

A QUANTITATIVE COMPARISON
OF SPONTANEOUS WITH DISGUISED
HANDWRITING

by Dolores Feigel de Maples

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*R. H. Shervenell and
Dygar*

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CURRICULUM STUDIORUM

Dolores Feigel de Maples was born September 21, 1934, in Puerto de la Cruz, Tenerife, Canary Islands. She received the Spanish Baccalaureate from the University of La Laguna, Tenerife, Canary Islands, in 1953.

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INTRODUCTION

It is generally accepted in psychology that personality is reflected in numerous ways, such as in expressive movements. One of the most natural records of expressive movement is found in handwriting specimens of practiced writers. Because these writers have practiced handwriting extensively, their idiosyncrasies are also reflected in their handwriting movement without their awareness of this phenomenon.

The great interest in handwriting throughout the centuries speaks for the general belief that each individual's handwriting has been studied from many points of view. It has been studied for characterological descriptions, hereditary, pathological and other trends, or to complement biographies of historical figures. Educational research has found it useful in their studies. Criminology has given handwriting an important place in its field, such as in matters of forgery, anonymous writings, and other cases where experts are consulted by courts when the identity of the writer has to be established. In these situations it is generally accepted that detection of the writer's identity is possible in spite of his efforts at disguising it or forging another person's handwriting.

To the present writer's knowledge, this widely accepted view has not yet been proven through a controlled

experimental study. Such investigation is most timely in the field of graphology, which faces the acute problem of often being criticized and attacked because of its lack of objective experimental evidence for the claims it makes as a projective method.

It is the aim of this study to attempt such a controlled objective observation and comparison. In this manner, the theory of continuity of personality is examined through handwriting by a quantitative comparison of spontaneous handwriting characteristics with the corresponding characteristics in disguised handwriting. By spontaneous handwriting is meant the writing used by an individual in everyday life, while disguised handwriting would be the purposefully altered spontaneous writing.

The theory of continuity of personality supports the view that personality remains unchanged under ordinary circumstances; it follows that its manifestations, such as in expressive movement, should remain essentially unchanged as well. Applying this conclusion to handwriting, its characteristics should essentially remain unchanged in disguise. That is, the individuality of spontaneous handwriting should be maintained at least in some aspects of disguised handwriting. This study's aim is to attempt to establish to what extent characteristics of spontaneous handwriting remain unchanged in disguised handwriting.

The study begins with a review of the literature in the field related to individual consistency of handwriting in general, followed by an evaluation of sources dealing with disguised handwriting. Concluding this first section is the statement of the hypothesis.

A description of the experimental design takes up the second part of the study. It comprises the kind of characteristics selected, their definitions and the statement of the null hypothesis for each; the subjects used are described followed by detailed experimental procedures, methods of measurement and statistical analysis.

In the final section of this study the results of these experimental procedures are given and interpretation of the results attempted. Attention is drawn to possible factors contributing to the methodological problems encountered. The need for further improvement of methodological approaches or entirely different approaches was found to be supported.

CHAPTER I

REVIEW OF THE LITERATURE

Literature dealing with graphology or the study of handwriting was selected with regard to the specific aim of this thesis, namely the comparison of spontaneous with disguised handwriting. The search of the literature revealed no attempts at systematic comparison of spontaneous and disguised handwriting. Therefore, to set a general theoretical frame of reference for this research, evidence supporting as well as rejecting consistency of individual handwriting together with different approaches used to arrive at these conclusions will be evaluated first. Following this evaluation will be a section summarizing literature existing on disguised handwriting. The chapter concludes with a statement of the major hypothesis.

1. Individual Consistency of Handwriting : Methodological Approaches.

It is generally accepted knowledge that the signature of an individual is considered his trademark so to say in everyday life. Many examples of a similar nature could be given since the literature dealing with the study of handwriting is extensive. However, in order to stay within the specific purpose of this study, only selected, relevant material will be brought to light here, respecting its

chronological appearance. In cases where many similar conclusions were arrived at by a number of authors, only a few have been selected so as to avoid repetition.

Regarding individual consistency of handwriting, five authors in the field of expressive movement were selected from amongst the many who stress that handwriting is a projection of the personality.

Ludwig Klages,¹ founder of the German Graphological Society, stated that there is unity of character in all volitional movements of any individual. Applied to graphology, handwriting to him represented "the sediment of living", of character, in which each single movement reflects the sum total of the writer's intellectual, emotional and physical tendencies.

Allport and Vernon's studies and observations based on statistical evidence, also led them to the conclusion "that there is some degree of unity in personality, that this unity is reflected in expression, and that, for this reason, acts and habits of expression show a certain consistency among themselves".²

1 John Elderkin Bell, Projective Techniques, Longman's Green & Co., p. 293, quoting Ludwig Klages, Handschrift und Charakter, Leipzig, Barth, 1919.

2 G. W. Allport and P. E. Vernon, Studies in Expressive Movement, New York, The Macmillan Company, 1933, p. 171.

Bell put similar ideas into these words:

Handwriting is not simply peripheral manual movement but the activity of the Gestalt which is called the personality. Handwriting [...] is an individual movement resulting in graphic products that bear unmistakable individuality.³

In a paper presented at the 50th Anniversary Meeting of the American Psychological Association, under "Measures of Personality", Wolff⁴ reported that data suggesting consistencies of graphic movements throughout life were found in the measurement of signatures of about one hundred famous people at various stages of their lives and in drawings of preschool children, indicating that a unit and organization of movement seems to exist independent of training. He also reported that in selecting documented signatures made in a state of elation and of depression there was found a regular increase of proportion in elation and a decrease in depression. This to him suggested a relationship between graphic movement, its proportions, its degree of consistency and personality. No details were given in the article as to how or whether statistical evaluations were made. The presentation at the meeting was illustrated with slides.

³ John Elderkin Bell, Op. Cit., p. 292.

⁴ Werner Wolff, "Graphometry: A New Diagnostic Method", Psychological Bulletin, Vol. 39, 1942, p. 456.

Several years later, Wolff⁵ described graphic experiments on the consistency of movement patterns taken in individual sessions. Each session was repeated twice after intervals of three days, the subjects being twenty female students. The experiment consisted of each subject drawing six simple geometrical patterns and writing her signature with eyes closed, once with the right hand, then once with the left hand. The same procedure was repeated with eyes open. Although Wolff did not say how measurements were obtained, he reported fifty-four per cent as the number of identities in the twenty subjects. According to him, ten per cent of identities can be obtained in similar random movements entirely by chance. Thus he concluded that his fifty-four per cent was far above chance.

He reported similar results in another experiment in which he used twenty male students. This time, the subjects made their signatures only, with the right hand, with the left hand, with eyes open and closed. Wolff reported that if the extent of the movements is measured, such as from the beginning to the end of the writing, in many cases it is the same. Such hidden consistencies are reported to have appeared in twenty-eight per cent of the cases, which is above chance.

⁵ Werner Wolff, Diagrams of the Unconscious, New York, Grune & Stratton, 1948, p. 20-27.

Wolff concluded that consistency apparently need not lie on the surface, but may be detected in the depth of the structure investigated. He repeated the experiment after a week and reported a slight decrease of consistency. To find out how much a conscious intention and the subject's resistance influence the movement patterns, after the consistencies of forms defined in terms of their lengths were demonstrated to each of the subjects, each was asked to repeat the experiment once more and to deliberately alter his signature. Very surprisingly, instead of decreasing, consistencies slightly increased. Wolff compared this phenomenon to the resistance against suggestion or hypnosis which may increase susceptibility and that likewise the resistance against the consistencies increased the subjects' readiness for them. The arithmetic mean for the consistencies of forms with twenty subjects in the third repetition of the experimental series was apparent in fifty-nine per cent of the cases. The arithmetic mean for the consistencies in the length of first and second name in the same experiment was observed in thirty-one per cent of the cases.

Although the number of subjects is rather small and it is not entirely clear how measurements were evaluated statistically, an authority like Werner Wolff and his conclusions can hardly be overlooked. He said that graphic movements get their individual pattern neither by chance nor

by learning nor by practice, but by factors of which the individual is unaware. He emphasized that graphic movement is a reflection of the total organization of the biopsychological personality and that graphic expression is not only patterned by some factors of personality, but by the unity of personality.

