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A STUDY OF AGE RELATED RETENTION OF
INDIVIDUAL CHARACTERISTICS IN HANDWRITING

Dissertation submitted in partial fulfillment
for the Degree of Bachelor Science in Forensic Science

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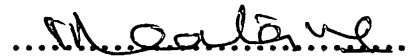
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CERTIFICATE

This is to certify the dissertation entitled

"A study of Age related retention of Individual characteristics in Handwriting"

is the bonafide record of research work done by

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During the period of December 2008 to April 2009

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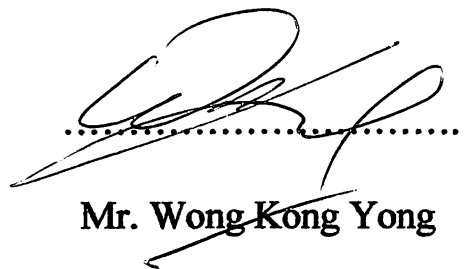
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ABSTRACT

Handwriting and signature have been much involved in human life. It serves as the basic tool in education, recording of information, exchange of knowledge, communication and personal identification. Even in the wake of the modern digital world of computerization, the importance of handwriting and signature are still undisputed and cannot be neglected. This makes handwriting and signature as a form of evidence which gain high interest in the field of Forensic Science. The document examination has been using and proving the identity of the author and also revealing any mean of forgery.

Researchers and experts have studied and explained various individual characteristics which are used as the cue for positive identification and detecting the attempt of forgery. Various factors which influence handwriting and signatures had been discovered as physical factors, medication, mental states, aging and so on.

Aging is an important factor in forensic investigation. Humans undergo various changes in the aspect of physical as well as psychological as aging proceeds. This may produce significant changes in the handwriting and signature of an individual. The credibility and probative value of this evidence may be disputed due to this reason. Hence, this research is aimed to explain the age related retention on the individual characteristics of handwriting and signatures.

This study involves qualitative assessment and analysis of handwriting or signature samples which are influenced by aging. The variable aging is assessed by analyzing samples executed in different times of interval (past and recent) with. The parameters used to identify the individual characteristics include termination, design of letters, location of dots and so on. The individual characteristics are marked for the comparison between past and recent samples by mean of comparison chart which shows the retention of the individual characteristics.

The result of the study proved the retention of the individual characteristic in one's handwriting or signature even after aging. This study may increase the probative value of handwriting and signature evidences which have aging influenced. The retention of the individual characteristics can be very well recognized and identified. This can later be used for analysis and identification.

INTRODUCTION

A document can be defined as an item that contain writings, symbols, marks whether visible or invisible and conveys a meaning for someone. Meanwhile, document examination is defined as a discipline in which a document is examined and analyzes in order to obtain information that can be used to serve the justice system based on the scientific explanations. The aim of document analysis is to determine various properties such as origin, production source, production process, inscription, chastity, integrity, legitimacy and authenticity. The examination comprise various aspects such as handwritings, signatures, ink, paper, printed documents, indentations, obliteration, alterations and other factors.

The history of the document analysis can be dated back prior to 1900. In 1672, books were written by Jacques Raveneau on the handwriting identification. During this era, various other scholars namely Albert S. Osborn, Hagan, Frazer, Ames, and so on had been interestingly participated in the handwriting analysis. The efforts on expanding the knowledge in this field had finally made it was accepted in Common Law Procedure Act of 1854 in England and later broadened under the British Criminal Procedure Act 1865. The knowledge and application of the document analysis had widespread and expanded greatly since then.

Nowadays, in the rise of digital world, the usage of printed material taking a bigger role in document analysis that include analysis of ink, paper and printing instruments. However, handwriting and signatures are playing a vital role in the document analysis. These analyses are important to determine the document authenticity and its integrity.

Handwriting is a very complex skill. It is a skill that can be acquired through learning and involved a complex function of both perception and motor task. Since the action of handwriting involve both the perception and motor task it is referred as neuromuscular task. As the term implies, handwriting involves the action of 27 bones and are controlled by more than 40 muscles. The muscles are connected to the fingers via tendon and this form a network that is regulated by neural control. The control which is coordinated by nervous system at a very accurate and precise manner causes the movement of the arm, hand, and fingers. This highly synchronized movement make the manipulating of writing instrument are possible. The precision in timing and harmonized control of muscles related to the handwriting determine the pattern of writing produced. There are various factors that influence the handwriting and become very important to understand them.

