STUDY OF THE CHARACTERISTICS OF LEFT HANDED WRITING

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Abstract

There are many crimes involving documents that relate to handwriting identification. Forensic handwriting requires examination of a document that was collected from a criminal suspect. The aim of this paper is to investigate the characteristics of left handed writing.

In this study, samples were collected from 50 left handed writers. The examined features were slant, slope, alignment, the edge of a ball point pen and heavy and light strokes. These features were measured by video microscope. The data was analyzed according to the frequency of each feature. The results showed that 94% of the samples appeared with the left side of the edge of the ball point pen and 86% of the samples appeared with a heavy line at the upstroke. These features had more chance to appear in left handed writing.

Key words: Handwriting feature examination, left handed writer handwriting, edge of a ball point pen, the heavy line

Introduction

Handwriting is a system of communication consisting of a set of rules which decide the way in which messages have meaning [8]. Handwriting is done with the fingers and hand these contain many nerves and muscles that can affect the act of writing. Individual characteristics of handwriting are depending on instructions sent from the brain [4, 8]. Neuro-muscular movement tendencies are correlated with specific observable personality traits that affect the handwriting [8]. The objective of this study is to investigate the feature and characteristic of left-handed writing.

Materials and Methods

Each subject received a questionnaire, sample collection form, a blue ball point pen, blue color ink with diameter 0.7 mm. (Lancer, clic 878, Thailand). Both materials were packed in a brown envelope (ba paper open end envelope no.9×12 ¾, from See Thong 555, Thailand).

The source sentence included all four zones; tonal symbols, upper vowels, consonants, lower vowels, up-to-down, down-to-up, upper loops, lower loop initial points and wide, normal and narrow letter width. The source sentence was

"ในวันพฤหัสบดีที่จะถึงนี้คุณชัชฎาพรจะไปงานสัปดาห์หนังสือที่ศูนย์ประชุมแห่งชาติสิริกิติ์"

Table 1 The observation alphabets in each feature analysis

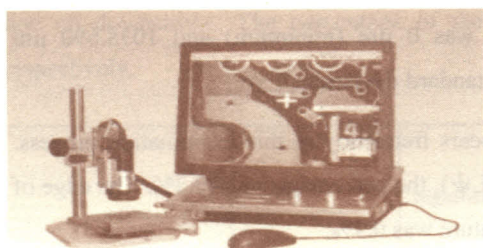| Feature analysis	Observation alphabets	Number of the selected sentences
Slant	1, �, ฎ, ำ, ปี	4
Alignment	ค,ป, อ, น	5
Slope	All sentences	25
The edge of ball point pen	ฤ, ก, ค, ศ,	5
The heavy and light stroke	ฤ, ฬ, ปี, น	5

Figure 2.1 Digital CCD Microscope MS-804 Scopeman [5].

The process of this study started with questionnaires and sample collection forms were distributed to 50 subjects who are left handed writers. Each subject was asked to copy a sentence for 25 handwritten sentence samples. Subjects were allowed to take as much time as they wanted. The subjects need to record personal information such as age, sex, education level and occupation. We collected all sample sentences from each subject, checked the number of sentences and the letters and selected the sentences and alphabets for feature analysis. The feature analysis considered slant, alignment, slope, the edge of ball point pen and the heavy and light stroke. The last process was a comparison of the result in each group of the sample by statistical analysis, i.e. t-test, f-test or chi-square test.

All data were analyzed by using a statistical package SPSS for windows version 17.0. A statistical significance was considered at p-value< 0.05.