Thus, these five authorities in the field are consistent in the view that handwriting is a projection of the personality and that the expressive movements reflected are as consistent as personality itself.

In order to present some further evidence for these foregoing statements, the literature was reviewed with this point in mind and it was found that the study of handwriting has been the subject of great controversies.

In an extensive review of experimental research in graphology from 1933-1960, Fluckiger, Tripp and Weinberg reported high estimates of consistency of handwriting signs obtained by several researchers. However, these researchers stressed the fact that although "a vast number of articles have been written on handwriting in many languages, few rigorous experimental studies have been done."⁶ For them, handwriting is still in the "embryonic stage"⁷ experimentally.

⁶ Fritz A. Fluckiger, Clarence A. Tripp and George H. Weinberg, "A Review of Experimental Research in Graphology, 1933-1960", Perceptual and Motor Skills, Monograph Supplement 1, Vol. 12, 1961, p. 67-90.

⁷ -----, Op. Cit., p. 67.

Although these authors found that the trend is now more toward experimental investigation rather than the former speculation, they found it difficult to draw many conclusions since the methods used and the criterion variables investigated had been highly diversified. However, they did find that there has been a developing appreciation of the need for appropriate controls and for statistical treatment of data.

Experimental designs were found to approach the problem in two main ways: the holistic and the atomistic approaches. In the holistic experiments no attempt was made to specify the individual handwriting characteristics which were relevant in making the judgment, whereas in the atomistic studies the degree of appearance of some handwriting features was related to the appearance or magnitude of some non-handwriting variable.

The methods used in the holistic approach were almost exclusively of the matching and sorting type. Drawbacks of these methods are pointed out. For example, when pairings are not independent, a correct match increases the chance of another correct match and vice versa. Another weakness is that a judge often considers a particular handwriting to be characteristic of two, or perhaps three different individuals and clearly not characteristic of the others. In order to make the necessary pairing, he must make his final selection from the three nearly at random. In the matching method, a set of handwriting samples

is given to the judges along with independently obtained descriptions of the writers of those samples. These descriptions may consist of only one-sentence statements regarding the writer, diagnostic reports or personality sketches.

In many studies it was found that untrained judges were used and as Bell said, this "reflects on graphology about as much as the layman's capacity to read the record of an electroencephalograph would describe the validity of this instrument of the medical specialist".⁸

The second holistic approach described is the sorting method by which judges score or rank total handwriting samples with respect to the supposed presence of some variable in the writer, such as masculinity or intelligence. In this method, the judges must consider the samples with respect to each other. One limitation according to the authors is that they do not allow the examiner to make well defined statements about handwriting signs. Another limitation inherent is the use of judges which causes difficulties of reconciling inconsistent findings and of generalizing from results.

The authors seem to view the atomistic method as more objective, since more sophisticated measuring devices, like electronic machines or photographic equipment are available; also experimental designs can be used for specific handwriting characteristics, such as writing pressure or speed. However,

⁸ Bell, Op. Cit., p. 310.

these authors discovered that although the various devices to measure writing pressure and speed as well as combinations using photographic and cinematographic equipment are described, very little has actually been done experimentally with these devices. The writer assumes that this might be due to the difficulty of analyzing separate aspects of handwriting meaningfully when handwriting is considered an expression of the unity of personality and not of some of its isolated components. In this respect, Harvey⁹ concluded from one experiment he made in which he compared measures of traits of a slowly written text with the measurements of a rapidly dictated text of fifty college girls, that there was a complicated relationship between many handwriting signs. His study was criticized by Jan Meloun¹⁰ because he restricted his observations to measurable traits omitting to measure the individual degree of variability of every single handwriting characteristic in the same specimen, thus obtaining inaccurate average measures. He is of the belief that variability is an individual trait only in handwritings which have been produced at an habitual speed and under normal conditions.

⁹ O. L. Harvey, "The Measurement of Handwriting Considered as a Form of Expressive Movement", Character and Personality, Vol. 2, 1934, p. 310-321.

¹⁰ J. Meloun, "Handwriting Measurement and Personality Tests", Character and Personality, Vol. 2, 1934, p. 322-330.

Other researchers have been found to differ on this point, which will be discussed under the section of disguised handwriting.

Another experimental study measuring handwriting pressure, pressure range and speed of writing was done by Pascal¹¹ over a period of ten days. He found that these factors tend to remain relatively constant when the subject is asked to write naturally. He also found that they vary with the instructions given and the writing instrument used. In a later research he tested the significance of handwriting variables for personality, and found some significant relationships but advised caution in interpreting the results obtained.¹² In this study he used twenty-two college men, each subjected to several hundred hours of study by the Harvard Psychological Clinic. They were rated and ranked by psychologists for each of thirty-six personality variables and each of the twenty-two handwriting variables used. Pascal concluded from his findings that certain aspects of handwriting are significantly related to certain aspects of personality. He stressed the fact that research is necessary to clarify the problem of variability of handwriting measures, since different meanings must be attached to those aspects which remain relatively stable over a period

11 G. R. Pascal, "Handwriting Pressure: its Measurement and Significance", Character and Personality, Vol. 11, 1943, p. 234-254.

12 -----, "The Analysis of Handwriting: A Test of Significance", Character and Personality, Vol. 12, 1943, p. 123-144.

of time, than to those which tend to fluctuate with changing circumstances. Although Pascal advised caution in interpreting the results obtained, he still concluded that certain aspects of handwriting are significantly related to certain aspects of personality. Secord¹³ however, stated that Pascal's statistics, if correctly interpreted, do not support a relationship between handwriting and personality when both variables are measured according to Pascal's methods.

To overcome the difficulties arising with these segmented approaches, Lewinson and Zubin¹⁴ combined both clinical judgment and objective measurement with formal statistical methods. Fluckiger, et al., reported that this procedure has recently been viewed as the best method of combining clinical and statistical techniques for making predictions. Based on this scale, further research was done in combination with other projective tests¹⁵ but the authors did not account for the interrelationships among the individual variables.

13 E. F. Secord, "Studies of the Relationship of Handwriting to Personality", Journal of Personality, Vol. 17, 1949, p. 430-448.

14 T. S. Lewinson and J. Zubin, Handwriting Analysis: A Series of Scales for Evaluating the Dynamic Aspects of Handwriting, New York, King's Crown Press, 1942, as quoted by Fluckiger, et al., Op. Cit., p. 71.

15 R. L. Munroe, T. S. Lewinson and E. S. Wachsner, "A Comparison of Three Projective Methods", Character and Personality, Vol. 8, 1944, p. 1-21.

In another project¹⁶, no correlation was found between eleven of the twenty-two Lewinson and Zubin handwriting variables and judges' ratings of each of eleven personality variables to which the signs were supposedly related. However, an inherent flaw in this project was that only the hypothesis of the one-to-one relationship between an isolated handwriting sign and an isolated personality trait was tested, whereas the Lewinson-Zubin scale combines the scores of all the signs and the clinical judgment into one score. The reviewers point out another experimental study in which the Lewinson-Zubin scale was applied to the handwriting of two groups: thirty-three delinquent and thirty-three non-delinquent boys.¹⁷ It was found that in this study the scales did differentiate between the two groups in the expected direction. The global or complex score yielded by the signs of the Lewinson-Zubin scale seems to have meaning, whereas when only individual signs are singled out for experimental studies, the scale does not yield discrimination. The signs thus may relate to each other in a complex way which research so far has not elucidated.

16 F. P. Secord, "Studies of the Relationship of Handwriting to Personality", Journal of Personality, Vol. 17, 1949, p. 430-448.

17 H. Wolfson, A Study in Handwriting Analysis, Ann Arbor, Michigan, Edward Bros., 1949 as quoted in Fluckiger et al., Op. Cit., p. 67-90.

