formations either at the initial strokes or at the terminal's ones.

Connecting strokes

The strokes are present between the letters to join them. It might be present or absent depending upon the individual's writing.⁷

Significance in forensic science

- Examination of handwriting has always been of great utility in forensic science not only as a source of physical evidence in a criminal investigation but also for evolving new techniques and ideas related to the purpose of personal identification if it becomes possible to predict the gender of the writer so that the innocent could be protected and thus aid in the investigation process.⁸
- Handwriting analysis can depict a lot about personality.
- Large companies use graphology to check job applications.
- The police still use handwriting experts to determine forgery and interpretation of suicide notes or personal diaries.

MATERIALS AND METHODOLOGY

A survey paper was created. The survey was conducted at Annai Fathima College of Arts and Science Thirumangalam Madurai. A total of 70 samples, 35 each from male and female were collected from the students. Throughout the survey, DOMS.GL .0.6 pen was used and the participants were asked to fill the survey paper placed on the same table to avoid any errors. The participants were asked to copy down a given statement in the survey paper to a box provided. The primary examination was conducted for all the seventy samples that were collected. The samples were analyzed and compared properly by considering handwriting characteristics. The percentage of each characteristic exhibited by females and males was calculated and recorded.

RESULT AND DISCUSSION

While analyzing pen pressure, it was found that most of the males apply heavy pressure while writing whereas females seldom apply pressure while writing (Figure 1).

On close examination of all the samples, it was observed that most of the male's handwriting is slanted whereas the handwriting of most females is straight (Figure 2).

On comparing handwriting samples, the females have more completeness of letters than males (Figure 3).

While examining the size of letters (Figure 4), it was observed that only slight variations could be seen between males and females.



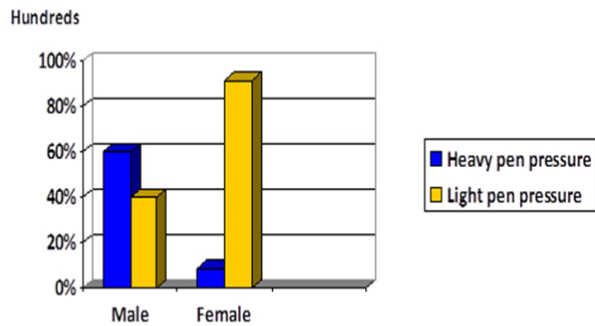


Figure 1: Graph depicting the correlation of gender and pen pressure

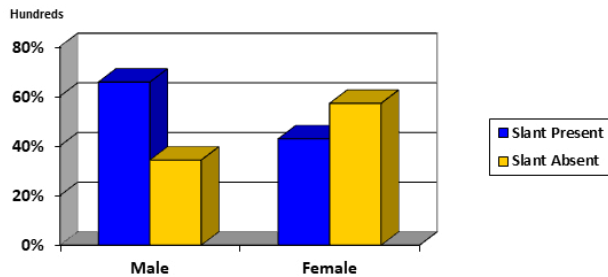


Figure 2: Graph depicting the correlation of gender and slanting

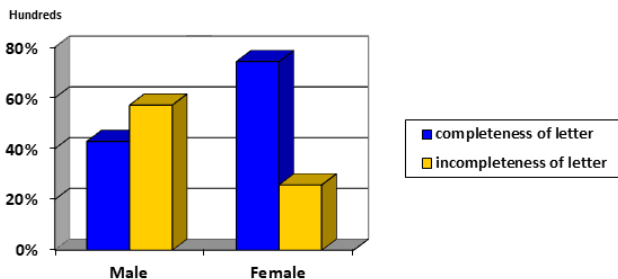


Figure 3: Graph depicting the correlation of gender and completeness of letter formation

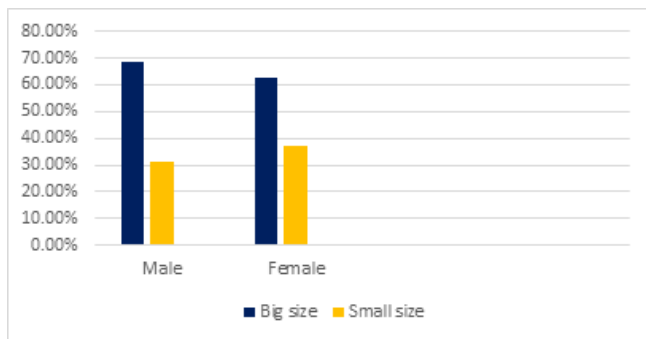


Figure 4: Graph depicting the correlation of gender and size of the letter

The handwriting of females is more uniformly spaced than males (Figure 5).