Results

General characteristics of the samples

In this study, 50 samples were collected from left handed writers. Number and percentages of general characteristics of the samples are given in Table 2

Table 2 Numbers and percentages of general characteristics of the samples

General characteristics of the samples	Numbers	Percentages
Sex		
Male	39	78
Female	11	22
Age interval (years old)		
20-25	14	28
26-30	25	50
≥31	11	22
Education level		
Lower diploma	30	60
Diploma or better	20	40
Occupation type		
Soldier and general laborers	33	66
Teacher, student and government official	17	34

From Table 2, the results of the general characteristics showed that most of the samples were male, 39 samples, accounting for 78% and 11 females, accounting for 22%. For age intervals, most of the samples were 26-30 years old (50%). About 28% were 20-25 years old. The smallest group was ≥31 years old, with 22%. Most of the samples were from those with education level of lower diploma level, accounting for 60% and upper diploma or better, accounting for 40%. Most of the occupation types of the samples were soldiers and general laborers, accounting for 66% and teacher, student and government official, accounting for 34%.

Data description

In this study, the features analyzed were slant, alignment, the edge of ball point pen, heavy and light stroke and slope. The results of data description were given as follows.

The mean of **slant measurement** for each subject was 65.581° (minimum) and 106.584 ° (maximum). The characteristic of this data was wide data phase with high standard deviation.

The mean of **alignment measurement** for each subject was 0 μm (minimum) and 1038.690 μm (maximum). The characteristic of this data was wide data phase with high standard deviation.

The edge of ball point pen (+L↑), is the feature that appears frequently in this examination process. The percentage of this feature was 56.4%. For the edge of ballpoint pen **(+L↓),** the percentage was 47.3%. The edge of ball point pen **(+R),** appeared in just L sample and the percentage of this feature was 0.3%.

The heavy and light stroke (+L↑), is the feature that appears frequently in this examination process; there were 43 samples and the percentage of this feature was 21.8%, The heavy and light line quality **(+L↓)** was found in 35 samples and the percentage of this feature was 6.6%.

The results of slope measurements were not unclear in all samples.

Comparisons of the features of the handwriting

The comparisons of the features of the handwriting between sex, age interval, education level and occupation type are given in Table 3-6, respectively.

Feature analysis	Statistical method	Significant different		Not significant different	
		Number of the object	Percentage	Number of the object	Percentage
Slant	T- test	-	-	20	100
alignment	T- test	-	-	20	100
The edge of ball point pen (+L↑)	Chi-square test	-	-	20	100
The edge of ballpoint pen (+L↓)	Chi-square test	4	20	16	80
The edge of ball point pen (+R)	Chi-square test	-	-	20	100
The heavy line on upstroke (+L↑)	Chi-square test	-	-	20	100
The heavy line on downstroke (+L↓)	Chi-square test	3	15	17	85

Table 3 A comparison of each feature between male and female (The results in the table were analyzed by t-test or chi-square test, significant at p-value < 0.05)

From Table 3, there were two features that were significantly different between male and female. The features were the left side of the edge of ball point pen on downstroke and the heavy line on downstroke. The percentage of the objects that was significantly different with 20 and 15, respectively.

Feature analysis	Statistical method	Significant different		Not significant different	
		Number of the object	Percentage	Number of the object	Percentage
slant	F- test	-	-	20	100
alignment	F- test	2	10	18	90
The edge of ball point pen (+L↑)	Chi-square test	3	15	17	85
The edge of ballpoint pen (+L↓)	Chi-square test	4	20	16	80
The edge of ball point pen (+R)	Chi-square test	-	-	20	100
The heavy line on upstroke (+L↑)	Chi-square test	2	10	18	90
The heavy line on downstroke (+L↓)	Chi-square test	5	15	15	75

Table 4 A comparison of each feature between age intervals (The results in the table were analyzed by t-test or chi-square test, significant at p-value < 0.05)

From Table 4, there were five features that were significantly different between age intervals. The features were alignment, the left side of the edge of ball point pen on upstroke, the left side of the edge of ball point pen on downstroke, the heavy line on upstroke and the heavy

line on downstroke. The percentage of the objects that was significantly different with 10, 15, 20, 10, and 15, respectively.