The reviewers concluded from investigating the literature that "those features which have been of prime interest to graphologists are hardest to measure and have received the least attention and that the field of applied graphology feels that the mainstream of its theory is untouched by experimental testing so far."¹⁸

On the other hand, another reviewer¹⁹ postulated that the reason for the lack of progress in reaching decisions concerning the nature of the relationships between handwriting and personality may lie in the methodology used, pointing out the following weaknesses:

- 1) Failure to consider the consistency of an individual's handwriting.
- 2) Insufficient attention to the reliability of raters' judgments: Out of eleven studies from 1919-1949 only three dealt with this aspect and all three report fairly high re-test reliabilities.
- 3) Lack of specification of criteria used to evaluate handwriting. It is reported that the basis for handwriting evaluation has been largely intuitive in these studies and that only in four of the eleven various measuring devices were employed. (The present writer also questions the competence of the judges used in these experiments in assessing handwriting, since most of them were untrained, except in four studies where graphologists were used as judges).

¹⁸ Fluckiger et al., Op. Cit., p. 86.

¹⁹ E. S. McNeill and G. S. Blum, "Handwriting and Psychosexual Dimensions of Personality", Journal of Projective Techniques, Vol. 16, Dec. 1952, p. 476-484.

- 4) Inadequacies of the global matching methods: questions arise such as which is the optimal number of matches beyond which efficient judgment is impaired. The order of presentation is important, depending on very easy or difficult matches; since an initial error can lower success to a degree where it does not represent the actual ability to judge. Statistical difficulties in this method are abundant.
- 5) The problems of tenuous generalizations are aired. The researchers state that Allport and Vernon, Bell, Cantril, Castelnuovo-Tedesco, Rand and Allport, Secord and Sonnemann are in unanimous agreement that statistical correlation of single graphic signs with personality traits is rubbish.

In conclusion, these authors tried to show that specific handwriting signs may very well be found to correlate with personality dimensions. The diversity of conclusions reached by a great number of researchers may confuse the reader. However, out of these contradictions emerge clear statements by authorities in the field, as previously outlined. Thus, Bell clearly stated that "single-trait analysis, while amenable to statistical treatment, is bound to discredit graphology, unless it is recognized that such analysis is not representative of the methods of graphology".²⁰ This may be the reason for the lack of atomistic experimental research using statistical analysis, and also may be the reason for the contradictory results in the experimental research done comparing personality traits to handwriting signs.

20 Bell, Op. Cit., p. 293.

To emphasize the aforesaid, the writer would like to quote Harrison who found that

[...] a handwriting may be characterized not only by the form of its master pattern but also by the nature and extent of the variation around the master pattern exhibited by each of the individual letter designs, since this varies considerably with different persons. [...] irrespective of the general appearance of the different specimens, all the handwriting of any individual will be characterized by the same master patterns for the letter designs which remain essentially unaltered. This will be the case whether the writer is alert or fatigued and whatever the nature of the writing instrument which has been used.^{21,22}

It seems that Harrison's method of arriving at these conclusions was by inspection and comparison of samples of handwriting, and singling out letters to have a clear master pattern of these. Statistical methods of analysis are not evident in his writings.

21 Wilson R. Harrison, Suspect Documents, New York, Frederick A. Praeger, 1958, p. 301-303.

22 Harrison uses the term "master pattern", meaning that although no single letter written by the same individual is exactly the same as the other because of natural variation, if these letters are taken as a group, they conform to the same basic form, characteristic of the individual writer. This basic form Harrison calls the master pattern.

Harrison's and previous similar views are supported however by an experiment carried out by Pophal and Dunker,²³ studying handwriting in slow motion. The authors pointed out that in previous decades studies using movie cameras were hampered by too slow an exposure time. With technical advancement these researchers were able to study, to their knowledge for the first time, handwriting movements in an adequately slow motion. For this purpose, they used a sixteen millimeter movie camera with thirty meter film (about ninety feet), taking one thousand exposures per second. They used only eleven subjects in this experiment due to expense incurred by technical requirements. The subjects' task in the experiment was to write one nonsense word while the handwriting movements were recorded by the camera. Tables were given in the article showing the various time measurements up to one thousandth of a second for the movement sequences with corresponding mean values.

Summarizing their results, the authors ventured to say - a) that slow motion photography of the handwriting movement provides a unique record of the finer graphic motor movements in their entirety, which cannot be seen in an already available written sample. Even the most careful

²³ Rudolf Pophal and Erich Dunker, "Zeitlupenstudien des Schreibvorganges", Zeitschrift fuer Experimentelle und Angewandte Psychologie, Vol. 7, 1960, p. 76-99.

observation of the writing movement is not capable of reporting meaningfully on the hidden graphic movement phenomena. This is only possible through analysis of slow motion, which also permits a numerical time analysis. b) Slow motion pictures of graphic movements can be used in graphological analysis. c) They also help in clarifying the question regarding the rhythm of the stroke. The authors maintained that if a single stroke really has rhythmic phenomena of its own, as has been asserted, they should be detectable in slow motion film. Rhythm was not detected in the graphic strokes of the eleven subjects used when these strokes were examined by means of the slow motion film. Although it is not entirely clear what the researchers meant by rhythm of the stroke, rhythm is a characteristic recognized by many investigators of expressive movement.

Rhythm is a term difficult to define. The writer sees rhythm as a pattern that cannot appropriately be studied through analysis of a quantitative nature, which might explain why the above researchers did not find it in single strokes. More pertinent to this study is the authors' final conclusion that movements of the hand through the air, the starting movement of writing, the movements when pausing as well as the manner of writing itself showed individual nuances which had never been observed before. Thus, this study would support the individual consistency of hand-

writing even though it is to be considered as a pilot study because of its reduced number of experimental subjects.

In a more recent study which explores the relationship between handwriting and personality factors, Mann²⁴ compared two samples of spontaneous handwritings written at intervals of five weeks. In this study he found high re-measurement reliability, mostly in the nineties, the average correlation being .95, for what he described as basic handwriting variables.

While in the above mentioned study high re-measurement reliability was found, further investigations by Hofsommer, Holdsworth and Seifert²⁵ not only revealed high interscorer reliability based on an analysis of written samples and writer personality variables; the influence of the type of writing tool used was investigated and found to be of satisfactory reliability.

One sub-study of the above investigation, especially pertinent to the present study, examined the questions of

²⁴ Wilburn Raymond Mann, A Continuation of the Search for Objective Graphological Hypotheses, unpublished Ph.D. thesis presented to the University of Ottawa, 1961, vi-92 p.

²⁵ W. Hofsommer, H. Holdsworth and T. Seifert, "Reliabilitätsfragen in der Graphologie" (Questions of Reliability in Graphology), Psychologie und Praxis, Vol. 9, No. 1, 1965, p. 14-24.

writing tool reliability as well as reliability of judgments made by two psychologists. It will be shortly described in the following:

Subjects were nineteen foresters who were asked to write a short, improvised story with ink and a similar story with pencil. After one week the same experiment was repeated under the same circumstances. Subjects knew about the scientific purpose of the investigation and were asked to write as naturally as possible, especially not to purposely disguise their writing. The nineteen writings in ink were submitted to two independently working psychologists whose task it was to classify them in rank order according to the subjects' suitability as foresters. The same procedure was followed for the samples written with pencil, and for the two samples written a week later. The judgment was based on prerequisites necessary to fill a leading position (such as available vital energy, self-confidence, adaptability, balance between impulse and control, etc.)²⁶ τ coefficients were calculated.

²⁶ Translation of German terms by the writer:
(z.B. gute Energiereserven, Selbstvertrauen, Anpassungs-
fähigkeit, Balance zwischen Antrieb und Steuerung usw.)

Correlations were high irrespective of the type of writing tool used. All values obtained for the type of writing tool used were on the .01 level of significance. Correlations were high for judgment irrespective of the type of writing tool used.

In interpreting these results, it has to be remembered that one is considering the reliability of diagnostic judgments. The main purpose in describing the foregoing study was to illustrate the reliability of judgments found with respect to the type of writing tool used, since this was claimed by other authorities in the field without providing experimental evidence.

Wallner²⁷ made a survey of methodological problems and of successful and unsuccessful correlation and factor analytical studies of graphological data published up to 1963. He pointed out that the measurements of graphic variables of one factor analytic study done by Lepine, Lorr and Golder²⁸ were undertaken in an entirely inappropriate manner. He used this study to illustrate that statistical analysis should never be undertaken without thorough knowledge of the material studied. Conclusive statements concerning the validity of

27 Teut Wallner, "Graphologie als Objekt statistischer Untersuchungen", Psychologische Rundschau, Vol. 16, No. 4, 1965, p. 282-298.