The positioning of diacritics is more accurately placed in females than in males (Figure 6).

It is possible to determine the gender from handwriting characteristics like pen pressure, slant of words, completeness of letters and placement of diacritics is possible as they show

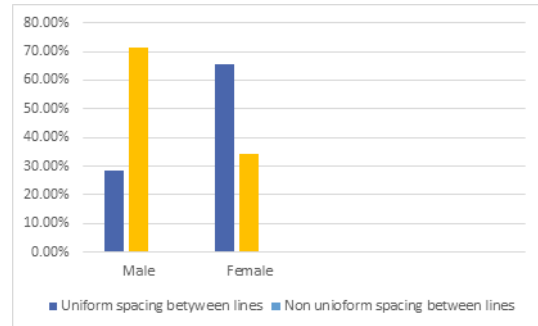


Figure 5: Graph depicting correlation of gender and uniformity of spacing between the lines

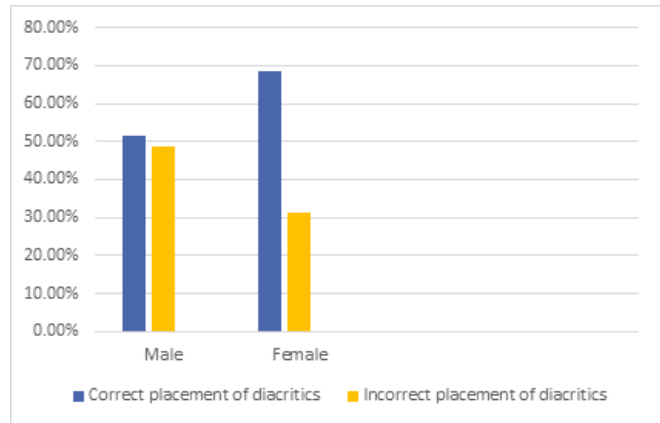


Figure 6: Placement of diacritics

a great difference in their percentage of similarity in male and female individuals whereas the size of letters show a slight difference in their percentage and hence cannot be used as a parameter for gender determination.

DISCUSSION

The primary purpose of handwriting analysis is to look for differences between two writing samples. Gender determination by handwriting analysis was aimed at finding out the differences exhibited in the handwriting samples of male and female genders.⁹ On average, males have bigger hands than females and their second fingers tend to be relatively shorter than their fourth fingers possibly resulting in a different writing style.¹⁰ Multiple mechanisms are identified to explain why men and women have different handwriting characteristics. One mechanism is the different physical features of men and women.¹¹ The second mechanism is that women have prenatal hormones that cause more feminine handwriting. The third mechanism, men have larger overall cerebral size than women after the brain development through the teen ages. Pen pressure, slant of words, completeness of letters, size of letters, spacing between lines and the placement of diacritics were examined.¹² Pen pressure and slant of words are more prominently exhibited by males than females. About 60% of males write with a heavy pressure which might be because men apply the force from their arm along with their fingers on the writing instrument rather than using fingers only.

About 65.71% of males have a slant in their handwriting than females. Completeness of letters, spacing between letters and placement of diacritics are more carefully followed by females. 74.28% of females have completeness of letters. In 68.57% of females place the diacritics correctly and 65.71% of females follow uniform spacing between lines, which might be because they are more attentive while writing and give more weightage for a neat presentation. The study published by Sumeet *et al.* (2013) concludes that there are significant differences in the writing of males and females. Dilara Oner *et al.*, published a study on gender determination based on the ascending and descending parts of the letters. The study was significant in differentiating male and female writings. Moreover, females write more slowly than males who give less weightage for a neat draft. Analyzing the size of letters does not give a clear distinction between males and females.¹³

CONCLUSION

Handwriting is the key evidence in cases of suicide notes, questioned documents, and personal diary notes. It is possible to determine the gender of an individual to some extent by analyzing pen pressure, slant of words, completeness of letters and positioning of diacritics. But there are chances that gender cannot be accurately determined by analyzing these characteristics due to individual differences and the mindset of the writer at the time of writing, writing instrument, plane of writing, etc. The analysis of handwriting will help to narrow down the conclusions to a female or a male.

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