Feature analysis	Statistical method	Significant different		Not significant different	
		Number of the object	Percentage	Number of the object	Percentage
slant	T- test	8	40	12	60
alignment	T- test	-	-	20	100
The edge of ball point pen (+L↑)	Chi-square test	1	5	19	95
The edge of ballpoint pen (+L↓)	Chi-square test	2	10	18	90
The edge of ball point pen (+R)	Chi-square test	-	-	20	100
The heavy line on upstroke (+L↑)	Chi-square test	1	5	19	95
The heavy line on downstroke (+L↓)	Chi-square test	1	5	19	95

Table 5 A comparison of each feature between education levels
(The results in the table were analyzed by t-test or chi-square test, significant at p-value < 0.05)

From Table 5, there were five features that were significantly different between education levels. The features were slant, the left side of the edge of ball point pen on upstroke, the left side of the edge of ball point pen on downstroke, the heavy line on upstroke and the heavy line on downstroke. The percentage of the objects that was significantly different with 40, 5, 10, 5, and 5, respectively.

Feature analysis	Statistical method	Significant different		Not significant different	
		Number of the object	Percentage	Number of the object	Percentage
slant	T- test	1	5	19	95
alignment	T- test	-	-	20	100
The edge of ball point pen (+L↑)	Chi-square test	2	10	18	98
The edge of ballpoint pen (+L↓)	Chi-square test	2	10	18	90
The edge of ball point pen (+R)	Chi-square test	-	-	20	100
The heavy and light line quality (+L↑)	Chi-square test	-	-	20	100
The heavy and light line quality(+L↓)	Chi-square test	4	20	16	80

Table 6 A comparison of each feature between occupation types
The results in the table were analyzed by t-test or chi-square test, significant at p-value < 0.05.

From Table 6, there were four features that were significantly different between occupation types. The features were slant, the left side of the edge of ball point pen on upstroke, the left side of the edge of ball point pen on downstroke and the heavy line on downstroke. The percentage of the objects that was significantly different with 5, 10, 10, and 20, respectively.

Discussion

In this study, the numbers of left handed writers was 50 persons. Normally, the proportion of right handed writers is more than that of left handed writers, so we could not control sex, age, education levels and occupation types. In general there are fewer persons who are left handed writers. For sex, most of the samples were collected from

soldiers who worked in three provinces in the south of Thailand, so the subjects were male more than female. For the age interval, we should have collected the handwriting from people in the age range between 25-60 years old because this range gives good quality handwriting which has the personal trait and stability, but there were fewer persons available who were left handed writers above about 30 years old. For the education level, normally, we should collect the handwriting from the person who has a bachelor's degree or higher because the education level effects the handwriting quality. However, there were few persons who were left handed writers so the education level that we collected started in primary high school, junior high school, senior high school to master's degree. We divided the occupation type into two groups by considering how much writing there is in their routine. The condition results in significantly differences in five features between age intervals. The education levels in which we collected the sample were primary high school, junior high school, senior high school to master's degree. The significant differences in five features between education level were obtained from the effect of education level on the writing line quality. Most of the occupation types that we collected were soldiers which have a low quality of writing. They have low legibility and poor line quality [10] while others were teachers, students and government officials who had higher quality of writing. They had high legibility and good line quality so that significant differences occurred in four handwriting features between occupation types.

Conclusion

The results from this study provided a good opportunity as to how to distinguish between a left or right hand. The two features of the handwriting that we analyzed could be used to answer this question. The left handed writing had more chance to appear with the left side of the edge of a ball point pen on the up and down strokes. For the heavy and light line quality, the up stroke would have more chance to appear with the heavy line from the physiological characteristic of the human muscle. However, handwriting is not just "hand" writing. There were many factors that influence the letter formation. The results obtained from this study could be used to help a handwriting examiner to estimate the probability of various features. Other features such as speed could be included in the handwriting examination.

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