28 L. T. Lepine, M. Lorr and J. Golder, "A Factor Analysis of Some Handwriting Characteristics", Journal of Personality, Vol. 22, 1954, p. 348-353.

graphologic assessments cannot yet be made because the results of various investigations are not unanimous. However, Wallner also pointed out that those investigations in which the interests of graphology are adequately considered by the experimenter generally lead to results which seem to justify further systematic investigation of handwriting as a projective method.

To sum up, it has been established in the previous experimental studies mentioned that high remeasurement reliability exists and that the different types of writing instruments used were found to be of insignificant influence in judging handwritings. In spite of great methodological problems further investigation in this field seems justified. The review of the literature also points toward the existence of individual consistency in handwriting in ordinary circumstances. With this in mind, the discussion will now turn to non-spontaneous, deliberately altered handwriting.

2. Disguised Handwriting.

The question of whether individual handwriting can be successfully altered or disguised through deliberate efforts of the individual has been a matter of legal concern. It is generally known that experts are consulted in court judgments in cases of forgery or when the legality of signatures is contested. In the following, several authors' statements on the subject will be presented.

In order to answer the question of whether the expressiveness of handwriting is an individual one, Wolff²⁹ undertook several experiments, which will be described briefly.

In one experiment, he used twenty female students in the Department of Psychology at Vassar College in 1941-1942. Each subject was instructed to write the words "The United States of America" in the subject's ordinary handwriting, then in printed capital letters and then in a disguised handwriting. The second part of the experiment consisted of giving each subject the mentioned handwriting sample written in triple form (normal, printed and disguised) by three other subjects with instructions that they were going to make experiments in judging graphic movements. They were told that the specimens were written by students and that if the handwriting was recognized, to report it immediately. They were asked to match those specimens which were produced by the same writer out of the nine specimens submitted and to distinguish between the original and the disguised handwriting. Results were reported as eighty-three per cent of correct matching of unrecognized specimens and seventy per cent of correct distinctions of original from disguised handwritings.

²⁹ Werner Wolff, Diagrams of the Unconscious, New York, Grune & Stratton, 1948, p. 178.

The question arises that if graphologists had been used for the matching procedure in this investigation, the percentage would probably be higher still. With reference to previous critiques of the matching method, however, it seems that the sample used is rather small and to choose from three sets of samples is smaller yet. There is a final question of whether students all reported writings they may have recognized. It is not that the present writer does not agree with Wolff's statement that "disguise in handwriting and forgery may be detected by the fact that certain characteristics of handwriting usually are difficult to change".³⁰ It is only the method used in the experiment that is criticized because it is believed higher percentages could be obtained. Wolff is of the opinion that if handwriting identification succeeds in cases where the usual writing is purposely disguised, it follows that the writer in spite of his intention to transform his writing is not able to do so. He concluded that there must be trends in the writer's personality of which the writer is unaware. Reference is made here to Wolff's³¹ experiment in which subjects were asked to repeat an experiment and to deliberately alter their signature after consistencies in these had been pointed out to them.

³⁰ Werner Wolff, Op. Cit., p. 11.

³¹ -----, Op. Cit., p. 20-27.

Instead of decreasing, consistencies slightly increased.

Harrison³², Director of the Home Office Forensic Science Laboratory in Cardiff, stated that the master patterns, mentioned previously, of writings of different appearance by the same author can be seen to be identical. Amongst his many observations he also noticed that certain features are rarely disguised, mentioning that the general appearance of a handwriting may give a useful pointer to its probable author, for instance, in the spacing of the words. Harrison continued saying that in the majority of disguised handwritings the word spacing is almost certain to be proportionate to that of the normal script, and that the arrangement of the writing, like margins, space between lines, and the extent to which paragraphs are inset, is rarely affected by disguise. However, he did not mention what methods he used to examine the handwriting specimens.

Many of the other characteristics he mentioned only occur in some writings, since they are idiosyncrasies of the individual and the search of the literature has not revealed any statistical methods by which these could be approached. To mention some examples of these idiosyncrasies: underlining of words, connected words, special elaborations, at

32 Wilson & Harrison, Op. Cit., p. 301.

the beginning, the middle or the end of words, types and placement of i-dots, and so on. This would also apply to omissions of letters, parts of letters or words.

Finally, the writer would like to quote what Dr. Saudek said on the subject:

The assertion that handwriting may be arbitrarily modified can, so far as graphological observation is concerned, be admitted only in a very restricted sense. Experience in thousands of cases, particularly in regard to legal graphologists, has proved that in forgeries, it nearly always has occurred that only those features of the writing were altered which graphologically were not relevant, but were most striking to the unpractised observer.³³

The most recent research seems to be in accord with this statement, as shown in the first section of this chapter on the consistency of handwriting.

From the search of the literature it may be concluded that detection of the writer's identity is possible in spite of his efforts at disguising it or forging another person's handwriting. This widely accepted view so far has never been proven through a controlled experimental study, using disguised handwriting for comparison.

³³ Robert Saudek, The Psychology of Handwriting, London, Allen and Unwin Ltd., 1925, p. 7.

Therefore, it is felt that these commonly accepted views should be investigated under controlled conditions. Such investigation is most timely in the field of graphology, which faces the acute problem of often being criticized and attacked because of its lack of objective experimental evidence for the claims it makes as a psychodiagnostic method.

It is the aim of this research to attempt such a controlled objective observation and comparison. Based on the theory of the continuity of personality, disguised handwriting should reflect the writer's individuality even in purposeful attempts at altering his expressive movements used in his spontaneous handwriting. This hypothesis would be supported by the empirical evidence in the literature presented throughout this chapter.

Thus, it may be hypothesized from these premises that there are characteristics in spontaneous handwriting which remain essentially unchanged in the disguised handwriting produced by the same individual.

The specific hypothesis to be tested in this study is that there are no significant differences between spontaneous and disguised handwriting on selected, objectively measured handwriting characteristics, namely length and

height of words, inclination of writing lines, terminal spurs and left-hand margin.

The procedures of this experiment will be presented in the following chapter.

CHAPTER II

EXPERIMENTAL DESIGN

Within the context of the ideas emerging from the search of the literature presented in the first chapter, this chapter will detail the experimental procedures used to obtain and compare samples of spontaneous and disguised handwriting for purposes of testing the hypothesis proposed at the end of the previous chapter.

This chapter begins with the enumeration of the handwriting characteristics used in this experiment and the reason for their selection. Operational definitions of these characteristics are given, some of which are based on the previously mentioned study by Mann.¹ The hypothesis for each of the characteristics is then stated. A description of the subjects used and the rationale for their selection follows in the second section of the chapter. The third section deals with the description of the material, followed by detailed experimental procedures. The fifth and last section of this chapter deals with an extensive description of the methods of measurement and statistical procedures used. Figures are included where clarification was thought to be necessary.

¹ Wilburn Raymond Mann, A Continuation of the Search for Objective Graphological Hypotheses, unpublished Ph.D. thesis presented to the University of Ottawa, 1961, vi-92 p.

1. Handwriting Characteristics Selected.

The original aim of the research was to include the following handwriting characteristics: left-hand, right-hand, top and bottom margins; length of words; height of words; distance between words; distance between lines; inclination of writing lines; connections between letters; connectedness and disconnectedness of writing; pressure on the paper; idiosyncratic characteristics, such as underlining, punctuation, i-dots, t-bars, end spurs, elaborations, emphasis on the beginning, middle or ending of words or other idiosyncratic forms of letters. The reasons for reducing their number were various. It was found that the study was too ambitious for one investigator to undertake the measurement of over twenty handwriting characteristics. Furthermore, some characteristics had to be eliminated which were either not clearly objectively measurable, or which were idiosyncratic and therefore not found in all samples.

To expand on the reasons for reducing the number of characteristics selected, for instance only the left-hand margin was selected for measurement instead of all four margins: the top, bottom and right-hand margins were thus not considered. The length of words was considered, but the length of the distance between words or lines was eliminated from the original list. These characteristics would be objectively measurable, but are similar to the two finally

selected and therefore were considered to increase the bulk but not the purpose of this study.