Handwriting identification is a process in which handwriting is used as a mean of comparison and discrimination. In a more specific manner, handwriting identification can be based on evaluation of the significance of their similarities and dissimilarities. The amount of significant similarities and dissimilarities will be the cue in concluding whether the handwriting is belonged to a particular person or not in cases like forgery and fraud. The process involves three major parts which is determination of the discriminating elements, comparison of the elements and evaluation.

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Discriminating elements are the key for handwriting identification. According to Huber and Headrick in "Handwriting Identification : Facts and Fundamental", discriminating elements may be defined as a relatively discrete element of writing or lettering that varies observably or measurably with its author and may, thereby, contribute reliably to distinguish between the writings of different persons. In general it is the characteristics, used to distinguish handwritings. Overall, these elements can be grouped into four categories as shown below:

1. Elements of style which is the element related to the style of the handwriting. These include various characteristics related to the design, size and pattern of the writing. Examples of this type of characteristics are design, slope, dimension, spacing and others.

2. Elements of execution are often considered as the characteristics produced due to the act of writing. Examples of these elements are termination, pen control, line quality and other characteristics.

3. Consistency or natural variation. This factor is much more a natural phenomenon in writing process rather than a characteristic. It may help identification and also may diverge it. Various factors contribute to this, and assessments need to be done carefully.

4. Lateral expansion and word proportion. These are the factors caused by writing habits and the least used in identification.

These discriminating elements are the factors that cause the individual characteristics. Individual characteristics are unique to a person. Handwriting and signature which originate from the same author may carry many individual characteristics such as stroke, line quality, slant and so on.

Many discriminating elements are identified for comparison purposes in document examination. For example, the discriminating element "slant" can be described either to the right or left which can be used to describe and identify a particular handwriting. A collection of significant similarities and dissimilarities of individual characteristic are identified in document examination. The following table (Table 1) shows the discriminating elements normally used in forensics handwriting examination.

Table 1: Type of discriminating elements and its definition

Type of discriminating elements	Description/Definition
Alignment of letters	Alignment is the relation of successive letters, signatures in relation to an actual or imaginary line.
Skill of writing	Skill can be said as the competency of the writer which can be evidence by the appearance of the handwriting.
Speed of writing	Speed of writing is the speed during writing the handwriting or signature. It can be evidence of forgery.
Location of dots and "t" crossing	This element is used in describing the manner the dots are placed in a handwriting or signature. "T" crossing is the manner the "t" letter is crossed.
Relative sizing of letters	Relative size is the ratio between two small size letters, two tall letters or one short and one tall letter.
Connection of letters	The way letters in a handwriting or signature are connected also can be a way of discrimination.
Termination	Termination is the way the letters in handwriting or signature are terminated.
Spacing	Spacing between letters and also between words can be used as a discriminating element for examination.
Detail design of letters	Design of letters can be somehow different in handwriting from different author. Therefore it can be used to discriminate to certain extend.

As other forensic evidences, handwritings are also being influenced by various factors. These factors are always being the interest of researchers since it may produce changes in handwritings. The influential factors may be divided into intrinsical and extrinsical.

Intrinsical or internal factors that occurring within the writer and controlled by the writer. It is based on the action and the will of the author or the writer. These factors are temporary because of the nature of the influence which do not prolong and is within the control of the writer. Example of this intrinsical factors are imitation which causes by tendency to imitate other type of writing and other circumstantial factors. Circumstantial factors are factors that affect the writing and vary according to the circumstance. It can be divided into several sub factors such as postures, purpose, environment and materials. Factors such as alcohol influences, hallucinogens and drugs influence, fatigue, and hypnosis are also included in the intrinsical factors that influence handwritings. These factors are temporary and vary in great degree. Therefore it is hard to be used as mean of cue in handwriting identification.

Extrinsical factors are beyond the control of the writer. These factors are developed during the development of handwriting since handwriting is an acquired skill which may not be influenced by hereditary. This type of factor that causes the notion that handwriting is specific for every individual. This is the key to cause variation and discrimination in handwriting examination process. Examples of extrinsical factors are writing systems, illness, age, mental state and so on.