Amongst those characteristics which were not clearly objectively measurable on the original list were the type of connection between letters used, breaks between letters or the pressure applied on the paper. Judgments here would be considered subjective or marginal and thus the statement of objectively measuring would be blurred.

Finally, the idiosyncratic characteristics, such as underlining of words, connection of words, elaborations, placement of i-dots and t-bars, emphasis placed on the beginning, middle or ending of words, spelling errors, particular form of letters, could not be considered for the obvious reason that they do not appear in all samples.

Thus, the five handwriting characteristics selected were:

1) Length of words - The distance measured in a horizontal line from the furthest point to the left of the word to the furthest point to the right of the word. (See Figure 1, a), page 31.)

2) Height of words - The distance between the highest point of the word's middle zone and its base measured in a perpendicular line. The middle zone comprises the body of each word without the peripheral extensions of the letters. (See Figure 1, b), page 31.)

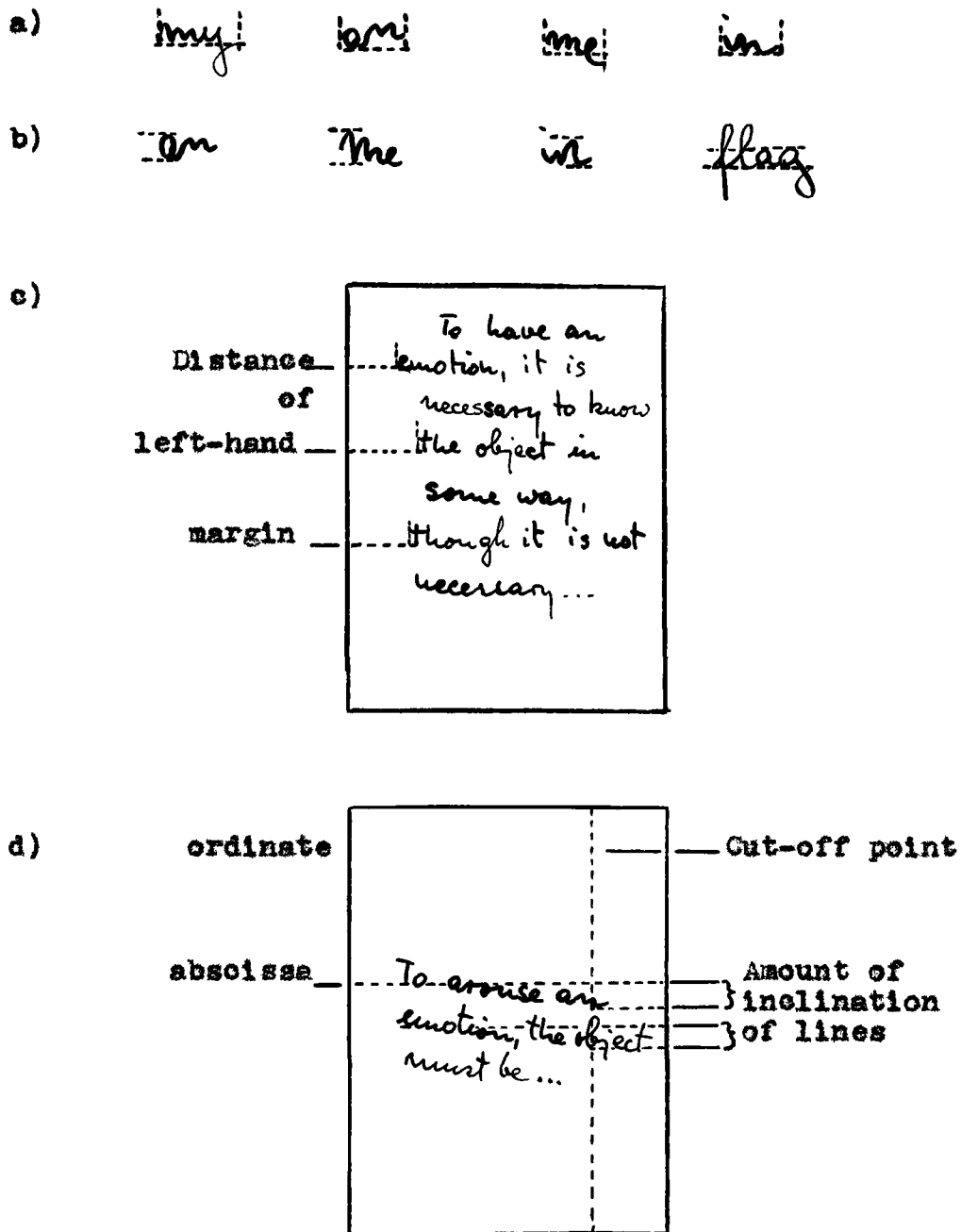


Figure 1. Graphic Representation of Operational Definitions of Terms

- a) length of words
- b) height of words
- c) left-hand margin
- d) inclination of writing line

3) Left-hand margin - The horizontal distance between the left-hand edge of the paper and the point furthest to the left of the base of the first letter in the line. (See Figure 1, c), page 31.)

4) Inclination of writing lines - The ascent or descent of the writing line when the base of the first letter of that line is taken as abscissa and the edge of the paper as ordinate. (See Figure 1, d), page 31.)

5) Terminal spurs - The rightward extensions formed by the pen visibly passing the right border of the last letter of each word.

All these characteristics yield high remeasuring reliability, as for instance found by Mann² to be mostly in the nineties. According to the literature the characteristics selected would be those least likely to change under present experimental conditions.

It is hypothesized that there is no significant difference in the length of words as measured in a spontaneous and a disguised handwriting sample of fifty-five subjects used in the experiment.

2 Wilburn Raymond Mann, A Continuation of the Search for Objective Graphological Hypotheses, unpublished doctoral thesis presented to the University of Ottawa, 1961, vi-92 p.

It is further hypothesized that there is no significant difference in the height of words as measured in a spontaneous and a disguised handwriting sample of fifty-five individuals used in the experiment.

It is hypothesized that there is no significant difference in the left-hand margin as measured in a spontaneous and a disguised handwriting sample of fifty-five subjects used in the experiment.

It is also hypothesized that there is no significant difference in the inclination of writing lines as measured in a spontaneous and a disguised handwriting sample of fifty-five subjects used in the experiment.

It is finally hypothesized that there is no significant difference in the terminal spurs as measured in a spontaneous and a disguised handwriting sample of fifty-five subjects used in the experiment.

2. Subjects.

The subjects used for the experiment in this study consisted of fifty-five students enrolled in a course of introductory psychology at the University of Ottawa. The rationale underlying the hypothesis regards the continuity and uniqueness of personality. Therefore subjects were selected of which one can safely assume that they are practiced writers and thus would reflect their individuality in the

unhampered flow of their writing movement. This would not apply to children or to those adults without writing practice, since both are bound to copy the model letters. Thus, their usual flow of expressive movement would be hampered and consequently the expression of their individuality as well.

Other variables, like sex, age, ethnic group, should not influence results as long as all subjects used the same type of writing, which in this case was the Latin script. The mean age was estimated around twenty-five years with a range from 18-35 years.

3. Description of Material.

The material used consisted of two sets of seven chemically sensitized sheets of paper of equal quality, size 8½" x 11", glued together in block form at both ends.

Subjects used their own fountain pen or ball point pen, since the type of writing utensil used should not influence the outcome of this study.

A typewritten, mimeographed passage consisting of two paragraphs was supplied with written instructions for the first part of the experiment. Further written instructions were supplied for the second part of the experiment. A sample of the passage mentioned may be found in Appendix A. The content of the instructions will be quoted in the following section on experimental procedures.

4. Experimental Procedures.

The procedures consisted of two parts. In the following will be an exact description of these.

1) Procedures for Spontaneous Handwriting -

In order to enhance cooperation, the experiment was conducted during the usual lecture time. Before distributing the material, the experimenter was introduced to randomly seated subjects by their professor. The experimenter made a short statement to the effect that an explanation about the experiment would be given once they had followed the instructions that were soon to be handed out. The subjects were also asked not to handle the paper before starting the experiment. The paper was then placed in front of each subject and the instructions handed out to them together with the passage to be copied. The instructions read as follows: "Please copy the following passage on the paper supplied to you, preferably using your own pen". An exact copy of the passage may be found in Appendix A. The blocks of paper had been numbered from one to fifty-five and each provided with the letter "A" for the first part of the experiment. The second set of blocks was only lettered with the letter "B" but the numbering was left out. The purpose of this procedure was to distinguish spontaneous handwriting samples from the disguised through lettering. The numbering was provided so that each individual could be distinguished from the rest without having to use

names. In order to ensure anonymity, the subjects themselves inscribed the second set of blocks with the same number as the one figuring on the first set.

Once all subjects had finished copying the passage in question, the experimenter explained that the purpose of this experiment was to compare the spontaneous with disguised handwriting and that no handwriting analysis was intended. Anonymity was further assured through the manner of lettering and numbering of the paper. Questions were answered as fully as possible. The subjects kept their first set of blocks so that they could check how they had written the passage when they were trying to disguise their handwriting on the second set of blocks.

2) Procedures for Disguised Handwriting -

Before handing out the second set of written instructions, subjects were encouraged verbally to alter their handwriting as much as they could and to take as much time as they wanted since there were no time limits set. Rapport was felt to be very good judging by the questions asked. When the examiner felt that the subjects were sufficiently motivated and had understood the aim of the disguise, the second set of blocks of paper, lettered "B" was distributed together with the following written instructions, so as to avoid any possible misunderstanding:

Now copy the same passage disguising your handwriting as much as you possibly can for the purpose of concealing your identity. This might be difficult to do, but suppose you are in a situation where this is a matter of life or death, so that if your identity is discovered, your penalty will be capital punishment ... However, you may not use printed or block letters. The writing has to be in long-hand and look fairly natural. You may make all changes you like otherwise.³

The reason for barring the use of printed or block letters is that they are extremely difficult to use for purposes of comparison with long-hand. The flow of motion is nearly entirely lost and idiosyncrasies are harder to detect when single letters are formed in such a manner.

Once the subjects had finished the task of disguising their handwriting, they were asked to mark the second block of paper lettered "B" with the same number as the one on their block lettered "A". This procedure assured them of their anonymity while the examiner obtained the disguised handwriting corresponding to the spontaneous handwriting sample. Both sets of blocks of paper were then collected randomly from the subjects who helped gather them. Many subjects seemed very interested in the subject matter as could be assumed from the questions asked after the conclusion of the experiment, which further supported the impression of good rapport and cooperation gained during the experiment.

³ Instructions given to subjects concerning disguised handwriting.

The time required for the experiment including introduction, establishment of rapport, verbal instructions and question period was not more than the usual class period of two hours.

5. Methods of Measurement and Statistical Analysis.

The objective methods of measurement and statistical analysis applied to the data obtained will be described in detail in this section. Definitions of terms precede each characteristic measured.

1) Length of words - The length of the word is defined here as the distance measured in a horizontal line from the furthest point to the left of the word to the furthest point to the right of the word. (See Figure 1, a), page 31.)

Measurements were taken in millimeters, using graph-paper, superimposed on the first three of each of the following words as they appeared in the sample: "an", "me", "in", and "my". The selection of these words was made primarily because of the frequency of their occurrence in the passage, as averaging the lengths of these words provides a correction for the internal variability of the handwriting. Because the type of words selected are written more frequently, they become unobtrusive to the writer, thus making them more likely to bear the writer's individuality in disguise. The reason for

writing these words more frequently lies in their function as qualifiers, or connecting words, which would explain why one's conscious attention is less focused on these than on other words which carry the meaning of the sentence.

For the statistical analysis, the differences between the sums of measurements for each individual's spontaneous and disguised handwriting were calculated. From these values, the square of the differences and the mean difference were obtained.

2) Height of words - The height of a word is defined here as the distance between the highest point of its middle zone and its base, measured in a perpendicular line. The middle zone of a word comprises the body of the letters without their peripheral extensions. (See Figure 1, b), page 31.)

Measurements were taken in millimeters, using graph-paper, superimposed on the first three of each of the words "an", "me", "in", and "my" as they appeared in the passage. The reasons for their selection were the same as those given in the previous sub-section under "length of words".

For statistical analysis, the differences between the sums of measurements obtained for each individual's spontaneous and disguised handwriting were calculated. From these values, the mean difference and the square of the differences were obtained.

3) Left-hand margin - The left-hand margin is defined here as the horizontal distance between the left-hand edge of the paper and the point furthest to the left of the base of the first letter in a line. (See Figure 1, c), page 31.)

Measurements were taken in millimeters, using five alternate lines. Paragraph indentations were disregarded because they are not considered representative of the margin.

For statistical analysis, the differences between the sums of the five alternate lines used for each individual in the spontaneous and the disguised handwriting were calculated. From these values, the mean differences, the square of the differences and the sum of these differences were obtained.

4) Inclination of writing lines - The inclination of a writing line is defined here as the amount a line has ascended or descended at the 160th mm from the left edge of the paper when this is taken as the ordinate and the base of the first letter in that line as the abscissa. (See Figure 1, d), page 31.)

Measurements were taken in millimeters, using graph-paper, superimposed on the first five writing lines of the second paragraph. The amount of inclination of the writing lines was thus measured at the 160th millimeter cut-off point using the base of the first letter of the line being measured as abscissa.

Two treatments were used in the statistical analysis. In the first, the difference between the sums of the ascending lines in the spontaneous and disguised handwritings were calculated separately from the difference between the sums of the descending lines. From these two values, the corresponding mean differences and squared differences were obtained.

In the second treatment, the spontaneous and the disguised handwriting samples were analyzed separately. The descending lines were subtracted from the ascending lines, the differences between these results were then calculated and the corresponding mean difference and squared differences obtained.

5) Terminal spurs - Terminal spurs are defined here as the number of rightward extensions of the letter "s" visibly passing the right border of the letter.

Measurements were obtained by counting the number of spurs in each sample.

For statistical analysis, the differences between the number of spurs in the spontaneous and the number of spurs in the disguised handwriting were calculated for each individual. The mean difference and the sum of the squared differences for each individual were obtained from these values.

To test the null hypotheses for these five handwriting characteristics, the t-test of significance of difference between correlated means was applied, represented by the following formula:⁴

$$t = \frac{M_d}{\sqrt{\frac{(D - M_d)^2}{N(N - 1)}}$$

In the following chapter, the statistical results will be presented and discussed. Possible factors likely to contribute to the methodological problems encountered in the literature as well as in the present study will also be discussed.

⁴ Lawrence-T. Dayhaw, Manuel de Statistique, Ottawa, Éditions de l'Université d'Ottawa, 1963, p. 364.

CHAPTER III

RESULTS AND DISCUSSION

While the previous chapter dealt with the description of methods of measurement, definitions of handwriting characteristics, and the kind of statistical procedures used in this study, this chapter will deal with the results obtained in testing the null hypotheses and the interpretation of these results. Conclusions drawn from the statistical results with tentative explanations regarding possible factors contributing to methodological and other problems encountered in the experimental field of graphology form the final section of the chapter.

1. Statistical Results.

The first handwriting characteristic considered, the results of which appear in Table I, refers to the length of words. As can be gleaned from Table I, the hypothesis of no significant difference in the length of words as measured in a spontaneous compared with a disguised handwriting sample of fifty-five subjects used in this experiment, was not refuted. No significant difference was found at the .01 level, with a t -value of 1.00 and a mean difference of 5.45.

Results obtained for the second characteristic, the height of words, are summarized in Table I. These results led

Table I.-

Results of Measurements and t-Values for the Five Characteristics of Handwriting for Fifty-five Subjects.