Aging is an extrinsical factor which is beyond the control of the author in term of handwriting. As aging proceeds, various changes occur in term of physiological, psychological and other aspects. In term of handwriting, it is understood that handwriting is changing throughout the lifetime. There are various factors that lead to these changes. This is parallel with the fact that handwriting is a skill which is learned skill which shows it will develop. However there are limits of this development which is the ability of muscle control in producing the harmonic movement of wrist which hold the writing apparatus. This harmonic movement will be manifested by writing apparatus into handwriting.

Handwriting development in a writer's life can be classified into four groups or stages based on control as the aging proceeds. The stages are the formative stage, impressionable or adolescent stage, the mature stage and the stage of degeneration. The formative and adolescent stages are very much influenced by voluntary control. This phenomenon is due to the effort in trying to copy and learn the writing. The learning process of handwriting can be explained by different schools of thought as School of Copying or Imitation, Physiological School of Thought and Psychological School of Thought.

From the view of School of Copying, handwriting is learned by imitating and copying the teacher's handwriting. This mean a writer will initially copy the exact letter which is written by the teacher. However this view is not accepted since the learning of handwriting doesn't stand alone on this factor only. Another perspective on handwriting learning is based on Physiological school of thought. This perspective agrees that writing is products of the movement of hand's muscles. The organized and harmonized movement of muscles in hand is manifested by the writing apparatus into writing which is influence by position, organization and strength of muscles. Handwriting is improved by repeated exercises in producing strokes. These perspectives also are rejected because it neglects the aspect of psychology in learning. Another view is the Psychological School of thought. According to this school, writing is the work of brain while hand is the agents which are used to execute the meaning or pattern desired. However this school neglects the function of brain in order to borrow the model from others. Hand write the forms which brain recorded. The theory on learning handwriting which is acceptable nowadays are comprises and mixtures of all three school of thought.

From formative stage, a writer move into the next stage which is the impressionable or adolescent stage. In this stage, person handwriting began to develop own style. The handwriting has changes in term of forms with various influencing factors. The desire of copying will still be there in search of personal style of handwriting. Changes will occur along this stage.

The next stage is the mature stage. This is reached once the writer becomes mature in term of handwriting. His or her handwriting adapt a more consistent form. Changes occur only in form of design or fluency. Fluency will be changing as a result of practices and writing frequency meanwhile design will be changes according to the occupation or circumstances. In overall, handwritings become more stable and consistent.

The final stage of handwriting's development in a person is the stage of degeneration or senility. This stage is more towards involuntary and under less control. In this stage, it is much influenced by the factor like disease, physical abilities and others. These are known as endogenous factors. As a human gets older, the ability of perception, motor skill degenerates and some may start to have disease which will affect handwriting such as Parkinson syndrome. These changes are different in different individuals and it is random. The handwriting of elderly people will be different from the handwriting of adult. Their handwritings show signs of tremor that cause inconsistency in term of slope, size, shapes and other. The quality and skill of handwriting become lesser. This mean changes occur as aging proceeds due to various factors and this raise the question on how these changes will affect the individual characteristics of the handwriting. Therefore this research is conducted with the objective to study the influence of age related retention of individual characteristics in handwritings. The samples have been collected from Malaysian subjects in the form of Malay Language, the national language of Malaysia.

LITERATURE REVIEW

Numerous researches and studies had been conducted with the purpose of expanding and widening the border of the forensics document examination particularly in the handwriting and signatures comparison.

One significant research was conducted at United States of America in 2002 by Shihari et.al. aiming to study and explain the individuality in handwriting. The study was a step into a new perspective in where it tries to explain individuality on the basis of statistical analysis. It was done on a population represented samples which comprises 1500 individuals in respect to gender, age, ethnic group and other proportion in US population. The analysis was done with computer based programs in various parameters such as pen pressure, writing movement, stroke, slant and word proportion in height. The result was computed in term of scientific statistical analysis. It was found that the confidence level for identification of writer is about 98%. The individuality of handwriting has the confidence level of 95%. It is also found that the confidence may up to 100% by considering finer feature. This study has proven that handwriting is unique to every person and can serve as positive evidence in forensic investigation.

Another study was conducted in 2002 on early elementary students by Deborah Marr and Sharon Cermak. The study was aimed to understand the consistency of handwriting on 93 subjects from kindergarten to first grade elementary school. The subjects were divided into groups based on their handwriting skills which are lower, middle and upper grade. The study was a longitudinal study where the post study was done after 15 months duration. The findings of the study indicated that there are 60% consistencies in the handwriting. There are improvement in some characteristics such as line accuracy and movement rhythm. This study proved that the handwriting in early elementary school student, who are in the learning phase exhibit inconsistency. Therefore a study of the retention of individual characteristics as age proceeds must be done on maturity stage subject.