Characteristic	Mean		M _d	Σd^2	t
	Spont. A	Disg. B			
Length of Words	146.73	143.27	5.45	89,786	1.00
Height of Words	31.98	37.16	-5.47	5,578	-4.24*
Left-hand Margin	58.24	49.55	8.90	26,673	3.26*
Inclination of Lines					
Treatment I					
Ascending	-8.09	11.16	-3.07	9,741	-1.77
Descending	-8.33	11.65	-3.32	13,597	-1.59
Treatment II	-0.38	0.76	-0.78	31,246	-0.24
Terminal Spurs	7.87	7.02	0.85	2,195	1.00

* Significant at the .01 level

to rejection of the hypothesis that there is no significant difference between measurements of fifty-five spontaneous and disguised handwriting samples of the fifty-five subjects used in this experiment. Table I shows a mean difference of -5.47 and a t -value of -4.24 which was significant at the $.01$ level. The results obtained were thought to be influenced by the selected measurement, that is, using only the highest point of the middle zone of the words measured. However, when all the heights of the middle zone of the same words were measured to obtain an average height the results and t -values were almost identical with those obtained in the first approach.

The hypothesis for the third handwriting characteristic, that there is no significant difference in the left-hand margin as measured in a spontaneous and a disguised handwriting sample of fifty-five subjects used in this experiment, was not rejected by the results obtained. The mean difference calculated was 8.9 and the t -value of 3.26 was significant at the $.01$ level. Table I shows these results together with the results obtained for the other characteristics.

The hypothesis that there is no significant difference between the inclination of writing lines, ascending or descending, as measured in a spontaneous and a disguised handwriting sample of the fifty-five subjects used in this study could not be rejected on the basis of either of the two treatments applied to the data.

In the first treatment, where the differences between the sums of the ascending lines between the spontaneous and the disguised handwriting sample were obtained, a mean difference of -3.07 and a t-value of -1.77 were obtained. The results of the same procedure applied to the descending lines were similar, that is, a mean difference of - 3.32 and a t-value of -1.59 were obtained. Neither of these values were significant at the .01 level. These findings are summarized in Table I.

In the second treatment, the measurements of the descending lines were subtracted from those of the ascending lines for the spontaneous and the disguised samples separately. Then the difference between these results was calculated. A mean difference of -0.78 and a t-value of -0.24 were obtained which was not significant at the .01 level. These summarized results are presented in Table I.

The fifth hypothesis, namely that there is no significant difference in the number of end spurs between a spontaneous and a disguised handwriting sample of fifty-five subjects used in this study, was not rejected by the statistical results obtained. The mean difference calculated was 0.85 and the t-value obtained was not significant at the .01 level, as shown in Table I.

2. Interpretation of Results.

The results summarized in Table I show that three of the five characteristics measured do not reject the hypothesis that there is no significant difference between their measurements in a sample of spontaneous and disguised handwriting.

It is obvious from the literature¹ and from the inspection of handwriting samples obtained in the present experiment, that the size and slope are amongst the characteristics most likely to be modified when disguise of handwriting is attempted. A modification of these two aspects of handwriting produces a considerably different appearance to the eyes of the untrained observer, which is why size and slope are frequently modified. Any change in size would also be expected to affect three of the characteristics studied, namely the length of words, the height of words, and the left-hand margin considering that proportion is their common denominator. Therefore, the results obtained for each of these three characteristics will be interpreted followed by a summarizing discussion. Finally, results obtained for the remaining two characteristics examined in this study will be discussed.

¹ Wilson M. Harrison, Suspect Documents, New York, Frederick A. Praeger, 1958, p. 349.

When examining the results obtained for the length of words, the means and the mean difference indicate a general, although insignificant tendency to decrease word length in disguised writing. The failure to reject the hypothesis of no difference provides support for graphologists. When considered from the standpoint of what usually happens in attempts to disguise handwriting, namely the tendency to increase size of letters, the nonsignificant decrease in length of words in disguise demands an explanation. The consideration of the effort involved in disguising one's handwriting leads to the realization that, as movements become more restricted, expansiveness is reduced. This could then easily produce the effect of a nonsignificant reduction in length of words.

While in general the length of words does not change significantly in disguise, as has just been discussed, the height of letters appears to increase in disguise, shown by the means and the negative mean difference for the height of the words. Although this phenomenon seems to contradict the findings for length, the effort involved in disguising one's handwriting just mentioned, producing the nonsignificant reduction in the length of words, could also produce an upward squeezing of the letters. In this manner, the significant increase in height could be produced in disguise, as found in the present study. Of course, those individuals

trying to decrease their usual letter size would also decrease their letter height. However, the principle of proportion mentioned at the outset of the interpretation of results should always be considered when there is a question of alteration of size. This point will be discussed further in the summarizing statements regarding the three characteristics of length and height of words, and the left-hand margin.

Results obtained for the third characteristic examined, the left-hand margin, indicated that margins tend to become narrower in disguise, as may be deduced from the means and the mean difference obtained.

In the review of the literature, it was pointed out that according to an expert in the disguise of handwriting,² in the majority of disguised handwritings, the word spacing is almost certain to be that of the normal script. Extending this further, it should also apply to length and height of words, margins, arrangement of the written page, space between the lines, paragraph indentations and all other aspects dealing with proportions, as has been postulated previously in the discussion of the results.

One might conclude therefore, that a different evaluation of the height of words and the approach to the left-hand margin might invalidate the negative results obtained in this study. To meaningfully represent the essential aspects of these characteristics, dependent upon

² Harrison, Op. Cit., p. 301.

proportion, an approach considering proportions as the main point of departure would most likely be more successful.

A comparison using metric measurements would then appear as not entirely recommendable and appropriate without taking into consideration that other characteristics might appear to be modified while their proportions remain the same. The writer does not know of any manner of overcoming this barrier of comparison with the presently available and required methods and thus had to use what was considered to be the most suitable approach in the circumstances.

The results of both treatments to statistical analysis of the inclination of writing lines would support the hypothesis of no difference between spontaneous and disguised handwriting for the measured characteristic. Although the second approach yielded a smaller mean difference, it is felt that the method used in the first treatment is more representative of the handwriting samples studied because ascending lines are considered separately from descending ones. This would permit a closer observation of what happens in disguise with ascending or descending lines separately and would permit a better appreciation of any tendencies by inspection of the raw data. However, it is noted that although results are not significant at the .01 level, the tendency in both cases seems to indicate an increase of the degree of inclination of the disguised line. That is, if in the

spontaneous handwriting lines generally go upwards, the disguised sample would show this tendency even more and vice versa.

The mean difference obtained in the measurement of terminal spurs would indicate that there is a general tendency for spurs to decrease in number in disguised handwriting, although the difference was not found to be significant at the .01 level. This tendency towards a decrease of spurs in disguise is probably due to the factors mentioned earlier, such as the greater effort and concentration involved resulting in more constricted movements.

The present writer should like to point out that the results obtained for two out of the three characteristics which have proportion as their common denominator, namely length and height of words and the left-hand margin, rejected the hypothesis of no difference. Taking the previous statements on the matter of proportion into consideration, the basic tenet of this thesis is strengthened in view of the findings of no significant difference for three of the five five characteristics measured. Future research may have an entirely different approach which would greatly simplify and permit a more representative evaluation of what has been done in this study.

In summary, results of measurements of five handwriting characteristics from a sample of spontaneous

handwriting compared with the corresponding characteristics from a sample of disguised handwriting of fifty-five subjects would permit the rejection of the null hypothesis for two of these characteristics. On the other hand, results for the remaining three characteristics did not permit rejection of the hypothesis of no difference.

3. Factors Likely to Contribute to the Methodological Problems.

The present writer has come to realize that the lack of rigorous experimental studies may be due to the difficulty in meaningful representation of expressive movement in handwriting by using measurements of the conventional type. Consequently, the evaluation of these measurements in the usual statistical manner would not reflect an entirely accurate picture of the expressive movement inherent to handwriting. The writer believes that a possible explanation of this problem of measurement and statistical analysis is that in comparing many individuals to one another and thus obtaining one global measure for all, the idiosyncrasies of each are lost. Thus, something global would be compared that might not be found in any of the expressive movements of the individuals in question. The reason for this assumption is based on the uniqueness of every individual's expressive movement. This expressive movement purportedly has internal consistency and yet no two movements are mathematically identical.

Considering this to be true, then the mean of mathematical measurements of a number of handwriting characteristics would not give a true picture of an individual characteristic, even when taken from one and the same individual. The error might be carried over when groups of individuals are used. This statement concerning the internal variability can be verified by comparing two spontaneous handwriting samples written by the same individual. Extending this idea, it should also apply to disguised handwriting.

The difficulty in objectively assessing expressive movement in handwriting has haunted most researchers in this field. This is reflected in the many approaches that have been tried, from the atomistic to the holistic approach, from the matching method to the approach by which expressive movement is recorded by using slow motion photography and other recording devices.

The atomistic method has been preferred by many investigators to the holistic approach because it is allegedly more objective since more sophisticated measuring devices and experimental designs can be used. However, very little has actually been done experimentally with these devices. As the present writer has already hypothesized, this lack of experimental research might be due to the difficulty in analyzing meaningfully separate aspects of handwriting when it is considered an expression of the unity of

personality and not of some of its isolated components.

In discussing the holistic approach in the review of the literature, the present writer could not help but question whether the judges used in the studies mentioned were experts in graphological analysis. As was pointed out in a later study by Wallner,³ statistical analysis should never be undertaken without thorough knowledge of the material studied. This should also apply to the judgments of handwriting samples and thus to the judges used for these purposes. The reason for this prerequisite is that if measurements or judgments are made, it is essential to know the underlying rationale, whether this rationale be from the field of graphology or some other field. Otherwise measurements might be very accurate, but inappropriate and meaningless. The same principle would apply to judgments made by judges who do not have the essential shared criteria underlying what they are judging.

Therefore, in the mind of the present writer loom several questions concerning the matching methods discussed in the first chapter. For instance, the descriptions given in the literature, such as "personality sketches", "diagnostic reports" or simply "one-sentence statements regarding

³ Leut. Wallner, "Graphologie als Objekt statistischer Untersuchungen", Psychologische Rundschau, Vol. 16, No. 4, 1965, p. 282-298.

the writer" do not seem sufficiently clear to judge the weakness or the strength of the method. Questions, such as the meaning of "a set of handwriting samples" arise, since there are certain essential prerequisites for adequate graphological analysis. Thus, it was not clear who the judges were nor what kind of graphological samples were used nor how descriptive of the subjects were their personality evaluations. "One-sentence statements", for instance, seem hardly sufficient to describe an individual and his unique, dynamic adjustment to his environment and to himself.

In summary, it was found that methodological problems have neither been solved in the literature nor in the present experimental assessment of expressive movement in handwriting. Many approaches have been tried, none of them entirely satisfactory. In spite of these difficulties, the results obtained in the present study continue to encourage further research. Future researchers may find an approach that satisfies both the needs of graphology and statistical requirements. The study of individuals separately instead of in groups might be the best method for this purpose.

SUMMARY AND CONCLUSIONS

The present study attempted to test the claim that the detection of the writer's identity through handwriting is possible in spite of his efforts at disguising it. Since this claim has not as yet been supported by controlled experimental investigation, such investigation was felt to be most timely in the field of graphology. Graphologists are faced with the acute problem of frequent criticisms and attacks for the lack of objective experimental evidence given for the use they make of graphology as a projection of personality.

Based on the theory of continuity of personality, it was postulated that the manifestations of personality through expressive movement in handwriting would remain essentially unchanged in disguised handwriting.

The present writer aimed to establish, by means of a controlled experimental investigation, to what extent characteristics of spontaneous handwriting remain essentially unchanged in disguised handwriting.

Five handwriting characteristics were examined for this purpose: the length of words, the height of words, the left-hand margin, the inclination of the writing lines, and the number of terminal spurs. Individual hypotheses of the null type were postulated for each characteristic.

All measurements were made in millimeters except one which was obtained by counting. The results would permit rejection of the hypothesis in two out of the five characteristics in question. Significance was at the .01 level.

Due to methodological problems encountered in the literature and in the course of the present study, the results of the experiment did not provide clear evidence either for or against the claim that handwriting can be significantly disguised. Although results were equivocal, they generally supported the claim graphology makes as a projective method of personality assessment. Improved techniques of evaluation and analysis of handwriting characteristics may lead to different results. An approach using photography as a means to transform disguised writing to the same size as the corresponding spontaneous sample was suggested. In this manner the question of proportion might be eliminated which would permit more meaningful measurements of those characteristics related to proportion.

The main contribution of this thesis is to emphasize the pressing need for further research in this field.

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Wallner, Teut, "Graphologie als Objekt Statistischer Untersuchungen", Psychologische Rundschau, Vol. 16, No. 4, 1965, p. 282-298.

A detailed treatment of questions of objectivity, reliability and validity of graphological analysis when used in psychodiagnostics, with an evaluation of research from a statistical point of view in the field of graphology up to 1963.

Wolff, Werner, Diagrams of the Unconscious, New York, Grune and Stratton, 1948, vii-423 p.

A thorough study of expressive movement as reflected in graphic tracings, disguised and undisguised.

APPENDIX A

SAMPLE OP

Passage Used in the Experiment

"To have an emotion, it is necessary to perceive or to know the object in some way, though it is not necessary to know it accurately or correctly. In fact, we may ascribe to what we love or fear qualities that exist only in our imagination. We may love or fear something for reasons that have nothing to do with its physical nature or with the way it affects our sense organs.

To arouse an emotion, the object must be appraised as affecting me in some way, affecting me personally as an individual with my particular experience and my particular aims. If I see an apple, I know that it is an apple of a particular kind or taste. This knowledge need not touch me personally in any way. But if the apple is of my favourite kind and I am in a part of the world where it does not grow and cannot be bought, I may want it with a real emotional craving..."

APPENDIX B

OPERATIONAL DEFINITIONS OF TERMS

Spontaneous handwriting: for the purpose of this study, spontaneous handwriting is defined as that one used by the experimental subjects in copying a specific type-written passage.

Disguised handwriting: for the purpose of this study, disguised handwriting is defined as that one used by the experimental subjects following type-written instructions to alter their handwriting for the purpose of concealing their identity.

Length of words: for the purpose of this study, the length of a word is defined as the distance measured in a horizontal line from the furthest point to the left of the word to the furthest point to the right of the word.

Height of words: for the purpose of this study, the height of a word is defined as being the distance between the highest point of its middle zone and its base measured in a perpendicular line.

Middle zone of a word: the middle zone of a word comprises the body of each word without the peripheral extensions of the letters.

Left-hand margin: for the purpose of this study, the left-hand margin is defined as the horizontal distance

between the left edge of the paper and the point furthest to the left of the base of the first letter in a line.

Inclination of writing lines: for the purpose of this study, the inclination of writing lines is defined as the amount a line has ascended or descended at the 160th millimeter from the left edge of the writing page, when this edge is taken as ordinate and the base of the first letter of the first word in that line as abscissa.

Terminal spurs: for the purpose of this study, terminal spurs are defined as the number of rightward extensions of the letter "s", visibly passing the right border of this letter at the end of words.

APPENDIX C

ABSTRACT OF

A Quantitative Comparison of Spontaneous with Disguised Handwriting¹

The main aim of this study was to test the hypothesis that there are no significant differences between spontaneous and disguised handwritings on selected, objectively measurable handwriting characteristics. This hypothesis was based on the theory of continuity of personality.

For this purpose, fifty-five subjects copied a specific passage in their spontaneous handwriting. Then they recopied the same passage following instructions to disguise their handwriting.

The sums of the measurements for each of five selected handwriting characteristics from spontaneous handwriting sample were compared quantitatively with their counterparts in the disguised handwriting. Differences and mean differences were calculated and the level of significance tested by means of the t-test. Results for three of the handwriting characteristics compared in this manner would not permit rejection of the null hypothesis. Significance was at the .01 level. Two of the characteristics would permit rejection of the hypothesis of no change.

¹ Dolores Feigel de Maples, master's thesis presented to the Faculty of Psychology and Education of the University of Ottawa, 1967, ix-63 p.

It was pointed out that the atomistic method used, without any other adjustments for those characteristics dependent upon proportions, is not considered ideal for this comparative kind of study. When using the atomistic method, it is evident that idiosyncrasies cannot be evaluated which are retained in disguise. It was suggested that the problem of proportions might be tackled by photographic means by which the disguised handwriting would be transformed to the size of the spontaneous handwriting. This would make a comparison of measurements such as length, height or arrangement on the page more meaningful.

Support for the experimental hypothesis was sufficient to encourage further research of this nature in the area of graphology.