Another interesting research was conducted by Marcio A.Oliveria and his colleagues in 2008 regarding age-related changes in finger task. This research looks into the functioning of hand and fingers in performing tasks. The study emphasize on finger strength and multi finger interaction in force producing task. The study considered subjects across life span up until sixty years old. From the study it is observed that the strength of finger decreases as age increases and finger's independency in flexion. From the analysis, it was found that finger strength increase during six to ten years old and reach it peak at 22 years old and later decreases as age proceeds on. The reason for this loss of strength is due to neuromuscular changes in aging. The changes are the decreasing number of motor neurons, the increase in size of motor neurons, and changes in contractile ability (Oliveira, Hsu, Park, Clark & Kun Shim, 2008). These changes will influence the outcome of task which involves finger. This includes writing which is much related to neuromuscular activity.

In 2008, Rueckriegel et.al. conducted a research which tried to explain handwriting from the functional anatomy perspective. The study explained the influence of age on kinematic hand movement in childhood and adolescent. It was done with 187 samples by requesting them to write and draw on digitizing graphic tablet. The parameters used for the study include speed, pressure etc. The result showed high correlation between the parameters and age. This proved that both the tasks are influenced by motor maturity. In addition, it was revealed that speed increased as ages proceed. Meanwhile the pattern of pressure as age increased is not well understood. Maturation in the analyzed parameters in handwriting was between 15 to 17 years old. This study gives an idea on the aspect of maturation phase in a writer's life and factor influencing it.

Many studies have been conducted to understand the various factors that influence handwriting for document examination. One study was conducted in 2002 by Faruk A ıcıo lu and Nurten Turan on the effect of alcohol on handwriting of 73 participants. From the statistical analysis, it was found that there were increases in parameters such as word lengths, height of upper and lower case, length of ascending letters, height of descending letters, space between words, number of angularity and number of tremor. These parameters bring significant changes and necessary to be assessed well during document examination. It is also found that the changes occur at any level of alcohol influence. The effect of alcohol on neuro-muscular activity causes the changes.

Individual characteristics had always been subject of interest for researches relating to handwriting examination. R. Marquis and his colleagues had demonstrated a study in 2005 on the size of writing. The study was about the size influence on shape of handwritten characters loops. The study was done using 2325 small letters and 692 enlarged letters. The enlarged letters are letters which the writer wrote in three times larger in size. It is found that there are significant differences. In producing enlarged loop letters, the loop was enlarged and the slant was lesser to either right or left. This fact should be cautiously examined when comparing documents with different size as it may lead to a wrong impression and interpretation. The difference in such comparison may due to size influence as well as forgery.

Vladimir Pervouchine and Graham Leedham (2006) conducted a very objective and complex study regarding extraction and analysis of forensic examiner features used for writer identification. The study was conducted using a computer analysis which takes a different approach than usual qualitative examination by expert. The study was conducted on three characters which are "d", "y" and "f" and also a grapheme "th". The study involved various parameters such as height, width, height to width ratio, final stroke angle, slant of ascender and others. The results of this research form a hypothesis that a character form is influenced by the adjacent letters. The grapheme was found to carry more discriminating elements or individual characteristics than any single characters ("d", "y" or "f"). This is an evidence showing connection between letters have great probative value.

In 2001 Stephen Ling conducted a study on the application of preliminary investigation on handwriting examination by multiple measurements of letters and spacing. The study was conducted on 10 subjects who wrote the same paragraph and repeat it after two years. Measurements such as word spacing, space between ascender, height, width, slope of ascender and also depth. From the analysis using these measurements, it is found that it could be able to discriminate the writer. This means simple measurements can distinguish writers. However it is also found that these simple measurements failed in identifying another sample of handwriting by the same writer after two years time. It indicated that it is not reliable in differentiating samples from same individual written at different time. Stephen concluded that expert opinion which is trained on identifying individual characteristics is more reliable and better than using simple measurement.

OBJECTIVES

This study is conducted with the aim to meet the following objectives:

1. To study the effect of age related retention on the individual characteristics of handwriting in forensic science perspective.

2. To study whether individual characteristics are retained as aging progresses.

3. To understand and explain the significant of these features in forensics' handwriting analysis.

4. To complete the requirement to fulfill the graduation terms and conditions.